A PLANNING APPROACH TO THE DISPOSITION OF CROWN AND CROWN LEASED LANDS FOR PRIVATE USE

A Thesis

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INTRODUCTION

Introduction

In Canada, ultimate land tenure or ownership belongs to the Crown even though various forms of land titles have been granted to private individuals or groups. Of the various forms of titles, freehold title is the closest to absolute ownership of land. At the other end of the scale, Crown lands are those which have not been disposed of in any way to private individuals or groups. Crown lands can be and are being leased for various lengths of time to private individuals or groups so that they may make use of that land. Crown lands may also be sold to private concerns according to various terms, again so that they may make use of the land. Hypothetically, it is most advantageous for the country to dispose of Crown lands in such a way as to benefit both present and future generations of citizens.

The disposition and use of Crown lands is almost exclusively a provincial responsibility with the exception of Indian Reserves, National Parks, the Yukon and Northwest Territories and such policies as restricted sale of land to foreigners where the Federal Government is directly responsible. In part, this situation has been a factor in what is popularly known as the "have and the have not" provinces. In other words, the wealth derived from the use of Crown lands has for the most part accrued to the province in which the lands are located. In isolation, this may not appear to be a very just situation for a country which is supposedly governed as a united and federal unit. However, as

long as people are free to move from area to area or province to province in this country, they should be able to locate in a "have" province and reap the "benefits" if they so desire. Furthermore, those in "have" provinces usually make more money, are taxed more and thus contribute more to the social assistance programs and regional disparity programs of the day. From the point of view of wealth, then, it does not appear that it matters which level of government initially controls land use.

There is one important aspect of land use, be it Crown or otherwise, that should be handled at the Federal level. This involves the use of land by one province which affects the activities and/or land use of another jurisdiction. A prime example of this is the effects that the Bennet Dam in British Columbia has had on the Athabasca Delta in Northern Alberta. Alberta officials claim that many native people living near this delta have lost their trapping and fishing livelihood because of the water level changes caused by the Bennet Dam. The intricacies of this situation are not the concern of this thesis, however, they do partially indicate a role for Federal intervention into Provincial land use activities.

The purpose of this thesis will be to investigate the questions and problems involved in the disposition of Crown and Crown leased lands. The focus of this thesis will be on areas or regions of our country which are developing, but at present,

remain relatively undeveloped. It is in such regions, where much of the land is still Crown or Crown leased, that the questions and problems of decision-making regarding land disposition will possibly be most relevant.

The author's interest in this aspect of planning stems from two summers' work with the Provincial Planning Branch, Alberta Department of Municipal Affairs. As a summer student, the author was involved in a resource analysis and planning study, leading to a regional land use plan, for a region in west central Alberta. This practical experience coupled with the author's academic experience with the City Planning Department here at the University of Manitoba, has led him to believe that developing a model to aid in decision-making could prove to be a useful exercise for application to the region in Alberta as well as to other regions at similar stages of development. This model, which constitutes the major objective of this thesis, will be devised in a manner similar to what might be attempted by a provincial government. The model hopefully will provide a better understanding of the complexity of the decision-making process involved in making land use and land disposition decisions.

Consider a relatively undeveloped region consisting mainly of Crown and Crown leased land. Also consider a continuously increasing demand pressure for the disposition of these lands and their consequent development and use in the private sector.

One might readily consider it the duty and responsibility of the government to make "good" decisions in disposing of this land. Assuming this to be a valid point, the provincial government must establish a goal or goals for its responsible agencies to work towards or to use as a guide in land disposition decisions. Two such goals are suggested below:

(1) to ensure that the Crown and Crown leased lands of the province and consequently any of its regions be disposed of in such a way as to result in a planned and integrated pattern of land use for the benefit of present and future citizens.

(2) that any decisions made regarding regional land disposition must be based upon solid environmental and economic criteria.

The vagueness of these goals is typical of the type of generalities expressed by government policy. The goals stated above are in fact very similar to those expressed by the Alberta Department of Lands and Forests. The main purpose of this thesis will therefore be to suggest an interpretation of these goals and indicate one way at least that this interpretation can be realized.

Part I of this thesis will describe the basic theoretical framework necessary to understand how a model of this sort might be developed. This part will also discuss the sort of theoretical base necessary in establishing the two criteria suggested in the second goal - namely the environmental and economic criteria.

Consequently, Part I of this thesis will consist of discussion, on a theoretical level, about such factors as systems, control, the planning process, models and criteria.

Part II of this thesis will subsequently be charged with the application of this theory in developing a hypothetical decision-making model. A discussion of the elements of this model will give some indication of how it might be used in a real situation. Still, the merit and the actual operation of the model will really only become explicit when it is tested in a real-life regional situation. The Hinton-Yellowhead Region[1] of west central Alberta will constitute the real-life situation for testing the model.

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[1] Provincial Planning Branch (1971), Hinton-Yellowhead Land Use Study. Alberta Department of Municipal Affairs.

PART I

THEORY

PHYSICAL AND LAND USE PLANNING AS THE CONTROL OF COMPLEX SYSTEMS

CHAPTER 1

CHAPTER 1

PHYSICAL AND LAND USE PLANNING AS THE CONTROL OF COMPLEX SYSTEMS

Since this thesis will be involved with several complex systems, a system should be defined. As well, because this is a planning thesis, the connection between systems and planning must be established at the outset.

Generally speaking, a system may be understood as "a complex whole, a set of connected things or parts, an organized body of material or immaterial things and as a group of objects related or interacting so as to form a unity."[2] Recently, bodies of knowledge have grown up known as "General Systems Theory"[3] which deals with the notion of systems in general just as "Operations Research"[4] applies systems thinking via systems analysis to real-life situations. The study and the control of complex systems became known as "cybernetics".[5]

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2 Oxford Dictionary

3 von Bertlanffy, Ludwig (1951), An outline of general system theory British Journal of the Philosophy of Science, I. pp. 134 - 65.

4 Churchman et al. (1957), Introduction to Operations Research, New York.

5 Wiener, Norbert, (1948), Cybernetics. New York.

The relationships of man (and other creatures) with the environment can be identified in systems terms - as an ecological system (eco-system).

> ... the definition of any particular system is arbitrary ... the universe seems to be made up of sets of systems, each contained within one somewhat bigger, like a set of hollow building blocks. Just as it is always possible to expand the system to a scope of wider perspective, it is also possible to cut down the system to a smaller version... the point to seize on here is that if we wish to consider the interactions affecting one simple entity, then we shall have to define that entity as part of a system. The system we choose to define is a system because it contains interrelated parts, and is in some sense a complete whole in itself. But the entity we are considering will certainly be part of a number of such systems, each of which is a sub-system of a series of larger systems. So the problem of stating the system we wish to study is by no means easy.[6]

The relatively abstract notion of systems which appears above has been refined in view of large urban settlements. Over a decade and a half ago, transportation studies done for the Detroit and Chicago urban regions seem to have interpreted the urban region as a kind of system, a view which was confirmed by Mitchell and Ropkin.[7] These men and their colleagues viewed the urban

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6 Beer, Stafford, (1959) Cybernetics and Management, Chapter II. London.

7 Mitchell, R.B. and C. Ropkin, (1954) Urban traffic: a function of land use. New York.

region as a system whose component parts were small zones of land uses or activity, and whose connections were all forms of communication, expecially road traffic. At this time it was argued that if a future land use pattern could be defined, then the resultant traffic pattern could also be defined and a suitable transportation system could be designed to fit it.

Fundamental objections were raised to this view about a decade ago.[8] In essence the objections amounted to this:

> ... because land uses and traffic flows are interdependent, each affecting the other, we cannot push forward land use in one giant stride, of say twenty years and derive a traffic flow pattern or vice versa; for the simple reason that traffic flows alter in response to changing land use patterns while at the same time (though at different rates of response), land uses tend to relocate themselves in relation to the movement opportunities that are available: the city evolves through time in ways which depend upon the sequences in which changes in land use and movement facilities are introduced.[9]

Within a decade, then, the view of an urban region moved from a machine-like system - a system that works - to a view of the urban region as a system that evolves. In analyzing an urban region as a complex system that evolves, there are many profound

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8 Wingo, L. and H.S. Perloff, (1961), The Washington transportation plan: technics or politics? Papers and proceedings of the Regional Science Association 7.

9 Beesley, M.E. and J.F.Kain, (1964), Urban forms, car ownership and public policy: an appraisal of 'Traffic in Towns' Urban Studies - I. pp. 174 - 203.

consequences for many aspects of planning thought and practice.[10]

When seeking to control any dynamic system there must be an attempt to foresee how that system might evolve - how it would develop if left severely alone, and also what the outcomes of many different kinds of stimuli and intervention might be. Anyone who seeks to control anything must ultimately ask the question, 'what would happen if ...?'

If an urban region is viewed as a dynamic system which evolves in response to many influences, it follows that plans for it must be cast in similar form; they must be:

> plans for the nature, rate, quantity, and quality of urban change - for a process of development. They will be expressed in dynamic rather than static terms They will start with present conditions and point the direction of change.[11]

The implementation of such a plan will necessitate one specific type of control. Control may be considered to be on one or two levels, the lower level being of the monitoring nature. In other words, if a 'plan' of action has been determined, and in carrying out that plan, one of the variables changes, it would be

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10 McLoughlin, J.B. (1969), Urban and Regional Planning: a Systems Approach. London.

11 Mitchell, R.B. (1961), The new frontier in metropolitan planning Journal of the American Institute of Planners, 27. pp. 169 - 75.

this lower level control which must correct the situation such that the trajectory of the 'plan' remained on target. The higher level control may be viewed as being apart from the process described above. For example, this form of control is used in many scientific experiments. Scientists may be interested in the possible effects of a certain type of vitamin on a group of rats. They would feed this vitamin to one group of rats and maintain a second group of rats under identical conditions with the exception that this second group would not receive any of the vitamin. The second group would be known as the control group and would be compared with the first group as the experiment progressed. Consequently, it is the lower level control which will be necessary in the implementation of a plan. It is not suggested that this lower level control should be control in the narrow restrictive sense but in the fullest sense which includes 'positive' stimulus and intervention. The lower level control will be the form of control referred to from this point on except where the higher level form is specified. This form of control has been defined as "that... which provides direction in conformance to the plan, or in other words, the maintenance of variations from system objectives within limits."[12]

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12 Johnson, R.A., F.E. Kast and J.E. Rosenzweig, (1963), The theory and management of systems. New York.

This definition of control can be applied to the implementation of any plans including those involved with urban and regional systems which are of utmost interest here. If a city or regional system is to be controlled in the higher level sense, the desired states are expressed in the plan and the actual state of the system at any given time may be measured by surveys. The actual conditions can then be compared to those intended by the plan. The nature of a city or region is influenced by the addition, removal or alteration of component parts or connections ie. land uses and communications. It follows then that the evolution of the city or region can be influenced by regulating the flow of additions, removals and alterations to land uses and communications.[13] This suggestion may result in the control of a good deal of the evolution of a city or region, however, it fails to consider the evolutionary effects that are likely to be the result of actions or activities external to the isolated city or region referred to here. However, how does one know whether a proposal will be in accord with plan or not?

> The planning authorities must consider whether the development proposed would advance or hinder (or have no effect on) the policies and objectives set out in the plan.[14]

Experience may answer simple questions but to control more

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13 McLoughlin, J.B., (1965), Notes on the nature of physical change Journal of the Town Planning Institute 51, pp. 397 - 400.

14 Planning Advisory Group, (1965), The future of development plans. London.

complex systems like a city or region, analogies or models become necessary. Models may augment or amplify the planner's experience. They can also act as early warning devices, indicating needs for corrective action that may lie ahead and enabling the planner to experiment with different forms of public intervention or policies which could keep the system under control or put it back on course again.[15]

> ... this continuous planning process of the future will incorporate a feedback of information on community change and on the results of planned and programmed action. In this way, as progress is measured, the planning process can adjust to guide development, much as the course of a missile is guided by a feedback of information on its deviation from a projected course.[16]

From the discussion in this chapter, systems, planning and control all are interrelated. The last quote above makes mention of a 'planning process'. Chapter 2 attempts to better explain the interrelations of the three basic aspects of this chapter (systems, control and planning process) and also to put the 'planning process' mentioned here into a better perspective

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15 McLoughlin, J.B., (1965), op. cit.

16 Mitchell, R.B., (1961) op. cit. p. 171.

PHYSICAL PLANNING AS A PROCESS

CHAPTER 2

CHAPTER 2

PHYSICAL PLANNING AS A PROCESS

Man in his ecological setting often attempts to modify his circumstances in order to make improvements in his relationship with the environment. This physical relationship between man and environment may be viewed as a system. When dealing with such a complex and probabilistic system, one must be constantly aware that changes in activities and the spaces which accomodate them will result in repercussions which modify the system. These changes in the system motivate others to change their curcumstances, and so on.

If it is assumed that deliberate control of the man-environment relationship must be firmly based on a system view, then physical planning must be viewed as a process and more specifically as a cyclical process. The planning process must then have a similar shape to the human eco-system which it seeks to control.[17]

The evolution of the human eco-system has been the result of modifying actions taken by individuals or groups. These actions are merely the critical points in cycles which Chapin[18] has called

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17 McLoughlin, J.B., (1969), op. cit.

18 Chapin, F.S., (1965), Urban land use planning. Urbana, Illinois. p. 33.

'behaviour patterns', a term which expresses his interest in sociology. The cycle he describes, however, is more slanted towards his main interest in physical planning than is suggested by the choice of words for his term. In essence, the cycle is as follows:

1. The environment is scanned and on the basis of values held by the individual or group, certain needs or wants become apparent, some of which might be satisfied through the physical relationship with the environment.

2. Goals are formulated in broad terms and perhaps at the same time certain more precise objectives (which must be reached in order to move toward goals) are identified.

3. Possible courses of action to reach the objectives and move toward the goals are examined.

4. Evaluation of these possible courses occurs by reference to the means available, the costs likely to be incurred in overcoming constraints on action, the benefits likely to be derived and the consequences of action, so far as can be seen.

5. Action is taken on the basis of these considerations. The action modifies the relationship between the individual group and the environment; it will also alter the environment itself and, in time, the values held about it. The environment continues to be scanned and new goals and objectives may be formed.[19]

Thus the cycle is completed and begins afresh.

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[19] McLoughlin, J.B., (1969), op.cit. p. 95.

Physical planning as suggested, does have a similar form since it is the means for controlling the complex systemic changes which give rise to, and arise from, these behaviour patterns. To regulate and guide the results of actions taken by sections of the community, the community must adopt a form of control which has a "shape" which is similar to the behaviour patterns of its members. In terms of planning, the five steps of the cycle outlined above might be interpreted thus:

Stage 1, instead of scanning the environment, its counterpart might be the decision to adopt planning. In our contemporary Western society dominated by 'laissez-faire' principles, much of the decision-making takes place in the 'private-sector'. "Planning... has come into being in part to fill gaps left by other kinds of decision-making."[20] Regardless, the first stage of the planning process is the decision to plan. This is not a finite decision but one which needs continuing thought and effort as well as periodic review by all sections of the community.

Stage 2, remains as the formulation of goals and is a logical progression from the first stage of adopting planning since that in

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20 Dyckman, J., (1961), Planning and decision theory Journal of the American Institute of Planners, 27. pp. 335 - 45.

itself needs justification by a set of aims. Usually, progress towards a goal will require the attainment of certain objectives which are more precise and clear. Since much of the planning process depends upon the formulation of goals, they are of utmost importance. Planning goals must be clearly defined and consistent with other public goals while avoiding the pitfall of being the goals of the planners rather than of their customers.

Stage 3, of the planning process might be viewed as the derivation of possible courses of action. One of the basic constraints here has to be of an economic or financial nature. Legal requirements as well as personal or group preferences or desires also tend to confine courses of action. Possible courses of action outside the decision-makers' experience are of course discounted and consequently reduce the number of possibilities.

With the highly complex systems in which public planning becomes involved, it must be recognized that a plan will both impinge upon and make use of vast numbers of decisions made over a period of time. The 'generation' of possible courses of action requires the development of a model of the system which will show changes of state through time under the influence of a range of 'policy variables'.

Stage 4, is consequently the comparing and evaluating of the range of alternatives which have been devised. This stage may be consid-

ered a process unto itself since the refinement of the evaluation might proceed from the very general plan to a very specific or detailed plan. The time dimension also plays a large role in this evaluation stage and the planner must realize that he is not evaluating one decision at a point in time, but rather a trajectory of change through time. This involves a direct relationship with changing needs and preferences.

The cyclical nature of the planning process is best exemplified in this stage since evaluation will ultimately be based upon the established goals and if the goals require changing so the whole process will require changing.

Stage 5, as in the "behavioural pattern", is the taking of action. The planner's action must be in the nature of a control - to control the outcomes of a large number of actions which result in a continuous flow of change through time. It stands to reason then that the control mechanism must be continuous. Historically, as time has passed, the environment has changed as have many of the tastes, preferences and desires of a given society. In order then to complete the cyclical planning process, the control mechanisms need overhaul: the plan must be reviewed and modified to suit these changing circumstances.

McLoughlin[21] summarizes the planning process as a series of

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21 McLoughlin, J.B., (1969), op.cit. pp. 102 - 3.

steps or phases in a cycle:

(1) (strictly outside the main cycle of the control mechanism.) The decision to adopt planning and as to what methods of planning to adopt. This has a cycle of its own with a relatively long timespan in which the administrative methods and techniques are reviewed and the education and professional organisation of planners are considered afresh.

(2) Goal formulation and the identification of objectives for physical planning by appropriate agencies of all kinds, including the clarification of the ways in which physical planning will relate to other forms of communal action.

(3) Possible courses of action are studied with the aid of models of the environment. These studies show how the system might behave as it changes through time under the influence of a variety of influences arising from private actions and public activities and interventions.

(4) Evaluation of these courses of action in order to select an operational course by reference to assumed social values and the estimation of costs and benefits.

(5) Action to implement the plan including both direct works and the continuous control of public and private proposals for change. The essence of such control is to study the impact on the system of proposed changes in order to see whether or not they would deflect the system from the course charted for it in the plan. Again, the models of the environment used in Stage 3 are employed. As the process goes on it becomes clear that we must...

(6) Review the plan and its control mechanisms from time to time, in minor ways at shorter intervals and in major ways at larger intervals. This is necessary because we are dealing with a probabilistic system, one in which changes cannot be foreseen with certainty. Reviews must take account of both specific proposals which are different from those expected, of changes in the political, social and economic context in which the plan operates and which generate new needs, desires and aspirations in the community and its members.

Thus the cycle returns to Stage 2, and periodically to Stage 1 also.

Physical planning seeks to modify the man-environment relationship by means of monitoring or control. Since this relationship can be defined in systems terms and since systems are cyclical in nature, it has been suggested that physical planning too must be cyclical. It has been further suggested that this view of physical planning can best be described as an on-going planning process. The steps involved in such a planning process have been derived in this chapter. Step 3 of this process is the point at which models can be most beneficial. Since the major objective of this thesis is to develop a decision-making model, the main emphasis of the rest of this paper will be focussed on Step 3 of the planning process.

MODELS AND CRITERIA

CHAPTER 3

CHAPTER 3

MODELS AND CRITERIA

One common way of describing a system and one which permits investigation of its behaviour under varying conditions is the use of models. There are many different types of models employed for a wide variety of specific tasks. "Iconic" or physical scale models of buildings and machines are often used by architects and engineers in order to communicate their proposals to clients or to investigate the results of a design or modification. For example, the effects of silting, river and tidal flows can be tested by the civil and hydraulic engineer in a model of this kind. "Analogue" models may be constructed to test different kinds of materials and forces, ie. this type of model is not a direct representation of the system under study but provides a reliable analogy of it. For example, electric circuits are used as analogues of nerve structures and hydraulic systems. "Mathematical" models are often used to describe complex and probabilistic systems in simplified mathematical terms. These models are also used to describe very simple relationships. For example, the equation $a = b + c$ is a mathematical model which describes the relationships between the three symbols.

Another way of looking at models is suggested below:

> descriptive of a situation at a point in time (for example, in expressing the relationship between shopping center sales, localised spending power, the content and attractiveness of shopping centers and the

> means of transport from residential areas to the shops);
> predictive of future states either in continuous or discontinuous terms, that is, given relationships of the form mentioned above plus measures of time 'built into' the form of the model it can be used to make conditional statements about future values of the variables whose relationships it attempts to explain and
> prescriptive (or planning), that is the model cast in such form as to generate a number of alternative future states of the system and to evaluate these in relation to a set of built-in criteria and thus to indicate a best solution to a problem. These models are sometimes referred to as 'decision-making' or 'evaluative' models.[22]

Of particular interest, due to the topic of this thesis is a "prescriptive" or decision-making type of model which exhibits a combination of "analogue" and "iconic" characteristics. Such a model should allow for the handling of large quantities of data in a relatively short period of time. It should also make it possible to consider the various relationships between activities rather than simply considering each activity as a separate entity unto itself.

Models of this sort may be viewed as a means of representing reality, but not a duplication of all aspects of the reality being portrayed. Rather, they abstract factors from the total environ-

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22 McLoughlin, J.B., (1969), op.cit.

ment which are necessary to solve the problems for which they are designed. They allow analysis of total systems and any number of factors may be simultaneously interelated. By using these models it is possible to look at "what changes" rather than "what is", ie. they are dynamic. They may be said to consist of elements or activities and the rules which govern the changes in the relationships.

Rules are authoritative directions for conduct and procedure and may be derived from economic principles, scientifically established laws or may be developed by individuals or groups to mould decisions to their point of view. In the case of technological forecasting - to anticipate forthcoming technological capabilities, a technological forecaster needs to select the proper rules or parameters (measurable attributes like speed, melting point etc.) for the device or technique he is concerned with. All forecasting merely extracts some kind of pattern from historical data, and projects that pattern into the future, perhaps modifying it for known changes in conditions. The pattern, however, will only be as good as the data from which it is extracted.[23]

Since this thesis has to do with decision-making, criteria appear to be the type of rules which are most relevant here. A

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[23] Martino, Lt. Col. J. (June 1971) How to select a parameter <u>The Futurist</u> Vol. V No. 3, Washington, D.C.

dictionary definition should explain this relevance.

> criterion n. (pl. criteria), a standard law or rule by which a correct judgment can be formed.[24]

It should be apparent that depending upon what criteria are used, a judgment or a decision may become drastically different even with the same data and situation. It is therefore very important to identify the criterion or criteria which are to be used in a particular decision-making process.

Criteria are many and varied, however the two which will be of importance for this thesis will be environmental and economic in nature.

Environmental criteria:

This term is used here in a restrictive sense since it will not delve into the degree of intimacy which has been undertaken by, for example, the natural sciences. Since this thesis is concerned with land use and land disposition, the environmental criteria will be responsible for ensuring that the use of an area of land is compatible with the physical qualities of the land. In other words, the land must be suitable for the use and vice versa.

Economic criteria:

This term as well is used in a restrictive sense. The economic criteria will be used in an attempt to ensure that an area of land is used in such a way as to satisfy the largest volume of human wants and desires that is possible. There will, of course, be many wants and

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[24] Webster's New School and Office Dictionary

criteria will be used to ensure that an area of land is used in such a way as to satisfy the largest volume of human wants and desires which will not be included in this economic criterion. These aspects of human satisfaction such as the pleasure derived from the tranquil feeling of isolation in a virgin wilderness or the odor of fresh unpolluted air are very difficult to quantify. Hopefully there will eventually be a means of including these other aspects of human satisfaction in a similar model to the one proposed here. However, for the purpose of this thesis, the economic criterion will be responsible for resolving conflicts between competing land uses which are equally suited to a given area of land. The yardstick by which human satisfaction will be measured will, for the purpose of this thesis, include a double calibration. Firstly it will consider the amount (preferably in dollar terms) of usable product which will be the result of each competing land use. Secondly it will consider the assumption that - if people are willing to pay (again in dollar terms) for the use of an area of land, the amount of satisfaction they will derive from this use will be equal to the amount they are willing to pay for it. For the purpose of this thesis, the time duration for both the amount of usable product and the amount people are willing to pay will be one year.

The remainder of this chapter will more fully elaborate on and explain these criteria as they have come to be understood here in North America.

Consideration of our natural environment has been deemed necessary by various levels of government as well as groups of people throughout much of the industrialized world. This consideration

ranges from concern for specific problems such as the toxic emissions from our automobiles to a general concern about the fate of our "throw away" society. It would be difficult indeed to directly relate the above environmental concerns to the specific land use problems which will be the ultimate concern of this thesis.

The notion of conservation as opposed to the notion of development does however express a direct relationship between the environment, economics and land use. A more thorough understanding of these two notions will be very beneficial in elaborating on the two criteria used in this thesis. This understanding will also be of value in a more general sense since this thesis deals with a relatively undeveloped region where there are bound to be conservation as well as development pressures.

Conservation and Development:

There is a very complex and apparently conflicting polarization between conservation and development and one must be aware of their exact meanings. A dictionary definition might prove beneficial at this early stage of the discussion.

> Conservation n. Preservation from loss waste or harm especially the official preservation of natural resources.
> Further, to preserve means to protect from injury, peril or other adversity, and a preserve is an area maintained for the protection of wildlife or natural resources.[25]

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[25] The American Heritage Dictionary

> Development n. The process or result of developing. Further, to develop means to bring, grow or evolve to a more desirable state, or to make available or usable.[26]

Preservation, implicit in the notion of conservation, can be accomplished in many different ways and on many different levels of magnitude. It may involve one person's voluntary action in not walking on a well manicured lawn or it may involve a federal offence in cutting a single tree or picking a single flower in an area of thousands of acres. It therefore appears that preservation and thus conservation involves some form of constraint upon or molding of human activities, either voluntary or due to some law. The question immediately arises: why must there exist such constraints? To answer this question it will be beneficial to review the beginnings and evolution of this notion of conservation.

The notion of conservation did not have its beginnings in the United States; however, to review its evolution in that country might be best since it has been well documented and has led to the very contemporary notion which exists today. Concern about conservation began in the United States around the middle of the nineteenth century with a variety of individual trends of thought with regard to nature. Conflicts between man and nature became more

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26 The American Heritage Dictionary.

evident with increased contact between man and nature. Virgin land and water areas rapidly diminished as the westward human tide ebbed back over the land upon reaching the Pacific. Recognition of the need for conservation, preservation, management and planning in regards to natural resources was at first due to the concern of those labelled "nature lovers".[27] It was also becoming apparent to others that indiscriminate use and destruction of natural resources could not go on forever. There appeared to be an end to the seemingly endless reserves of natural resources. The question then arose as to how far government should go in attempting to put an apparently worthwhile theory into practice.

It was a highly visible and economically important resource which initiated the controversy over what was to be meant by conservation and what was to be done about it. Timber was the resource and the two major viewpoints were held by the Chief Forester of the United States, Gifford Pinchot and his great contemporary, naturalist John Muir. Both men and their friends were idealists who fought high-mindedly for the public good. Pinchot argued that conservation should be concerned with the well-managed attainment of utilitarian benefits. Muir was concerned more with the psych-

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27 Revelle, R. et al, (1967), Americas Changing Environment. Boston.

ological aspects of man's well-being including the sentimental, traditional and aesthetic values which he felt should not be disregarded in the complex business of conservation. In this competition between the utilitarian and idealistic aspects of conservation, there has never been and probably never will be a clear cut answer.

One of the most important early events involving government policy and conservation took place in 1903.[28] At this time, Theodore Roosevelt, not yet president, went on a tour of California's Sierra Nevada Mountains with John Muir. When Roosevelt became president and claimed he was "not building this country of ours for today", but "to last through the ages", it is felt that this outlook was much influenced by his meeting with Muir. Roosevelt maintained that a real knowledge and appreciation of wild things gives "added beauty and health to life." He was determined that conservation was to be one of the major achievements by which his term in office was to be remembered. By 1908, due to the accessibility provided by the Santa Fe Railway, many people were concerned that the Grand Canyon would soon become too commercialized. Consequently it is felt that the establishment of the Grand Canyon as a national monument in 1908 was one of the most significant

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28 Smith, G.H., (1958), Conservation of Natural Resources 2nd ed. New York.

actions of President Roosevelt.

The turn of the century in the United States was a time characterized by the growing up of organizations concerned with conservation.[29] The American Park and Outdoor Society (established 1897) and American League for Civil Improvement (established 1901) merged in 1904 into the American Civic Association, which became a powerful organization. Also in the early 1900's the garden club movement was started and women in all parts of the country mobilized to improve residential sections and to rehabilitate run-down estates. These clubs were far-sighted enough to become actively involved in the conservation movement. While these and other clubs concerned themselves with the preservation of green areas within the cities, other organizations were involved in conserving large outdoor units for nature lovers The Appalacian Mountain Club (established in 1876) worked in this direction. Their work involved volunteers building camps and trails along the mountain ranges. The Sierra Club (established in 1892) and led by John Muir was involved in similar work on the Pacific Coast. The more complex task of The American Scenic and Historic Preservation Society (founded in 1895) had taken part in the action to protect Niagara Falls. It was this society which in many cases acted as a predecessor to

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29 Kilgore, B.M. ed., Wilderness in a Changing World. Binghamton, N.Y. (1966).

government policy and was generally considered the legitimate advisor in all matters pertaining to the protection of scenic and historic sites.

In 1908 United States federal recognition was officially given to a form of conservation. It was also in this year that Gifford Pinchot persisted in his realistic definition of conservation and gave the word the connotation it is now generally understood to have: a comprehensive and well planned management of natural resources of every character, based on ever changing ethical and economic grounds. It is also interesting that in 1935, the American Civic Association combined with the National Conference on City Planning (established 1909) and became the American Planning and Civic Association. Under the leadership of Franklin Delano Roosevelt, Ullyses S. Grant III and Horace M. Albright, this association was and still is "dedicated to the education of the American people to an understanding and appreciation of local, state, regional and national planning for the best use of ... natural resources." This dedication, though well-meaning and probably acceptable to many people, is still very flimsy in that it makes no attempt to elaborate on "the best use of natural resources." Possibly the wording should be changed to "a better use of natural resources" based on the contemporary environmental, economic and social situation.

and yield crops as an assembly line produced automobiles."[30] As an immediate consequence, the Soil Conservation Service was established in 1935 and charged with the duty of conserving soil and water and assisting farmers and ranchers in matters of conservation. The American Public was intensively exposed to conservation literature and to writers who tended to belittle such efforts and to denounce those writers who pointed out the serious need for protective measures These apparently anti-conservation writers believed there was really nothing to fear since they were certain that science would in due time take care of all mankind's needs.

Another aspect of the notion of conservation, which appears to be an extreme pole within the polarization between conservation and development was the "wilderness movement".[31] The first public statement of this philosophy in the United States appears to have been made by Aldo Leopold in his book, A Sand County Almanac, expressing his thoughts about the place of the wilderness in forest recreation policy, 1921.[32] Leopold was originally a member of the

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30 Parson, R.L., Conserving American Resources. Englewood Cliffs, N.J. (1964).

31 Leydet, F., (1963), Tomorrows Wilderness. New York.

32 Leopold, Aldo, (1966), A Sand County Almanac. New York.

Forest Service as was Robert Marchall, a man who devoted his life to the idea of preserving as much as possible of the primitive areas still left in the United States. The activities and aims of these men and their friends who held similar ideas are recorded in the files of The Wilderness Society which was founded in 1935. These ideas appeared novel in the United States of the 1920's but were really a continuation of the line of thinking expressed in the works of Cutlin, Emerson and Thoreau. "Rationale", used by such men as Leopold and Marshall was such that preservation of wilderness areas must be recognized as a necessary and legitimate use of land, since the "wilderness" has become scarce and it is a commodity which cannot be renewed. They also felt that the wilderness was necessary for scientific study much of which is comparative. Leopold also felt that wilderness areas can teach man something which he called "land ethic". This he perceived as a law which governs the relations between the members of an ecological society - that is, members of a biotic community - or in other words, the relations between man and his natural surroundings.[33] Leopold also noted that one of the basic weaknesses of the conservation system which he encountered was that it was a system based wholly on economic motives and that most members of the

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33 Leopold, Aldo, (1966), op.cit.

land community have no economic value. To support his claim, he gives an example from his book "A Sand County Almanac".

> Of the 22,000 higher plants and animals native to Wisconsin, it is doubted whether more than 5% of them can be sold, fed, eaten or otherwise put to economic use. Yet these creatures are members of the biotic community, and if (as I believe) its stability depends on its integrity, they are entitled to continuance.[34]

This sort of attitude appears to be in direct contrast to the earlier ideas about conservation as expressed by Gifford Pinchot. Due to the definite concern about economics throughout American society, it was almost inevitable that those interested in conservation must be made to adapt their arguments to include economics. Such an adaptation is expressed below by American poet Walt Whitman.

> When we realize that in 1950 alone the amount spent by hunters and fishermen for their activities was about $9,200,000., there is no question that protective measures must be taken to ensure the reproduction of wildlife.

This sort of economic rationale as well as the cost benefit considerations in resource conservation have progressed and become incorporated in many of today's arguments in favour of the necessity for conservation of many things.

From this brief historical sketch, the evolution of the American

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[34] Leopold, Aldo, (1966) op. cit.

notion of conservation gives a good indication of what conservation is understood to mean here in Canada as well. Those who love nature and those who are concerned with the destruction and extinction of parts of and the whole of the natural environment have voiced this concern and hopefully have made other individuals and interest groups aware of the consequences of a disregard for conservation.

In his book Conserving American Resources, Ruben L. Parson attempts to relate "the conservation idea" as it exists today "to sustain our material culture which derives from natural wealth". His view is one of optimism rather than pessimism and essentially entails a need for education of every American in such a way as to inform him on resources and their conservation, ie. "to aqaint thinking Americans with the broad categories of natural wealth upon which their well being depends".[35] In general, the natural resources with which Parson concerns himself are the basic earth materials - water, soil, plants animals and minerals, - "that we employ or convert to sustain our material culture".[36] Parson concedes that sustaining this material culture is a given and that prosperity will thus depend upon the wisdom with which these resources are used. This assumption has recently come under attack by those who question growth for the sake of growth. Important in today's attitude toward conservation is the distinction between resources which are perpetual and those which serve only once, ie. renewable and non-renewable resources. Plants and animals will

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[35] Parson, R.L., (1964), op. cit.
[36] ibid.

reproduce and maintain their numbers unless they are badly treated. Soils can be maintained, and even improved, under productive use. But minerals extracted from the earth serve us only once, although certain metals can be salvaged and reused, before they are spent. Thus the conservator deals with two great groups of resources ie. renewable and non-renewable.

The non-renewable minerals are of utmost importance in today's age of technology but will surely lose their position as one after another becomes exhausted. We will then once again become reliant upon the renewable ones. Minerals are thus only conservable by more thorough exploitation and more efficient employment. According to Parson, then, the conservation idea means the fullest possible use of natural resources without neglecting any that can be used. "It means thrift, but not denial; frugality but not privation; efficiency but not austerity."[37] The words thrift, frugality and efficiency all have to do with degree. The degree to which these words and their meaning are to be pursued is not elaborated upon by Mr. Parson. Parson explains that preservation has a place in conservation, but only in exceptional phases of it. "Aesthetic resources are like prized antiques and heirlooms: displayed with pride but not used for profit."[38] It is not expected

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37 ibid.

38 ibid.

that everyone will subscribe to the notion of conservation which appears here as that of Ruben L. Parson, Resource Geographer, however it is probably a good indication of the contemporary notion of conservation which is the attitude of most government agencies involved in conservation.

The United States Department of the Interior, in their Conservation Yearbook No. 4,[39] has recorded what they termed - A Report to the Stockholders ... The American People. This report, for the fiscal year 1967, gives an indication of the U.S. Federal Government involvement in conservation as well as reflecting quite clearly the relationship between conservation and economics. This report contains all of the revenues and expenditures for that year that were attributed to the various conservation activities in which they were involved. The programs are all described and the sub-totals are recorded as well as the total revenues and expenditures. The total expenditures were 5.5 billion and the total revenues were 5.3 billion, possibly indicating that conservation is not a very good short term investment.

Since it has been suggested here that many people feel economics and conservation have become closely related, it might be of interest to

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39 United States Dept. of the Interior, (1968), Man an Endangered Species Conservation Yearbook No. 4. Washington, D.C.

see how an economist would define conservation.

> To the economist conservation involves the act of managing resources in such a way that a maximum volume of human wants will be satisfied. The economist would surely identify this act as arising out of concern for both present and future wants. The practice of conservation is essentially an engineering problem, involving the manipulation of physical entities that will permit the attainment of predetermined goals.[40]

It now appears that the polarization which once appeared quite evident regarding conservation and development has lessened somewhat since the time of the early conservators. This lessening appears to be due to a gradual change of attitude and definition especially of conservation. Conservation can be understood to mean the husbanding of natural resources; that is,

> the developing of these resources in accord with the best public interest, restoring to productivity those which have been depleted and guarding them against further depletion.[41]

The connection between planning and conservation is probably most evident on the Canadian scene.[42] The establishment of Provincial Departments of Municipal Affairs and the first Town Planning Conference to be held in Canada as well as the drafting of a comprehensive model

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40 Smith, G.H., (1958), Conservation of Natural Resource 2nd ed. New York.

41 ibid.

42 Gertler, L.O., (1968), Planning The Canadian Environment. Montreal, Chapter 7.

Provincial Town Planning Act for Canada, were all the direct result of the Commission of Conservation, established in 1909.

Environmental Criteria and Land Use:

The question now is - what connection is there between the above discussion and the establishment of an environmental criterion?

In considering man's relationship with his natural environment, any number of aspects could be included as criteria for making land use decisions. All manner of pollution could be included such as: water, air, noise, and sight pollution. Preservation and use of inherent natural resources including flora, fauna, water and minerals could also be considered as environmental criteria. The criteria must attempt to be comprehensive; however, none to date has been devised to include all of the above aspects save all of the many other aspects of the extremely complex relationship between man and nature. The criteria to be used in this thesis has to do with land suitability to a variety of uses. Although far from being all inclusive, the criteria used here can be considered one means of including some of the environmental concerns in land use decisions.

For the purpose of this thesis it is proposed that "intrinsic suitability"[43] maps be used to determine areas of land which are physically capable of supporting or suitable to a particular

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43 Belknap, R.K. et al., (1967), Three Approaches to Environmental Resource Analysis. The Conservation Foundation, Washington, D.C.

land use. Landscape architects and resource geographers such as Ian L. McHarg, G. Angus Hills and Phillip H. Lewis Jr.,[44] have devised environmental resource analyses aimed at producing such suitability maps. The basis to be used in deciding what areas are suited to what uses will be an extensive inventory of the natural environment of the region. The next step will be to have experts on the prospective land uses decide what physical or environmental characteristics are best suited to the land uses on which they are expert. The final step will be to apply these individual characteristics or criteria to the inventoried data resulting in the location of areas "intinsically suited" to the prospective land uses. This somewhat idealistic determination of land use location is likely to prove ineffectual when attempted in relatively developed regions. Economic and social factors ultimately play much more important roles in determining land use locations in these regions.

In dealing with a relatively undeveloped region, the use of this suitability approach is much more likely to succeed. For the purpose of this thesis, the "intrinsic suitability" of land areas will therefore be the environmental criteria in determining the supply of land available in the region for the prospective land uses.

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[44] ibid.

Just as the notion of conservation has evolved, so the values used in deriving suitability areas are quite likely to be changed or refined as more data and better techniques of analysis become known. The purpose of using the environmental criteria initially will be to control the location of land use and thus activities in such a way as to protect the natural environment as it is understood today.

Economic Criteria and Land Use:

Recalling an economist's definition of conservation - "to manage resources in such a way that a maximum volume of human wants will be satisfied",[45] one may view land as a resource and as such, it must be managed in such a way that a maximum volume of human wants will be satisfied. If therefore, one is confronted with a problem of competing land uses desiring the same piece of land, the economic criterion must be applied in deciding to allow that land use which will satisfy the greater volume of human wants.

This relatively simple criterion involves a great deal of research and quantification. Even if much of the quantification is in the form of accurate estimates rather than actual fact, this procedure is still very valid in that the gap between an arbitrary decision and a fully rational and logical decision will be reduced considerably.

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45 Smith, G.H., (1958), op.cit.

This chapter began by discussing models in general, then proceeded to describe the two criteria which will act as guide-posts for the decision-making model to be developed in this thesis. The model will be used to anticipate general categories of land uses or activities (based upon existing trends) and in so doing, to devise a framework within which decisions can be made about the highest and best location for these land uses (based upon environmental and economic criteria).

Applying theory to real life situations can be viewed in a similar light to that of the scientific method - formulating an hypothesis and then experimenting to see whether the hypothesis is correct or not. Contrary to scientific experiments, which often employ higher level controls and where an hypothesis can be examined and measured with a high degree of objectivity, the complex and changing systems involved in land use decisions make evaluation of good and bad, right and wrong decisions very difficult indeed. The model developed here therefore bears only slight resemblance to an hypothesis in a scientific experiment. Still it could be tested in a real-life situation in a similar fashion to testing an hypothesis. Part II of this thesis will in fact develop the decision-making model (based upon the theory stated in this part of the thesis) and then test this model in a real-life situation.

PART II

CONSTRUCTION OF A MODEL

THE ESSENTIAL ELEMENTS OF A LAND USE MODEL TO AID IN DECISION-MAKING

CHAPTER 4

CHAPTER 4

THE ESSENTIAL ELEMENTS OF A LAND USE MODEL TO AID IN DECISION-MAKING

Several assumptions will be made here about the first two phases of the planning process (see page 21). This will allow the discussion in this chapter to concentrate on the third phase of the process where models are most beneficial. Firstly it will be assumed that the government agencies, responsible for disposing of Crown lands, have decided to adopt planning. Secondly it will be assumed that the goals they wish to achieve in disposing of this land are those goals described in the introduction of this thesis (see page 4). The question as to how these goals may be achieved now becomes the responsibility of a decision-making model.

The author proposes to explain the elements that he feels are essential to the formulation of such a land use decision-making model. These elements fall into four broad categories: existing conditions, prospective activities, supply of land and formulation of alternative plans.

Existing Conditions:

Three basic elements will be used here to describe the present or existing conditions within a region. Physical resources, existing activities plus human needs and desires are these three elements and their study and investigation should lead to an appreciation not only for what the region is but also what it is likely to become.

There are of course many other elements which can be used to determine existing conditions. For example, the socio-political system both within and outside of the study area as well as the history of development might also be considered important elements in determining existing conditions. These and other similar elements have not been included but could be included in a more comprehensive model.

A physical resource analysis is a very essential element and often forms the basis for regional land use studies. This sort of analysis not only inventories the physical resources available within a region but also attempts to express the quality of the resources as well as their location in relation to other aspects of the region. Investigation of human needs and desires can be a very difficult multifaceted exercise as well as a difficult study to "keep up" since people's tastes are apt to change quite rapidly. There is always the question regarding whether the needs and desires of the populace should in fact be met or even attempted to be met. In a democratic society, one must accept as a given the needs and desires of the majority of the population. For this reason and since this thesis deals with a situation occuring in a democratic society, it will be given that the needs and desires of the majority of the people should be met wherever possible.

For the purpose of this thesis, human needs and desires will only be considered for the effects they may have on land use. The converse of this concern - the effect land use has on people, would

indeed be an interesting study, however one which might better be handled in a psychology or sociology thesis. The aspirations, needs or desires of an individual, group or organization to use land for various activities will be the major concern of this element of the model. Of concern as well will be the way in which people are using the land of the region at present. The interaction between people and the physical resources will result in both existing land use and activities as well as land uses to be expected in the future. This thesis assumes that people wish to make best use to their knowledge of the physical resources available to them and therefore a very basic economic factor comes into play. Economics is one of the many facets of the human personality which can play a dominant role in deciding the relative merits of land use activities.

The economics of the existing activities of the study region will not be of as much interest in this thesis as the economics of the prospective uses of land. Investigation of the existing activities, however, ranks with the study of physical resources and of people in determining the present situation of a region. The resource and the human elements interact as well with the existing activities element in deriving the types of land use which are likely to be needed or desired in the future.

Prospective Activities:

The prospective land uses derived from analysis of the above interactions form another basic element of the model. It must be stressed that this element does not purport to be an expression

of demand in the formal economic sense. Demand, in this economic sense, for the use of land within a region would require a great deal of quantification of data or conditions which are likely to be changing constantly. This is especially true for the relatively undeveloped and developing type of region for which this model is being formulated. The element considered here as - prospective land uses - is more an expression of the land uses likely to be pursued within a region of a given character or situation - physical resources, existing activities and people. In keeping with the goal of the model and the economic criteria already established (see page 27), it will become evident that certain land uses will satisfy more human wants and desires than will others. What follows is a crucial stage in the sort of decision-making model being discussed here. In other words, by applying the economic criterion to the prospective land uses and in view of the existing character of the region (also its surroundings), decisions will be made as to the relative degree of satisfaction of human wants as earlier defined inherent in each of the prospective land uses. This and the other stages of the model will be elaborated on in much greater detail after the model has been developed and when it is being tested. This decision-making stage, however, will result in another element of the model. The ordering of the prospective land uses into a range from the one which would achieve the most human satisfaction to the one which would achieve the least satisfaction, could constitute another element of the model.

Supply of Land:

The physical resource analysis carried out as part of the first category of model elements will result in some very beneficial guidelines in determining not only the location of land to satisfy the prospective uses but guidelines as well in determining how much land is physically suited to each prospective use. A second crucial stage in the model is reached when decisions must be made about what land is physically suited to what use. The environmental criteria discussed in Chapter 3 (see page 27) become factors necessary in making these decisions. Interaction between the resource analysis, the prospective land uses and environmental criteria will produce a description of the location and supply of land physically suited to each of the prospective uses. The location and supply of land for these uses form as many elements of the model as there are uses being considered. In other words, the location and supply of land physically suited to forestry could form one element of the model while the location and supply of land physically suited to recreational cottage development could form another element. The attractiveness of each parcel or unit of land, in each of the above elements, for each of the uses will depend to a great deal upon the "infrastructural"[46] nature of each

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46 The infrastructure referred to here and for the purpose of this thesis will be strictly of the physical nature. Consequently it will include only factors such as roads, power, and telephone lines, etc.

unit of land. For example, if there exists a unit of land within the region which is physically suited to country residential development but it is excessively distant from the nearest urban area, and the closest road is ten miles away, there is little likelihood that this land unit will attract this sort of development at this stage in time. Infrastructural factors should then make it possible to rank the supply of land for each activity and thus form separate model elements. For each land supply and location element, there will consequently be a ranking of this supply in view of the infrastructural factors. It must be noted that as these infrastructural factors change, there must be a corresponding adjustment made in the ranking of the supply. For example, the same unit of land used as in the country residential example would become more attractive if an all-weather road were to link it to the urban center. In this case, that unit of land would move upwards in the ranking suggested here as another possible element for the decision-making model.

When the supply and location elements were derived, there was no consideration given to the possibility that a unit of land may be physically suited to more than one use. The ranking (according to infrastructure) that followed could therefore quite conceivably have resulted in units of land which were not only physically suited to more than one prospective land use, but as well were highly attractive to more than one future use. The ranking of the supply of land must now be applied to the ranking of prospective land uses

to investigate the possibilities of conflict between land uses competing for the same unit of land.

Formulation of Alternative Plans:

This broad category must include the elements of the model which will bring together the supply of land and the prospective land uses to suggest means of resolving land use conflicts. The result should be several alternative plans expressing different courses of action which could be followed in attempting to realize the original goals (see page 4).

Evaluation of these suggestions or alternatives must remain the duty of responsible government officials who theoretically can best judge the wants and desires of their constituents. However, the evaluation phase of the planning process will be included in the model structure. The process of evaluation is closely tied to changes in any of the preceding elements. Consequently there must be an expressed feedback mechanism for the evaluation elements of the model. The result of these evaluations should be suggested courses of action. Both the evaluation and especially the courses of action are political in nature. They have been included in the model structure more to complete the planning process than as elements of the model and thus part of this thesis. Also included in the model structure will be an element labelled "Monitoring and Review". This element suggests the continuing and on-going system with which the model deals and as well completes the planning process (see page 21).

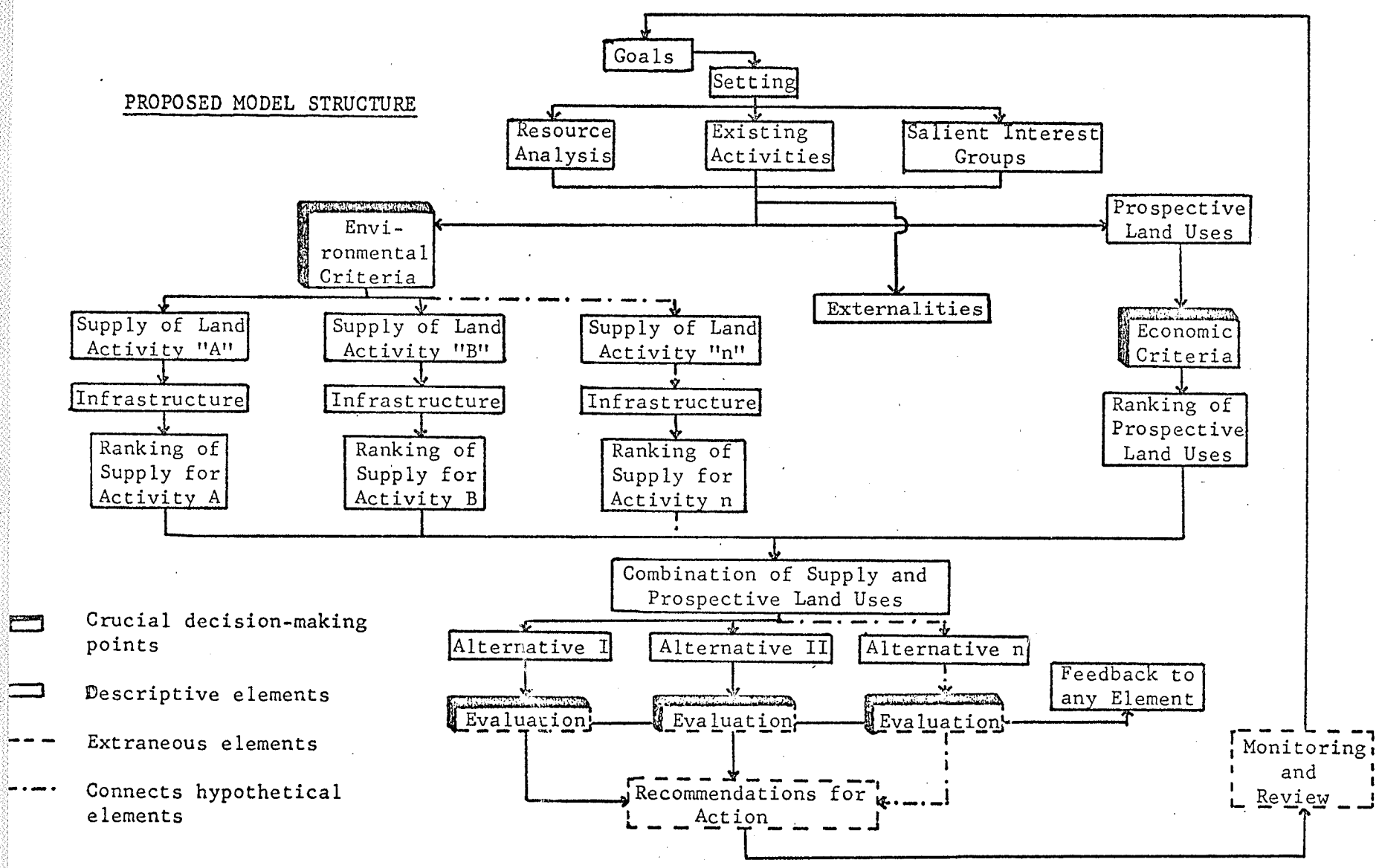
PROPOSED MODEL STRUCTURE
Goals
Setting
Resource Analysis
Existing Activities
Salient Interest Groups
Envi-ronmental Criteria
Prospective Land Uses
Externalities
Supply of Land Activity "A"
Supply of Land Activity "B"
Supply of Land Activity "n"
Economic Criteria
Infrastructure
Infrastructure
Infrastructure
Ranking of Prospective Land Uses
Ranking of Supply for Activity A
Ranking of Supply for Activity B
Ranking of Supply for Activity n
Combination of Supply and Prospective Land Uses
Alternative I
Alternative II
Alternative n
Feedback to any Element
Evaluation
Evaluation
Evaluation
Monitoring and Review
Recommendations for Action
Crucial decision-making points
Descriptive elements
Extraneous elements
Connects hypothetical elements

Figure 1.

What remains to be done is to suggest a structure or framework within which these elements can be arranged in a rational or logical order. The way in which the elements have been presented in this chapter gives some indication of the way in which a model framework could be developed. Even with this hint of order, many structures or frameworks could be conceived of. Just as the elements selected by the author have to be likened to a scientific hypothesis, so the framework for the model which appears as figure 1 might also be likened to an hypothesis.

Except for the box labelled "Setting", all of the other elements of the model have been discussed. The "Setting" will simply serve to introduce the region being studied.

In summary, the author feels that the model should include the following broad categories consisting of the more specific elements suggested below.

Broad Categories	Specific Elements
(1) Existing Conditions	- Resource analysis
	- Existing activities
	- Salient interest groups
(2) Prospective Activities	- Prospective land uses
	- Economic criteria
	- Ranking of prospective land uses
(3) Supply of Land	- Environmental criteria

	- Supply of land (for each prospective land use)
	- Existing infrastructure
	- Ranking of the supply of land (for each prospective land use)
(4) Formulation of Alternative Plans	- Combination of supply and prospective land use rankings
	- Alternatives

The remaining elements expressed in the structure of Figure 1 are strictly speaking not part of the model but have been included to indicate the whole structure of the planning process.

N.B. Externalities

This element has been included in the model structure to indicate that there are many other aspects or factors which may play a part in making land use decisions. Some of these are listed below:

-Policy and legislation regarding such matters as settlement patterns, resource exploitation or transportation and communication systems.

-Technological change, for example- a region which is being developed on the basis of say the oil and gas industry may be drastically affected by the discovery and use of a more economical source of energy. On the contrary, a region developing mainly as a result of pulpwood cutting may develop much more rapidly if a new means of paper production allowed this activity the latitude to locate a manufacturing plant in this region.

It becomes evident from the above that the aspects used in the model are by no means exhaustive and that any notion of "highest and best" land use can only be deemed possible if such externalities are considered.

THE ELEMENTS OF THE MODEL IN DETAIL

CHAPTER 5

CHAPTER 5

THE ELEMENTS OF THE MODEL IN DETAIL

Goals:

The goal being used as a basis for this model (see page 4), contains words and phrases such as: planned and integrated, present and future citizens, benefit, and solid ... criteria. All of these are open to interpretation. The author's translation is expressed in the model, elements, criteria and testing which occur in this thesis. The author feels that the true value of this thesis is the offering of one interpretation and methodology which can be used in grappling with these goals. An interpretation and methodology which can act more as a starting point from which more refined investigation and techniques may develop and which can generate thinking, discussion and awareness of the problems expressed in the goal. On this note, the remainder of the model elements will be discussed in more detail beginning with the element labelled "Setting".

Setting:

This element serves to introduce the study region. For the sake of simplicity and clarity, an outline will be used to indicate what is involved in many of the model elements. For example, below is an outline of what is involved in the element of the model, labelled "Setting":

Location
Regional setting
Designation of Boundaries
Physical Resume
- Geology and Topography
- Hydrology
- Soils

- Climate
- Flora (vegetation)
- Fauna (wildlife)

History of Settlement and Land Use

The above outline requires some elaboration. For example, when discussing location and regional setting, careful analysis must precede any decision regarding what the regional boundaries are to be. It must also be stressed that no region is isolated and that it is apt to be influenced by external activities and elements both immediately adjacent to it and those far distant from it. Since the regions of interest here are relatively undeveloped ones, it is likely that there will be only one or possibly two service centers located within their boundaries. An aggregate of the market areas must be used to determine a composite market area for the service center(s). If this market area is coupled with other area units such as forest management districts, agricultural districts, etc., it should be possible to determine a rough regional boundary. Maps portraying populated areas both within and external to the region will be necessary. These maps should also express political or administrative boundaries and possibly transportation and communication links to and within the region. Explanation and interpretation should accompany these maps.

The aspects considered under the heading of Physical Resume are all quite straight forward. The only question here is: to

what depth are these aspects considered? Since this element serves only to introduce the region, general maps of the entire region will suffice. The Resource Analysis element of the model will deal with these aspects in a much more detailed manner.

Since the region studied is relatively undeveloped, the history of settlement and land use may be summed up in a few short paragraphs. Description of these human phenomena should be accompanied by an explanation of why they took place as well.

The "Setting" element of the model may not be an essential prerequisite to the other elements of the model, however it will also serve as a handy reference when this thesis gets involved in all the detail of the remaining elements.

Existing Conditions:

(a) Resource Analysis:

Following is the outline of the aspects involved in carrying out this element of the model:

Method of Analysis
Data Input and Processing
Application of Methodology

This very important element of the model hopefully will serve two basic purposes. The first is to identify what resources are available within the region for the purpose of utilization. The second purpose is to ensure that the land uses and resource exploitation activities take place in such a way as to minimize disruption

of the natural environment. This second purpose may appear difficult to realize. However, from the point of view of land use, environmental suitability will act as the criteria. This point should become more clear as the detail of what is involved in a resource analysis is explained.

(i) Method of Analysis

There is no strict rule or direction for conducting a resource analysis and the realization of the necessity for such an exercise has not been assumed for too many years. It was not until the 1930's that a nationwide effort in the United States was initiated to locate and quantify a broad list of individual resources and to plan for their development. This was initiated under the banner of natural resource conservation and planning. By the late 1950's it appeared that this "single factor" approach began to evolve. The tendency to quantify resources was broadened to attempt inclusion of analysis of the quality of resources and their development potential. Spatial patterns and groupings as well as the environment as a whole were now considered in resource analysis.

Over the next two or three decades, billions of dollars and countless man-hours will most likely be spent to protect and develop the resources that create and affect the quality of our physical environment.[47] Because of immediate needs and desires, there is

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[47] Belknap, R K. et al, (1967), Three Approaches to Environmental Resource Analysis. The Conservation Foundation, Washington

no choice but to use existing approaches to resource analysis and to improve them as may be possible. Few approaches have been developed and little is known about those that do exist. Information about them is scattered in professional journals, project reports and proceedings or papers from conferences. The Landscape Architecture Research Office, Graduate School of Design, Harward University, has attempted to consolidate a review of three approaches to environmental resource analysis.[48] The researchers investigated and displayed the approaches of three leading individuals in resource planning, namely: G. Angus Hills, Phillip H. Lewis Jr. and Ian L McHarg. The concepts and ideas of these individuals are still held in high regard by their contemporaries and successors even though more advanced tools and techniques have been devised for resource analysis. The computer has become a useful tool and the SYMAP and GRID programs have become advanced techniques for conducting resource analyses. Better tools and techniques are sure to be developed, however, there is no choice but to use these existing approaches. The approach described here will be the one currently being pursued by the Research Section of the Planning Branch, Alberta Department of Municipal Affairs. This approach attempts to be inter-disciplinary and to use the technique known as SYMAP.

It must be stressed that the SYMAP program is only a sub instrument of the computer and as such is nothing more than a tool. It depends exclusively upon the accuracy of the data which is inputted

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[48] ibid.

and especially upon the ability of land use experts to choose the best suitable use(s) for that area of land.

SYMAP is a computer program for producing maps at a high speed by the use of an on-line printer. Its original concept was developed by Prof. H.T. Fisher of Harvard University. Its current version has been developed at the Laboratory of Computer Graphics, Harvard University.

The program is written in Fortran IV and is in use at quite a number of agencies and institutions here in Canada, including the Computer Center of the University of Manitoba.

The SYMAP program can produce the following three types of maps:

(a) Contour or isoline maps

- The contour map consists of curves connecting all points with the same numeric value e.g. elevation

(b) Conformat or choropleth maps

- In this map each data zone, predefined by boundaries, is given the same value and assigned the same symbol

(c) Proximal maps

- In the proximal map each character location is assigned the value of the data point <u>nearest</u> to it.[49]

A location in the SYMAP program is measured by a pair of co-

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[49] From an unpublished set of student notes distributed by Prof. H. Tanimura, Department of City Planning, University of Manitoba.

ordinates (DOWN & ACROSS). This is equivalent to the (-y,x) location in the Cartesian coordinate system, when the upper frame of the map is the x axis and the left side of the frame is the y axis In other words, DOWN is a distance in inches from the top frame of the map and ACROSS a horizontal distance from the left border.

The following story, related by Prof. Howard Fisher to the First Boston Architectural Center Conference in December of 1964, gives an insight into the necessity for such a computer program as SYMAP.

> Not long ago I was talking to a regional planning director who had devoted more than a year of effort to the building up of what he called a "data bank"- namely a collection of factual information pertinent to his activity and organized in a form suitable for machine processing. Upon finally completing everything in good order he asked the computer what he thought was a relatively simple question regarding the data. In reply, according to his story, he received a stack of folded paper about an inch thick consisting of tabular data page upon page. Repeating the process, after narrowing his question substantially he got back about a quarter-inch pile of paper. Again he submitted a simpler question and finally received a reasonably limited volume of tabular data which he gave to a draftsman who, three or four days later presented him with a map conveying in comprehensible graphic form the significance of the computer's output in relation to his study.[50]

Prof. Fisher reported this story as an illustration of the inadequate use of today's high-speed computers.

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50 Fisher,H.T., (1964), Architecture and the computer, Procedings From The First Boston Center Architectural Conference. Boston

In order for the human mind to comprehend large quantities of data, an organized graphic format can be of immense help. Data available only in tabular form is all too frequently worthless data. SYMAP, short for "synagraphic computer mapping" is designed as a program to deal equally well with past data, current data or future data. Equally, it is ready to deal with abstract space as any other, and may therefore be used for schematic charts and graphs as well as for representational maps, plans and diagrams.

In preparing a project for execution it is important to understand that there are two basic types of facts about which the computer must be informed: where things are and what they are. Provided with little more than this information the machine will take over and turn out a graphic display of the data in its correct relationship. If the facts to be represented are quantitative, they will of course be expressed in numeric terms. If they are qualitative, they will or can be so described. Density, for example, could be expressed on a print out in a range of computer symbols from light to very dense or dark zones. One can, of course, deal with any conceivable type of data. In feeding data into the computer, you may ask it to carry out computations desired such as figuring out ratios or percentages. Or, for example, the computer may be told to weigh the data by applying equating factors and thus be able to deal with relationships, arange a variety of subjects or merge them into one aggregate display.

Finally, if so desired and subject to provision of the necessary information, the computer will provide a title with supplementary explanation below each separate display. It will also print words or symbols directly within the display area to indicate different kinds of physical or other features which may be of concern to the user. Because of the memory capacity of a computer, one large advantage of SYMAP is that information common to a whole series of displays need only be inputted once.

The actual usability then of the SYMAP program can be summarized thus:
- it provided a graphic display of spatially disposed data
- it employs widely available computer equipment
- it is designed for use by people without prior computer experience and without advanced mathematical training

SYMAP in Perspective

The preparation of maps with the aid of a computer is a fairly recent development and one should be made aware here that the SYMAP program is not the only program developed for this purpose. For example, a program known as the GRID program has been created by Mssrs. Sinton and Steinitz.[51] The GRID program is designed specifically to provide a highly efficient means for graphic display of

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51 Steinitz et al. (1969), A Comparative Study of Resource Analysis Methods , Department of Landscape Architecture, Harvard University

large quantities of information collected on the basis of a rectangular coordinate grid. The necessity of collecting information in this manner plus the fact that GRID is unable to produce contour type maps indicate its limits as compared to the SYMAP program. The SYMAP program does however require a larger computer memory than does the more simplified GRID program. Regardless of the computer program used, one would be amply justified in using a computer mapping program as a resource analysis technique if the following are assumed:

- a large number of resource maps will be required over a period of time
- the region studied is of considerable size e.g. hundreds of square miles
- there will be a large variation in the data content for the maps
- preparation time for the maps is to be minimized and they must be highly accurate
- available data is readily convertable to machine readable form
- an immensely large amount of data is to be used
- available data is readily identified spatially

The preparation of a computer map requires three steps: providing the computer with data in a form acceptable to the machine (input);

the manipulation of the data preparation of the map within the computer's memory (processing); and the actual display of a map by the computer (output).

(ii) Data Input and Processing

Data collection is often a costly and time consuming step of the planning process. The type and amount of data used in any study does of course depend upon the nature of the study as well as such constraints as time and costs. The nature of this element of the model will be a complete resource analysis for a specific region. Therefore every attempt should be made to use all the spatial data regarding resources that are available from whatever sources can be tapped. Agencies involved in resource identification and development must be contacted for whatever data they might have for the region studied. Appendix A lists the data types and data sources used by the Research Section of the Planning Branch, Alberta Department of Municipal Affairs[52] in carrying out a resource analysis for a region such as the one of interest to this thesis. Data gathering can have a two fold benefit. Not only will it provide the necessary data to conduct out analysis but it will also serve to aquaint the various agencies with what the study is about and hopefully result in some very beneficial feedback

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52 Provincial Planning Branch, (1971), op.cit.

from these specific agencies.

Once it has been determined what data are available and can be used, there will be the question of what spatial accuracy to employ. The question of spatial accuracy (ie. whether to record data on the basis of square feet, acres, quarter-sections, square miles etc.) will be strongly influenced by the size of the region being studied. For example, it may be physically possible with the data being used to use one acre as the basic unit of analysis, however time and cost factors are surely to be formidable constraints when analyzing an area of hundreds of square miles. Hypothetically the ultimate in accuracy could be achieved by following the least common denominator rule.[53] This rule (see figure 2) essentially states that one must find the cell or data unit suze which is the smallest unit resulting from the overlay of the various data zones Again one must be aware that for a region composed of hundreds of square miles, which this analysis is likely to be involved with, it would economically be unpractical to follow this rule.

Let us assume that the quarter-section for example has been decided upon as the basic data unit for analysis. In making

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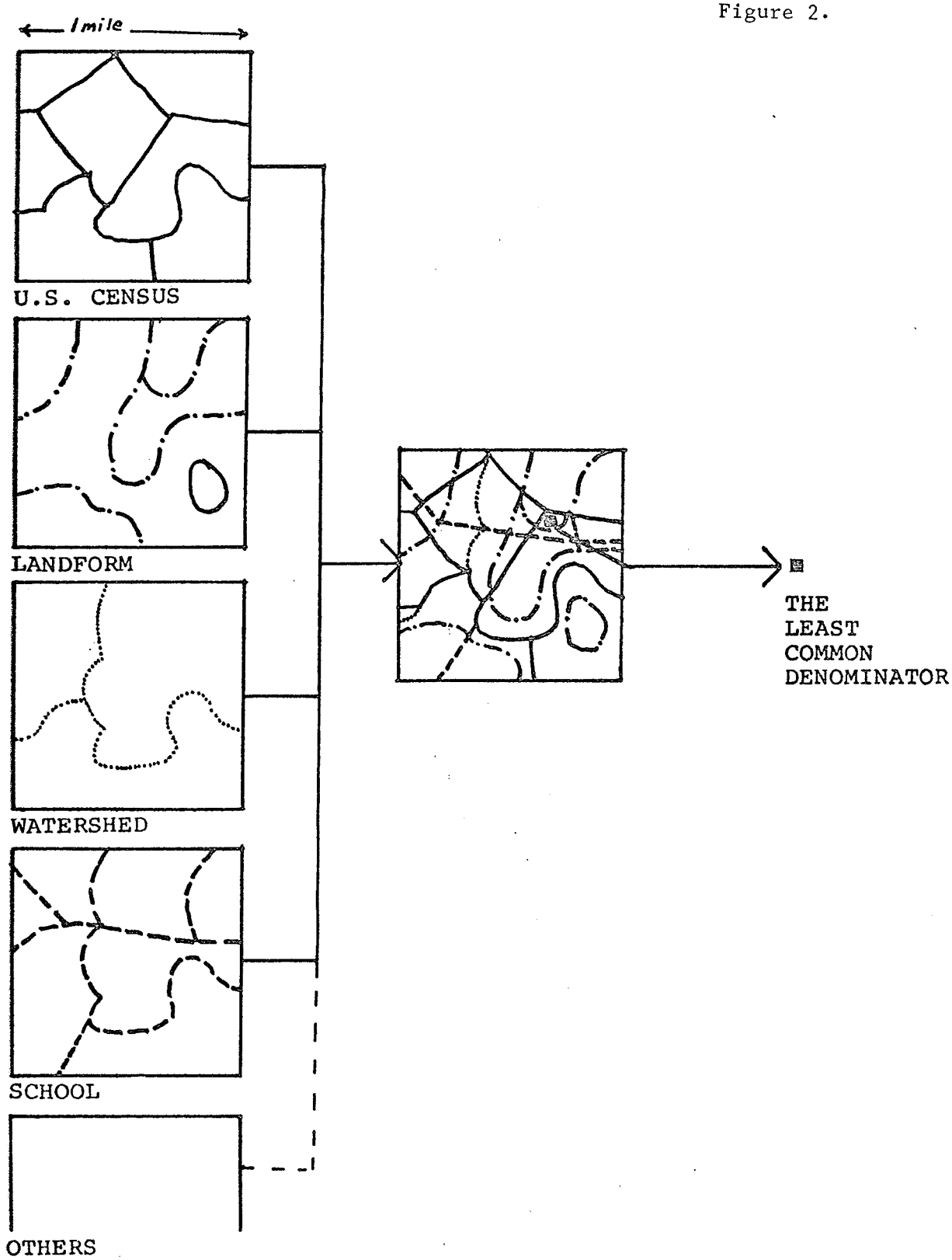
53 Steinitz et al, (1969), A Comparative Study of Resource Analysis Methods. Dept of Landscape Architecture, Harvard University.

Figure 2.

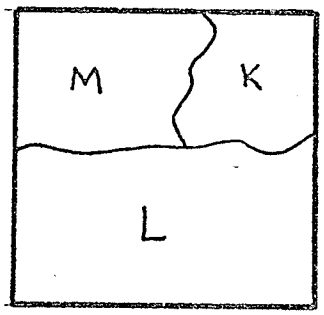


Source: Steinitz et al., A Comparative Study of Resource Analysis

this decision there will now be a committment to identify spatially all the data. In other words, each bit of data inputted to the computer will be identified with a specific quarter-section.

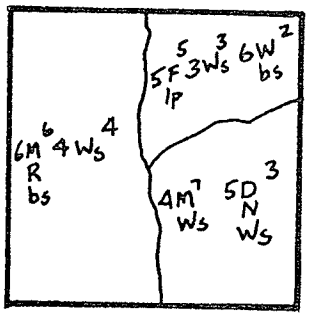
In order to facilitate and speed up the input of data into the computer, coding systems should be employed. For example, instead of key-punching the phrase "barren above timberline", the code letters BAT would mean the same thing The A.R.D.A. sponsored Canada Land Inventory series of maps are already in a coded form If this data is not available or not to be used, it will be necessary to devise a coding system. The next problem in coding and recording data has to do with how much detail is considered necessary and feasible. The best way to describe what is meant here is by using a specific example.

The square below represents a typical quarter-section from a Canada Land Inventory Present Land Use Map.



The M, K and L represent the three different types of land use which are found within the boundaries of this specific quarter-section. The question of detail in recording this data now becomes quite clear. Does one wish to record all three types of land use in this unit, just the two largest types or possibly just the one which covers the majority of the area. For the sake of accuracy it is evident that one would want to record all of the three uses and further achieve accuracy by expressing the relative importance of each use in terms of land area devoted to each - possibly by percentages (50%L, 30%M, and 20%K). In essence it might be recorded thus: 5L∅3M∅2K∅ (the ∅ symbols simply acting as fillers to separate the data bits). Accuracy however must sometimes be sacrificed due to time and cost constraints. When it is considered that present land use is just one of many types of data to be recorded for each quarter-section and when it is further considered that there are likely to be several thousand quarter-sections in the study area, there is definite cause for concern about how detailed the recorded data can be. A second example might help drive home this point.

Following is a typical quarter-section from a land capability for forestry map.



a completely accurate means of recording this information might look like this: 6MBRB64W?W45Ø4M?W75DNW33Ø5F?L53??W36W?B22.

Again in consideration of the number of times similar data must be manually recorded and then key punched it is easy to see how accurate detail might have to be sacrificed. A cost-benefit analysis similar to the one used to decide on the size of data unit to be used is necessary to decide what data accuracy will be used. The "Hinton Yellowhead Study"[54] being carried out by the Research Section of the Alberta Provincial Branch retained all of the accuracy mentioned above. There were several reasons for this, probably the most important of which was the fact that other similar studies were being carried out in Alberta and it was decided that fully accurate and uniform input could provide the basis for a comprehensive data bank which eventually could be extended to other areas of the province. Another deciding factor may have been the availability of "cheap" labour in the form of provincially sponsored summer students who were used to record much of the data. There are bound to be other considerations such as these that will help decide what accuracy will best suit the specific study situation.

Regardless of what accuracy is decided upon, the method of inputting the data will essentially be the same All relevant

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54 Provincial Planning Branch, (1971), Hinton-Yellowhead Land Use Study. Alberta Dept. of Municipal Affairs, Edmonton.

data will be manually transferred to sheets (each quarter-section has a corresponding data sheet) and the fully coded sheet is given to a key punch or key to tape machine operator who punches this coded information onto cards or a magnetic tape. Figure 3 gives a graphic interpretation of this the first step in producing a computer map (ie. the input stage). The cards or magnetic tapes are then simply fed into the computer memory banks. The manual parts involved in this first step are also likely to be taken over by automated data transfer equipment in the near future. Another possibility would be to have the agencies collecting the original raw data feed it directly into a computer rather than processing their own hand drawn maps etc. The object, of course, is to get the data into the computer and have it spatially identified, in this case, on a quarter-section basis.

(iii) Computer Output

There must now be a means of searching or retrieving the specific data required to produce whatever sort of map is desired. The computer system presently in use at the Alberta Planning Branch[55] is based upon the Glenrose Hospital Patient Information Retrieval

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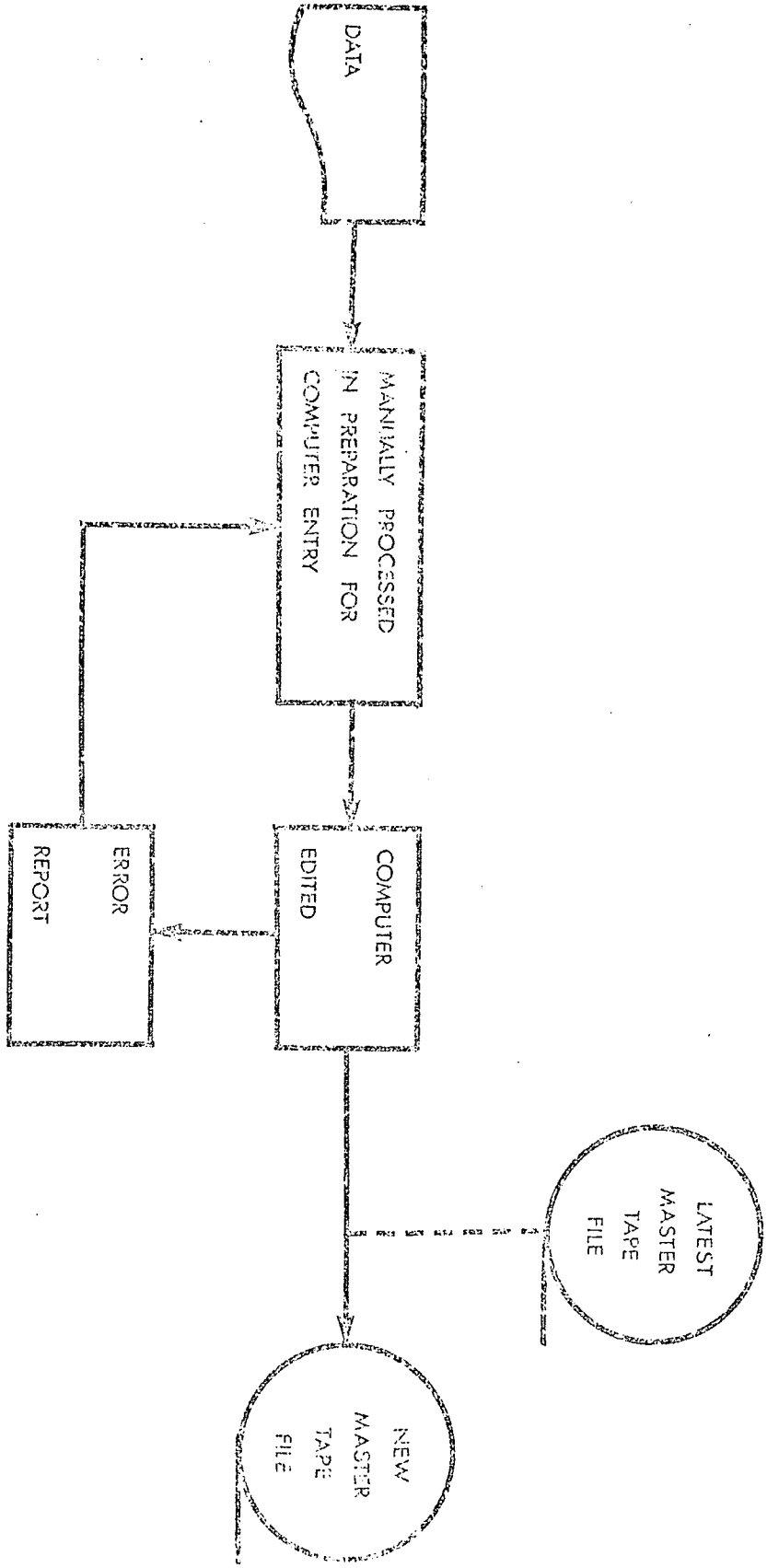
55 Provincial Planning Branch, (1971), op.cit.

Figure 3

DATA ENTRY PROCEDURE



Source: Provincial Planning Branch, Alberta Dept. of Municipal Affairs

System (G.H.P.I.R.S.). This system stems from the initial use made of IBM's Document Processing System (D.P.S.), in particular, the manner of collecting data by key-wording paragraphs within a text. This allows both a selective means of search and a relatively free form of input.

Since data collected in the course of the planning process is as extensive as it is varied, the mechanisms for storing and retrieving this data must be capable of handling virtually any type without resorting to other than minor special handling. In other words, the computer system must be free of encumbrance placed on it by the information content and instead it should be orientated towards the performance of a set of tasks. In this instance the set of tasks is that of creating and maintaining a compressed, machine readable file of data and retrieving facts from that file based on search requirements that are likely to be quite varied in content.

A significant difference between the Glenrose System and the D.P.S. is the use of magnetic tape instead of the disk for processing. This allows the new system to update and correct data, a very important feature not available with the D.P.S. Only minor housekeepint changes have been made by the Alberta Planning Branch in adopting the G.H.P.I.R.S. as the tool for this type of analysis. As yet, they have not been able to overcome the deficiencies in-

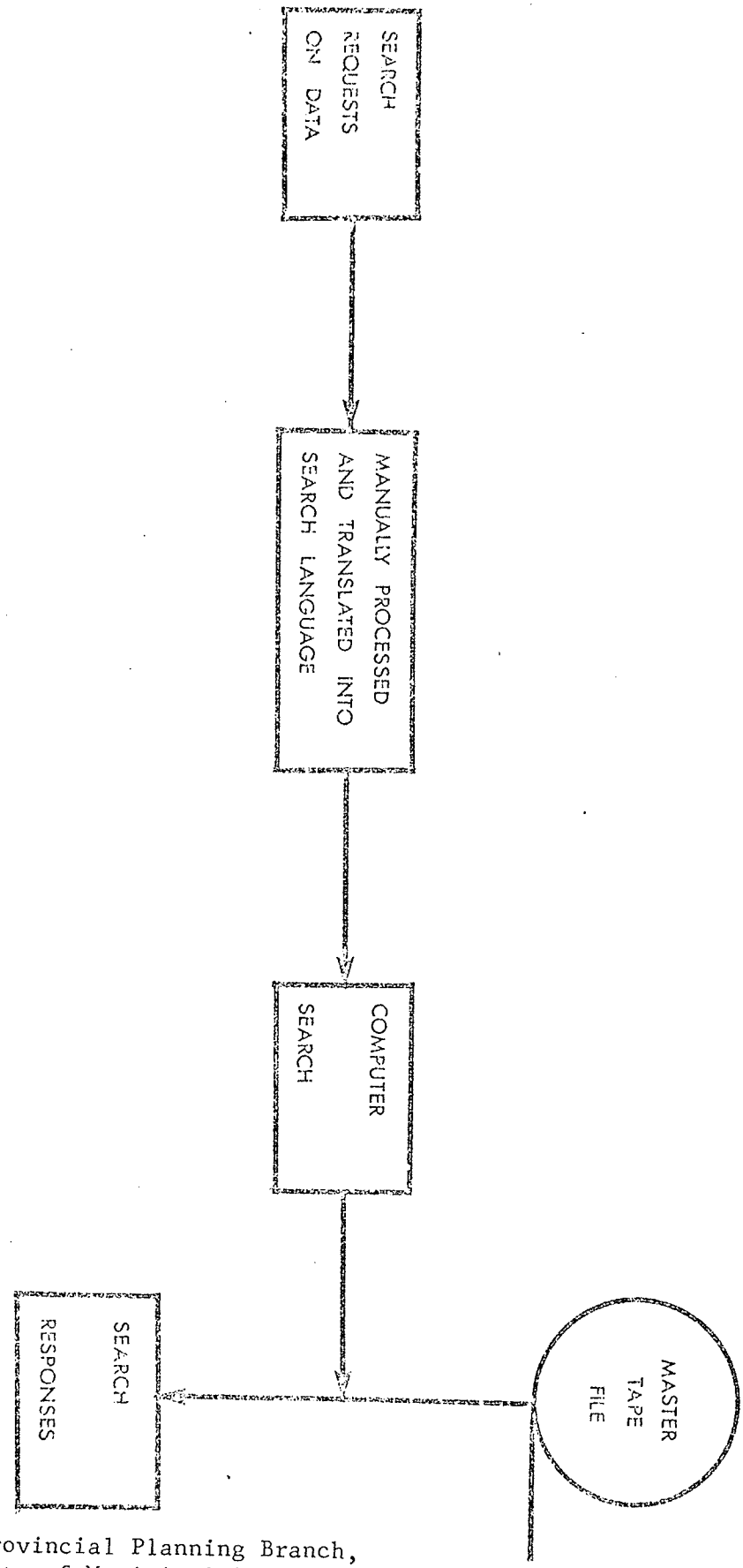
volved in the inability to do calculations on the data within the system. Figure 4 graphically indicates how data may be retrieved from the computer. What is important here is that the box labelled "search responses" could represent the specific data required to produce a desired computer map. This data could then be run through the SYMAP program to produce a desired map. Any other map required, based on the existing data bank would then simply require the specified search and the running of that search response data through the SYMAP program and so on. It should be noted that the whole procedure mentioned above requires only a matter of seconds of computer time.

(iv) Application of Methodology

The mechanics of producing computer maps based upon resource data has been explained and one may now begin to examine how this whole procedure can be of benefit in conducting a resource analysis for a region. If for instance, one wishes to know the extent of the region which is physically suited to the production of pulpwood, an expert on pulpwood production could look at the type of data which is inputted into the computer and then choose the data variables which combined would result in the land, tree species, tree densities, soil types, slopes etc. which would best be suited to this activity. He would then indicate the variables he selects to the computer programmer who in turn would write a short search

Figure 4

SEARCH PROCEDURE



Source: Provincial Planning Branch, Alberta Dept. of Municipal Affairs

program requesting the location of these data variables from the computer. This program would be run, the computer would select the appropriate data units which meet these criteria and these results would then be run through the SYMAP program. The output would be a computer map showing all the quarter-sections which met the criteria in an accurate spatial pattern and to whatever scale is requested

This same procedure can be followed to produce computer maps indicating the best physical sites for the development of houses, campsites, parks, cottages etc. The procedure is of course limited to the type and amount of data which has been imputted. This is particularly true for sub-surface resources. For example, if prospecting for minerals or exploration for hyrocarbons (oil and gas) has not taken place in the region being studied, it is virtually impossible to decide on the most likely or best location for these sorts of activities. All that can be done in this regard is to gather any information available for the region and for the areas adjacent to the region. This information can really only be used to establish likely trends for these types of resource developments and in doing so recognize the effects these types of development trends may have regarding land use for the region.

Since the value of this sort of analysis depends so heavily upon the extent and accuracy of the data bank, all efforts must

be made to assure that it be the most comprehensive, accurate and up-to-date collection of data possible. Of equal importance are the judgments made by physical resource and land use experts in deciding on the suitability of land for specific land uses. Below is one example of a land suitability judgment which might be made by these experts:

Example

A partially forested area of land might be cleared and used to grow cereal crops, hay or market gardening crops. It might be used for forestry, grazing, urban development, country residential development or it may be left in a wilderness state. In view of the physical attributes of that piece of land, the experts will be charged with deciding what uses this land is <u>physically</u> suited to. Assuming they decide the land is suited to grazing and country residential development, a further decision is required to determine which of these uses would result in the better use at a given point in time. The application of the economic criterion now becomes necessary to decide which of these equally suitable land uses should be allowed at this time.

The outcome of the interaction between the data and the experts will be a series of computer maps indicating the number and location of quarter-sections which are physically suited to each of the

land use activities being considered. The question of what land use activities to be considered will be derived through examination of the available resources, the existing activities and the salient interest groups of the region. The explanation of these other model elements will better explain how the prospective land uses are derived.

(b) Salient Interest Groups:

Questions such as these may be of pertinent interest here: Why have people located themselves in the region? What use are they making of the land at present? What land use activities are they likely to pursue in the future?

The people who live and work in the region at present will likely be only a portion of the interest groups examined here. It is quite possible that groups or organizations of people not living or working in the region at present will have appreciable effects upon the future land use of the region. Both government agencies and private sector groups must be investigated to determine what the existing land use situation is and what sort of needs or demands are likely to be experienced in the future. There will not be an attempt made to derive exact demand figures such as - twenty-seven and one half quarter-sections required for grazing by the year 1975. What will be derived however will be a grouping of the types of land use which can then be applied to the resource analysis data bank. The grouping of types of land use will become known as "prospective land uses."

The analysis of the salient interest groups will be accomplished by investigation of three broad parts. Identification of the group will be the first part. The amount of land currently devoted to or used by the groups will indicate the relative importance or commitment of the group to the region and consequently forms the second part. The third part introduces a futuristic aspect and will be labelled aspirations. This term will mean the needs and desires of those interest groups involved. The best way to determine these aspirations is by personal interview or questionnaire. As expressed earlier (p.49) it will be the policy of this thesis to meet the needs and desires of the majority of the populace wherever possible. This third part is especially important when considering groups which are not presently involved in land use in the region and are thus not given consideration in part two. An example of how these parts might be expressed will be very beneficial at this point. By expressing these parts in chart form such as below, the present and future land use situation for the region can be represented in a comprehensible and effective summary.

Salient Interest Group	Existing Land Use Commitment	Aspirations (future land use needs or desires)
(1) Ajax Pulp Co.	400 sq. miles of leased land	expand lease area to 600 sq. miles and expand pulp mill production within 10 years
(2) Parks Branch (Provincial Gov't)	nil	from 5 to 25 sq. miles of lake and stream area close to highway #12 to be used for a provincial park

Where is the information available to fill in the blank spaces of the chart? Much of this information or data will have become apparent during the data collection phase of the resource analysis. Many of the groups and agencies contacted for data at that time are likely to be in a position to aid in providing information for this part of the model. Field trips to the region can be of invaluable assistance in gathering this sort of information and possibly of more importance in acquainting the people and groups of the area with the study which is being undertaken. This element of the model allows a means by which some of the reactions of these groups can be expressed and input into our decision-making model.

The existing land use commitment can be accurately determined by researching the files of government agencies such as the Lands Branch or the Land Titles Office. The best way to accurately summarize the aspirations of the groups is by personal interview with a member or person who is in a responsible position. Most of the groups or individuals examined will become quite obvious or visible without too much investigation. Some of the future land uses may be the result of individual actions such as the building of summer cottages or country residences. It is not likely that the people involved in this type of land use will be part of a group or organization expecially if they are not presently abiding in the region. These more nebulous land use aspirations must also be considered, however, even if only by accurate estimation.

This element of the model is probably the most highly volatile part in regard to change and will therefore require the closest scrutiny in monitoring and updating.

The interaction between the existing interest groups and the physical resources of the study region in the past is expressed by the existing land uses and activities which constitute the present character and situation of the region today.

(c) Existing Activities:

This element will serve as a condensation or consolidation of the other elements which have thus far been used to describe the existing conditions in the region being studied. The condensation will be in the form of a map and accompanying explanatory text. Because this map will be directly related to the "salient interest group" element, it will be more explanatory and helpful than a simple land use map. In other words, this map will not only indicate what use is being made of a piece of land but also who (in general terms) is making use of it. In essence then, this map will be a combination existing land use and land disposition map. Among other things, it will be beneficial as a reference source when considering the other elements of the model.

It is often true that existing activities of a region have profound effects on what activities are likely to occur there in future. Economists speak of multiplier effects and spin off resulting from the location of a certain type of industry in a given area.

For example:

> A steel mill has a higher leverage effect than a textile mill with the same payroll for two reasons: it may make larger local purchases of transport, water, electric power and possible limestone and coal; and it is likely to attract linked firms: metal fabricating plants, coke ovens, refactories, chemical, and the like. The textile mill by contrast, has little agglomerative attraction and limited demands for local products other than fiber.[56]

The point here is that one or any of the existing activities of the region may have the potential to or is in the process of attracting other activities to the region. This point requires consideration when the analysis of the region's existing condition (including the resource analysis and the salient interest group elements) attempts to derive what future or prospective land uses are likely to be vieing for space within the study region. If this very important point is viewed in a cyclical manner, one becomes aware that in future, today's prospective land uses will become existing activities. What sort of multiplier effects can be expected from them?

Consequently, this element must be considered along with the previous elements of the "existing conditions" category in deciding how to narrow down the possible land use types which can be considered as prospective land uses. The analysis is therefore designed to narrow down the possible types of land use likely to

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56 Stewart, C.T. Jr., Economic Base Dynamics Land Economics. Nov. 1959 pp 327 - 336.

occur in the future. For example, if the study region was comprised of some 5,000 land units (quarter-sections) and after the analysis of data was completed, a SYMAP run made, it could result in designating 180 units physically suited to pasture or grazing.

The next model category then is the one which has been labelled "prospective activities".

Prospective Activities:

(a) Prospective Land Uses:

Consideration of the existing conditions of the study region will result in a list of the categories of regional land use likely to occur in the future such as: grazing, intensive recreation, extensive recreation, urbanized areas, pulpwood cutting, cottage subdivisions, country residential sites, etc. What is being suggested here is that if these land use categories are considered likely future prospects, then such regional land uses as cereal crops, dairy farming, and market gardening have been eliminated as possible prospective land uses. Consequently the land use categories deemed prospective will simply be listed to form this element of the model. The problem or question of deciding which prospective land use will result in the best, second best, to "n"th best use for the region will be resolved by the application of the economic criteria introduced in Chapter 3 to be discussed next.

(b) Economic Criterion:

This element has to do firstly with the quantification of some

aspects of human satisfaction (see page 27) which may be derived by each category of prospective land use. This quantification is by no means a complete picture of human satisfaction, however it should give some basis for judgement within the given limits ie. the use of the dollar figure. An example might give a much more clear picture of the steps which are involved here.

The rural-urban fringe offers an excellant sample situation. Assume a parcel of improved farm land in this fringe area, currently being used for the production of cereal crops. Also assume that there is a desire or demand to use this same land for urban expansion in the form of a residential subdivision. Below are the economic considerations which effectively demonstrate which of these land uses will result in the greatest volume of human satisfaction, measured on the basis of one year.

(1) Human satisfaction derived from crop use on a small farm.[57]

Investment in land - $7,300. for 555 acres or $\frac{7300}{555}$		$13.10 per acre
Crop enterprise investment - $9,021. for 555 acres or $\frac{9021}{555}$		$16.25 per acre/year
Value of production per improved acre		$18.83 per acre/year
Indication of the amount of human satisfaction derived from the use of this land for cereal crop production	TOTAL	$48.18

(2) Human satisfaction derived from a residential subdivision.

Assuming a residential lot is valued at $2,000 and when ammortized at 8% over 20 years, its value would be 2000 x .04 = $180 per lot per year. If five lots were developed per acre, an acre of land used for residential purposes would equal 5 x 180 = 900.per acre per year.

The $900. figure alone indicates that a greater amount of human satisfaction could be derived if the parcel of land being used for crop production was to be used for residential development. The use of such dollar figures to represent human satisfaction is no longer considered valid by many including some economists. It must therefore be stressed again that these figures represent only one aspect of human satisfaction but one which is important since it is easy to understand and allows for quantification of the various elements with respect to a single common denominator.

There are many other factors or means of economic measurement which could be used in making decisions about land use, however, many of them have to do with evaluation of the effects of land use after the initial locational decisions have been made. The value of the economic criteria suggested here mainly has to do with economic justification for deciding which competing land use is likely to satisfy the greatest volume of human wants or desires.

The location of the land, which is desired by more than one use, is of importance in determining the volumes of human satisfaction likely to result from each of the competing activities.

If, however, a hypothetical piece of land is considered for each activity or prospective land use, an indication could be derived as to the volume of human satisfaction that each activity might produce. For example: Consider a quarter-section of land which is physically suited to the grazing of feeder cattle. The volume of human satisfaction likely to be produced by this unit of land used for this activity could be derived in a similar manner as the cereal crop vs. residential subdivision example. The result of this exercise would be a dollar figure which would represent the amount of human satisfaction produced by a quarter-section of land physically suited to grazing and being used for grazing.

(c) Ranking of Prospective Land Uses:

The same exercise could then be carried out for all of the other prospective land uses of a region and the result would be a list or ranking of the prospective activities, ranked from the one likely to produce the greatest volume of human satisfaction to the one likely to produce the least volume of human satisfaction. The ranking which has beed described here is in fact a separate model element from the "prospective land uses" and the "economic criterion". At this stage of the model one would have a summary of the prospective land uses ranked according to the volumes of human satisfaction they would likely produce given the same size area of land with the same physical attributes. This could be likened to the demand factor inherent in economic demand and supply models.

Supply of Land:

(a) Environmental criteria:

In the previous discussions about the resource analysis element, there was mention made about how the environmental criteria could be used to determine what land units are intrinsically suited to what prospective land uses or activities. A sample illustration will make clear how these environmental criteria might be used to determine what land units are physically suited to what activities.

Consider the activity or prospective land use termed recreational cottage development. Depending upon the type and extent of physical data which is in the computer as a result of the resource analysis, judgments must be made about what aspects of the physical environment are compatible with this type of development. The soil type, slope, tree species and density as well as proximity to lake or stream shoreline are all variables which affect the location of recreational cottage developments. The specifics of these variables (eg. less than 10% slope) must then be decided upon by experts in this form of development. These specifics essentially constitute the environmental criteria and, as mentioned in the "resource analysis" element, a short computer program is written which asks the computer to print-out all the land units which exhibit these specific characteristics. A computer SYMAP can then be made showing the location of all these chosen land units within the region.

explanation. For example, if there were only eight quarter-sections in the whole region physically suited to cereal crop production, these eight land units could be expressed thus:

NWQ05-51-25-5
SWQ32-51-26-5
NWQ16-52-23-5
NEQ18-52-23-5
SEQ21-52-23-5
SWQ03-52-24-5
NEQ04-52-24-5
SEQ05-52-24-5

Each line represents one quarter-section which is physically suited to cereal crop production. For example, NWQ05-51-25-5 means the northwest quarter-section of section 5, township 51, range 25, west of the 5th meridian.

Regardless of how this locational information is expressed, The same exercise could be carried out for each of the prospective land uses with a set of environmental criteria being established for each of these activities. The results will be a map and a listing of the land units physically suited to each of the prospective land uses. The number of these maps and their accompanying lists of land units will of course depend upon the number of prospective land uses being considered.

(b) Supply of Land (for each prospective land use):

The maps indicating land units physically suited to whatever prospective land use they depict are quite self-explanatory. The lists representing the same information, however, may require some

in map or list form, the next logical step is to determine how attractive these land units are likely to be for the activities to which they are physically suited. If it is assumed that the attractability of each land unit will depend upon the amount and quality of the infrastructural elements (see page 52) available to the land unit being considered. The supply of land for each prospective land use then will be accompanied by an analysis of the available infrastructure which in turn forms a separate model element.

(c) Existing Infrastructure:

The roads, power lines, urban service centers etc. could all be displayed on the computer suitability maps by use of a separate computer program. For the purpose of this thesis however, this information will be displayed on a transparent material. The transparency will simply be overlaid onto the maps depicting the land units intrinsically suited to the prospective land uses. This relatively simple procedure can give a good indication of the land units which are not only physically suited to a prospective use but are also infrastructurally suited. It can also indicate those land units which, though physically suited to a prospective use, will not be attractive from an infrastructure point of view.

Since each activity is likely to have different infrastructural requirements, separate judgments will have to be made for each prospective land use. For example, power and telephone lines are not necessary for pulpwood cutting, however, they would be al-

most essential for a group of country residential sites.

If any information is available about future construction of the region's infrastructure, it can be of great help in determining which land units are likely to be better serviced in the near future. This predictive venture will only be necessary until such time as a Regional Plan has been adapted. At this time any future construction would be a co-ordinated effort tied to the Plan.

For many types of prospective land use the availability and quality of ground water supply is a very important factor which may be considered infrastructural in nature if it is not included in the resource analysis.

The result of this infrastructural consideration should be an objective ranking of all the land units for each prospective use as to their attractiveness for that use. For example, of the eight quarter-sections mentioned as a previous example (see page 91), five of them might be ranked highly attractive for cereal crop production (from an infrastructural point of view) because they are serviced by an all weather road accompanied by power and telephone lines. The remaining three quarter-sections might be ranked less attractive because they are serviced only by a seasonal road with no power or telephone lines within ten miles.

(d) Ranking of Supply of Land (for each prospective land use):

For the purpose of this thesis, quarter-sections will be ranked in two categories only, ie those which are at present infrastructurally suited to the prospective land use and those lacking suf-

An overview of the model elements elaborated on to this point reveals a ranking of the prospective land uses according to their ability to satisfy human wants and a ranking of the supply of land units physically capable of supporting these uses and infrastructurally suited to them. The procedures involved in arriving at this stage should, in real-life, give the planners involved a considerable appreciation for the region and how it is likely to develop.

Formulation of Alternative Plans:

(a) Combination of supply and prospective land uses:

This element of the model will be responsible for suggesting alternative ways of dealing with the land available and the land uses expected in the study region. Mention has already been made of the likelihood of more than one prospective use of land being ficient infrastructure. The second category will therefore represent areas which could be attractive to the prospective land use being considered if suitable infrastructure were constructed. As such, the quarter-sections in this category could be considered areas for possible future expansion of a given land use.
physically suited to and equally attracted to the same available land unit. For the purpose of this thesis, this competition for equally suitable land will be resolved by the use of the economic criterion discussed earlier in deriving the ranking of prospective land uses. The point here is that this hypothetical situation could be resolved in more than one way, each having desirable and undesirable repurcussions or aspects.

(b) Alternatives:

Large scale land use zoning could be one alternative example of how the previous model elements could be combined to fulfill the goal of the model. In other words, "a means of ensuring that the Crown and Crown leased lands of the region are used and disposed of in such a way as to result in a planned and integrated pattern of land use for the benefit of present and future citizens." This form of legal constraint upon or implied direction for development has been suggested for large areas or regions. An example of suggested regional zoning is evident in the National Parks Policy of Canada.

> Specifically the purpose of a zoning plan is to define areas within the park in accordance with acceptable use and development. It would detail not only type and extent of acceptable use and development, but also acceptable means of access to each of the zoned areas. The extremes of a zoning plan would be a wilderness area on one hand, and a permanent townsite on the other, but either extremes would not necessarily be part of a zoning plan for every park. Lacking a zoning plan, eventually parks may find themselves without a suitable wilderness area, without lakes or valleys that are accessible only by foot, horse or canoe, or without other of the many qualities that are part of the reason for their establishment.[58]

A zoning plan could be devised for the study region on the basis of the previous model parts and as such could constitute one alternative means of accomplishing the model goal. The model elements labelled "alternatives" will consist of a written text describing the alternative as well as a map (where applicable). The map will express graphically the pattern of land use which

might be expected of or desired from each of the alternatives so described.

Another alternative means of accomplishing the same goal would be to establish a planning and development committee or board which would judge each application for land use on its own merit. This method of land use control might be somewhat analogous to the actions which were taken by the British Board of Trade. This Board of Trade was charged with making decisions about regional industrial locations, and its control was in the form of Industrial Development Certificates.[59] A firm wishing to locate a new plant of any appreciable size had to, under the Distribution of Industries Act of 1945, obtain a Certificate from the Board.

It is not suggested that development certificates constitute an alternative, however an administrative framework such as the aforementioned Board of Trade could form an alternative means of accomplishing the sort of land use pattern described in the model goal.

The zoning plan and the above administrative structure are only two suggested alternative means of arriving at the same goal.

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58 Queen's Printer Ottawa, National Parks Policy National and Historic Parks Branch, Dept. of Indian Affairs and Northern Development of Canada. p. 17.

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59 Lee, D., (1969). Regional Planning and Location of Industry. London.

It is quite likely that other alternatives might also be developed. The very important point here is that regardless of what alternatives are suggested, all of them will initially be based upon the previous model elements and especially the rankings of the prospective land uses and the rankings of the supplies of land for these activities.

When the model is tested, a much better understanding of the model elements and function can be expected. There are only three model elements which remain to be discussed hypothetically before the model will be tested in a real-life situation. These remaining elements are those which are not strictly part of a model and which are considered in this thesis to be more in the realm of political rather than model functions.

Evaluation:

Essentially, this element asks the question - what would happen if? Consequently it entails a view to the future in trying to determine how land use decisions, inherent in each alternative, would affect the future pattern of land use for the region. This and the final two model elements have been included as part of this thesis mainly to indicate the direction or procedure that should be followed upon completion of the model stage of the planning process.

What is required of this element then is to determine which alternative or combination thereof would best accomplish the original land use goal. Many of the factors which formed and or derived previous model elements will directly influence evaluation and thus any changes in previous elements must be immediately considered in the evaluation process.

An important aspect of evaluation has to do with the competance of those responsible for it. It is suggested that such an evaluation must be one which is carried out by all those concerned with that which is being evaluated. In other words, evaluation of land use possibilities for a region should include inputs from all of the previously mentioned "salient interest groups". It is the author's belief that a planner should not be charged evaluating his own plan but rather it should be those affected by the plan who evaluate it.

Recommendations for Action:

It is expected that the evaluation process will result in recommendations for action, which will be political in nature. These recommendations are likely to be the result of the choice of one of the alternatives suggested in the main body of the model. Of major importance in so far as recommendations are concerned, is the necessity for consideration of their ultimate

changeability.

Monitoring and Review:

Even the smallest change in any of the previous model elements could easily be compounded to cause a new alternative, a new evaluation and possibly a new recommendation. Throughout the theoretical discussion about the planning process, there was continuous reference made about the inevitable changeability of the complex systems being dealt with. This element represents the lower level control referred to on page 11 which operates as a part of the model structure. The higher level control is analogous to the decision to plan or to the final recommended plan.

This last and important element of the model ties the model structure together by connecting the end with the beginning in a cyclical fashion. In doing so it indicates how all of the previous model elements are ultimately responsible to the beginning goal.

Essentially this element involves the necessity for periodic updating and review of all the model elements and all the intricate factors they represent. It is only in this manner that a real-life situation can be controlled. Therefore this element suggests the necessity for an on-going review and constant re-evaluation of

previous elements. It also concludes the discussion of the elements of the model in detail.

TESTING THE MODEL

CHAPTER 6

CHAPTER 6

TESTING THE MODEL

The word testing implies an attempt to prove an hypothesis. It is used here, though, in a restrictive sense. Since the author is unaware of a model similar to the one developed here, this model cannot really be compared to or tested in view of a similar structure. Consequently this chapter will therefore be a demonstration of how the model can be used in a real-life situation.

The real-life situation to be used here exists in the West Central portion of the Province of Alberta. The introduction of this thesis explains how the author became involved in regional studies with the Alberta Provincial Planning Branch in this part of that province. The specific region chosen by the author to be included here has been labelled the "Hinton-Yellowhead Corridor"[61] by the Planning Branch. The Planning Branch considers this area to be a region in view of the aggregate market area for the only Town (Hinton), the influence of a major highway (thus the term Corridor) and the geographical and physiographical homogeneity of the land, as well as the flora and fauna.

> A region is not an actual, distinctive, physical entity which exists merely waiting to be discovered - its definition depends upon the criteria employed in defining it and thus for the most part, upon the specific needs

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61 Provincial Planning Branch (1971), op.cit.

of the study.[62]

The "Hinton-Yellowhead Corridor" is an area of land which possesses enough of the measure of sameness of various characteristics to distinguish it from its neighbours. Integration of this regional plan with those for the adjacent regions will produce a composite land use plan for the whole Hinton-Yellowhead Study Area and ultimately a general plan for the area now labelled Improvement District No. 14. Much of the information used in this chapter has been supplied to the author by the aforementioned Provincial Planning Branch to whom he is very grateful.

The demonstration of how the model can be used will take on a similar form to the way in which the model elements were described in detail (Chapter 5). Consequently, the first element to be considered in this chapter will be the "goals".

Goals:

The goals for this particular demonstrative region will be:

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62 Hamburg et al, (1964), Selected Methods of Analysis for Urban Economic Planning and Development. Dept. of Internal Affairs, Pennsylvania.

- to ensure that the Crown and Crown leased lands of the "Hinton-Yellowhead Corridor" be disposed of in such a way as to result in a planned and integrated pattern of land use for the benefit of present and future citizens.
- that any decisions made regarding regional land disposition must be based upon solid environmental and economic criteria.

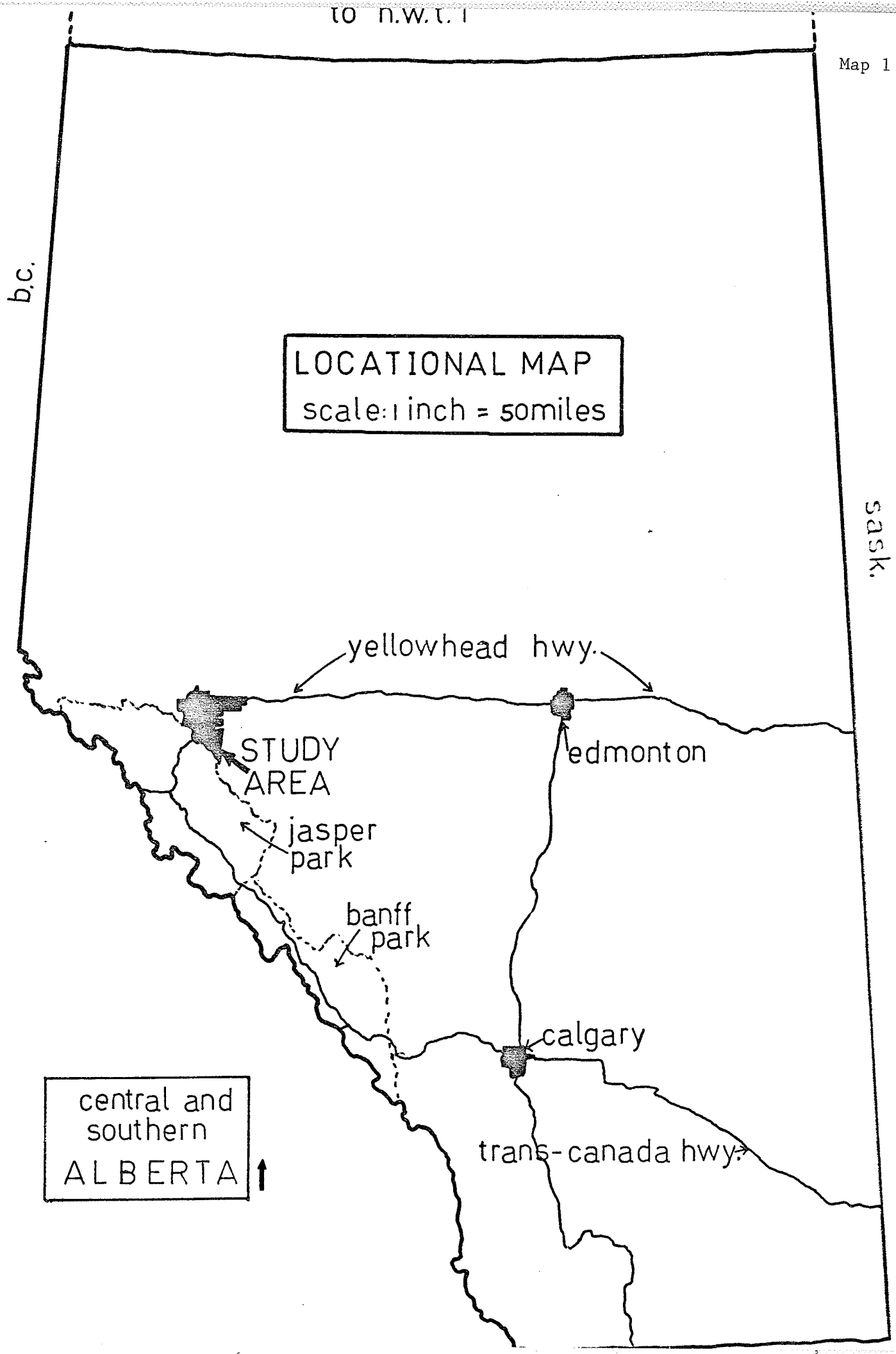
The general aspects of this and all the other model parts have already been discussed in Chapter 5. For this reason, the content about the model elements in this chapter, will consist mainly of the results which have been attained for the 'workings' of each of the model elements.

Setting:

(a) Location of Study Area:

The Hinton-Yellowhead Corridor is located in west-central Alberta extending from Tp. 47 to Tp. 53 and from Rge. 22 W5 to Rge. 1 W6.(see Map 1) It forms part of Improvement District 14 and covers 561 square miles. This area extends along Highway 16 from the East Gate of Jasper National Park to about 1 mile south-west of Obed. Edson is located approximately 37 miles to the east of the study area and Edmonton 164 miles to the east. Hinton, the only significant urban centre, is located in the central portion of the region on the Athabasca River.

Map 1


to n.w.t.
b.c.
sask.
LOCATIONAL MAP
scale: 1 inch = 50 miles
yellowhead hwy.
STUDY AREA
edmonton
jasper park
banff park
calgary
central and southern ALBERTA
trans-canada hwy.

(b) Designation of Boundaries:

Besides considering the market area for Hinton, the homogeneity of the geographical and physiographical features plus the influence of the Yellowhead Highway, attempt was made to have the regional boundaries also coincide with those of the units upon which the available data is based. Two data units were given consideration: Enumeration Areas, as established by the Dominion Bureau of Statistics, and the Forest Management Units of the Alberta Forest Service.

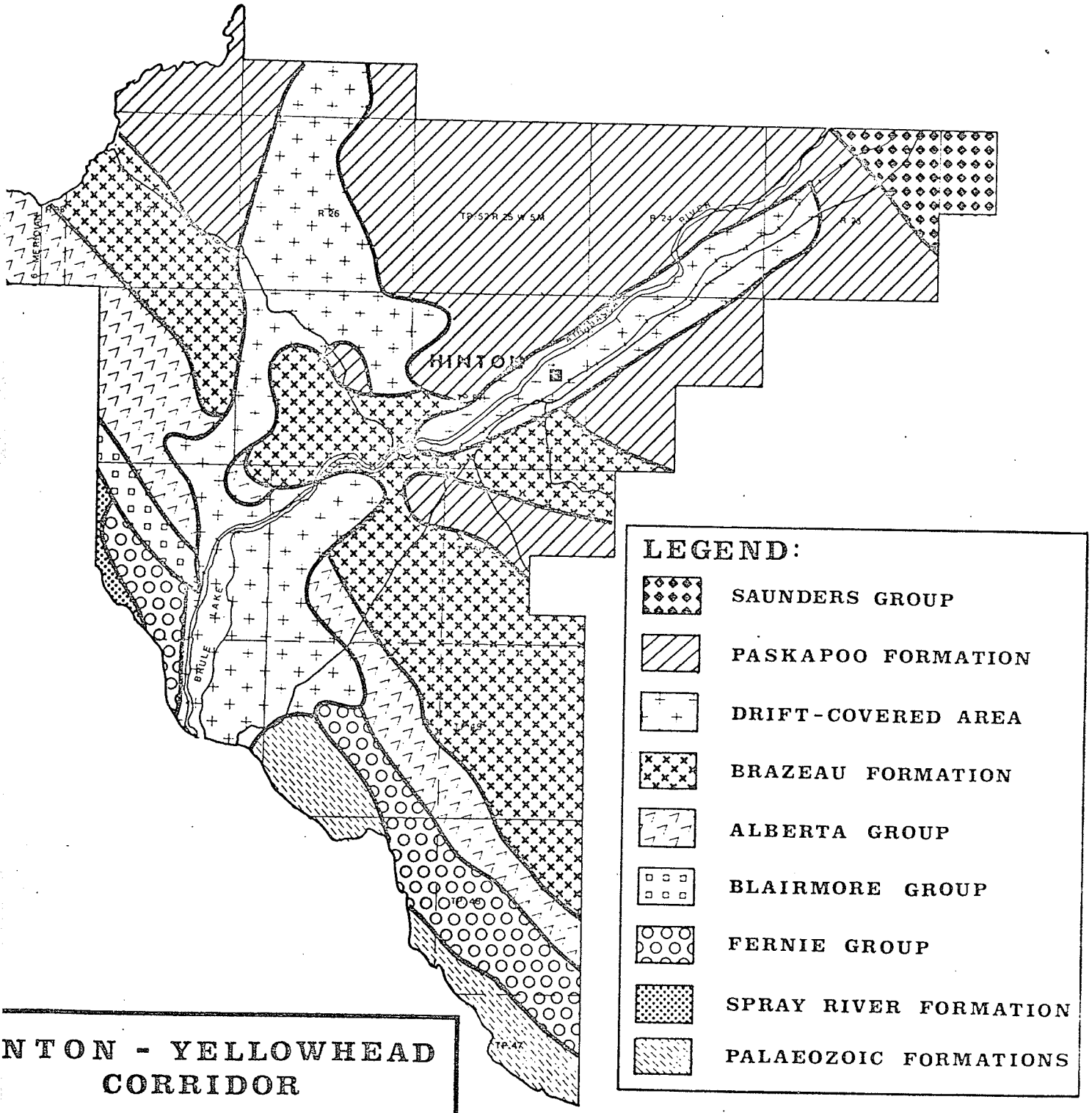
(c) Physical Resume:

(i) Geology and Topography

In the Hinton-Yellowhead Corridor the horizontal beds of the Interior Plains meet the up-turned strata of the Rocky Mountain system. A foothills complex with southwest facing scarp slopes marks the transition zone. This situation produces an extreme variation in topography, ranging from level to mountainous and generally increasing in relative relief in a southwesterly direction.

Three major divisions can be distinguished in the Hinton-Yellowhead Corridor: (1) Rocky Mountain Front Ranges, (2) Rocky

Map 2



NTON - YELLOWHEAD CORRIDOR

GEOLOGY

LE 1 : 316,800 or 1 inch = 5 miles

ource: Provincial Planning Branch
lberta Dept. of Municipal Affairs

Mountain Foothills, and (3) Interior Plains. The Rocky Mountain Front Ranges consist of a number of northwesterly trending ranges and valleys, composed of a succession of overthrust sheets lying between southwesterly dipping faults. Spectacular cliffs, U-shaped valleys and alpine structure characterize these these Front Ranges. This mountainous area is underlain by carbonate, argillaceous and arenaceous rocks of Devonian to Permian age. The high ranges are mostly bare of overlying surficial material and have elevations of up to 8,000 feet above sea level.

The Rocky Mountain Foothills lie along the eastern margin of the Front Ranges in a narrow, northwesterly trending belt. The eastern edge of the Foothills is marked by the east flank of the Prairie Creek Anticline in the vicinity of Hinton.[63] Elevations range from 3,500 to 5,800 feet above sea level.

The Interior Plains extend eastward from the Rocky Mountain Foothills. This portion of the region is underlain by the Paskapoo Formation which consists of weakly consolidated sandstone, siltstone and shale of Paleocene age.[64] Thin beds of gravel overlie

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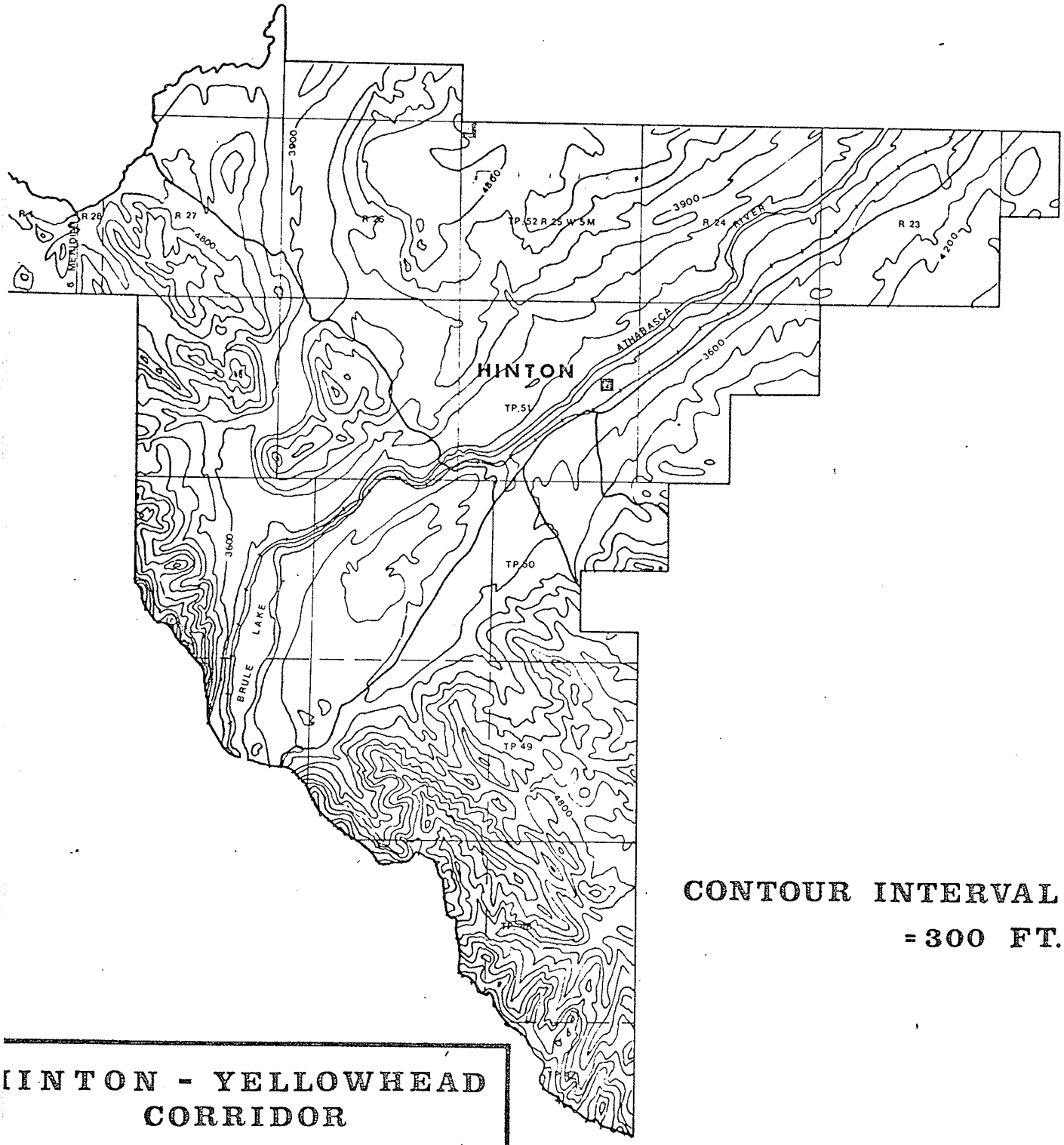
63 Roed, Murray A., (1968), Surficial Geology of the Edson - Hinton Area, Alberta. Thesis, University of Alberta, Edmonton, Alberta, pp.15.

64 McCrossan, R G. and Glaister, R.P., editors, (1964), Alberta Society of Petroleum Geologists, Geological History of Western Canada. Calgary, Alberta.

Map 3



CONTOUR INTERVAL
= 300 FT.

HINTON - YELLOWHEAD CORRIDOR

TOPOGRAPHY

SCALE 1 : 316,800 or 1 inch = 5 mile.

Source: Provincial Planning Branch
Alberta Dept. of Municipal Affairs

the Paleocene sediments in the tableland areas. The portion of the region in the Interior Plains can be further divided into local units which are referred to as (1) tablelands, (2) benchlands, and (3) the Jarvis Lake Valley. Tablelands are highlands which have relatively steep-sided slopes and flat tops, and are commonly underlain by gravel deposits. Benchlands are characterized by a number of distinct benches or ill-defined terrace levels. The Jarvis Lake Valley trends obliquely across the regional structure grain of the subregion and is rimmed by bare bedrock cliffs along much of its length.

(ii) Hydrology

The Hinton-Yellowhead Corridor falls within the drainage basins of the Athabasca, McLeod and Wildhay Rivers. The Athabasca River flows through the central portion of the region for 36 miles in a northeasterly direction. The river originates in the Rocky Mountains south of Jasper and drains an area of 4,000 square miles before reaching Hinton.

The Wildhay River forms the northwestern boundary of the region for a distance of 15 miles. The northwestern portion of the area as far south as Peppers Lake drains into this river. After leaving the study area, the Wildhay River flows into the Berland River which in turn joins the Athabasca River.

The McLeod River, although it does not flow through the

region, provides the drainage system for the southeastern portion of the region. It eventually flows into the Athabasca River at Whitecourt.

(iii) Soils

Successful strategies of land use are highly dependent on thorough comprehension of the soil resource. The basic task in using soil is to preserve its favourable features and to prevent or control unfavourable characteristics. It is for this reason that a thorough knowledge of the soil and the factors responsible for its development is so important.

The Hinton-Yellowhead Corridor has been subdivided into two soil areas based on the distributional patterns of the soil resource. A brief description of parent materials, topography and soils for each planning unit follows.

Soil Area I

This unit is essentially a rectangular area of land situated between Brule Lake and Hinton. It is characterized by complex topography arising from the long, irregular, bedrock controlled slopes leading downward to the Athabasca River and Maskuta Creek. The area is underlain by intensely folded shales, sandstones and conglomerates, above which is found a very cobbly, high lime till of Cordilleran origin. Overlying these deposits is a blanket of

coarse textured loess which is 50 - 80 feet thick in the vicinity of Brule Lake but thins very rapidly to a thickness of 1 - 2 feet near Hinton. Soils formed on the loess have distinct, partially humified surface horizons, lime carbonates throughout the sola, and mildly alkaline soil reactions.

Soils of this area have a long history of loess accretion, the periodic occurrence of which continues to the present. Regosolic soils occur at the eastern portion of the area where accretion is least. Intermediate positions are occupied by Brunisolic soils. Poorly drained depressions are occupied by Gleysolic and Organic soils.

Soil Area 2

Area 2 extends down river from Area I. It is identical to Area I in all respects except that the loess deposit is seldom more than 12 inches thick. Also, the soils lack distinct Ah horizons, may or may not have lime carbonates throughout their sola, and are slightly less alkaline. This area occupies the central portion of the Athabasca River valley, extending up the valley walls to about the midslope position.

Elevation and associated climate exert strong influences on soil morphology in this area. Below tree line the soils are very shallow, but are essentially similar to the Luvisolic and Brunisolic

soils described for the Foothills. Above tree line the incidence of Luvisolic soils decreases drastically and soils with an accumulation of Ah material (Alpine Brunisols) become more common. All soils, however, are rather loose and fragile, and therefore subject to erosion if disturbed.

(iv) Climate

The Hinton-Yellowhead Corridor lies in the Boreal Climate Zone. This indicates an average temperature of 50°F or more for a period of one to three months of the year. This climate zone is also characterized by long severe winters and short summers that produce a wide variety of conditions and generally small amounts of precipitation.

The Entrance weather station, operated by the Ministry of Transport, is the only source of climatic data within the region. However, the Jasper station experiences climatic conditions similar to those of the mountainous portions of the area. Table 1 presents the available data for these weather stations.

(v) Flora

The whole of the Hinton-Yellowhead Corridor, excepting a few mountainous and barren areas along the boundary with Jasper National Park, is characteristically Boreal Forest. The vegetation map (see map 4) indicates that most of the region is covered by natural

TABLE 1

TEMPERATURE AND PRECIPITATION SUMMARY

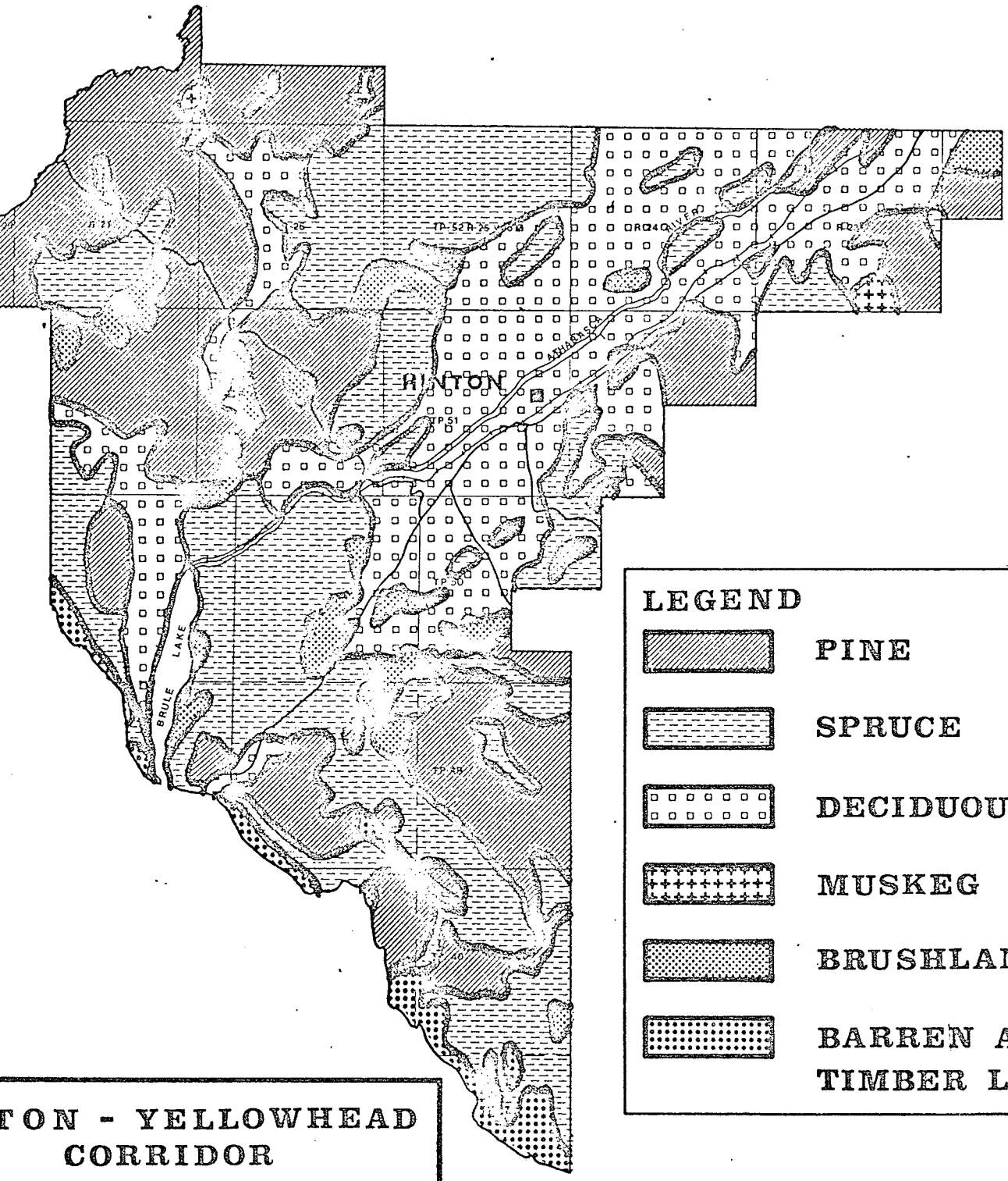
		JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	ANNUAL
ENTRANCE	Mean Temperature	12.6	16.6	25.0	37.7	47.7	53.5	58.7	56.0	49.3	40.4	26.8	16.6	36.7
	Maximum	24.0	29.6	37.1	51.2	62.5	67.3	74.0	71.1	63.8	53.2	37.5	27.6	49.9
	Minimum	1.1	3.6	12.9	24.2	32.8	39.6	43.3	41.0	34.8	27.5	16.0	5.6	23.5
	Rain	.04	T	.05	.46	1.99	3.59	2.72	3.10	1.68	.59	.12	.07	14.41
	Snow	7.7	7.3	9.2	7.6	1.1	0.0	0.0	0.0	1.3	5.2	8.3	8.0	55.7
	Precipitation	.81	.73	.97	1.22	2.10	3.59	2.72	3.10	1.81	1.11	.95	.87	19.98
JASPER	Mean Temperature	11.5	18.3	26.8	38.3	48.0	54.2	59.4	56.8	50.3	40.7	25.6	17.4	37.3
	Maximum	21.0	29.2	37.8	50.2	61.5	67.0	73.6	70.2	63.3	51.2	33.9	25.7	48.7
	Minimum	2.0	7.4	15.8	26.4	34.4	41.4	45.2	43.4	37.2	30.2	17.2	9.1	25.8
	Rain	.07	.06	.13	.46	1.23	2.15	1.96	2.01	1.40	1.02	.37	.20	11.06
	Snow	10.3	9.3	5.0	2.7	0.8	T	0.0	0.0	0.2	1.3	8.7	10.9	49.2
	Precipitation	1.10	.99	.63	.73	1.31	2.15	1.96	2.01	1.42	1.15	1.24	1.29	15.98

SOURCE: TEMPERATURE AND PRECIPITATION NORMALS FOR ALBERTA

Climatology Division, Meteorological Branch - Department of Transport

Data based on a thirty year period 1931 - 1960

Map 4



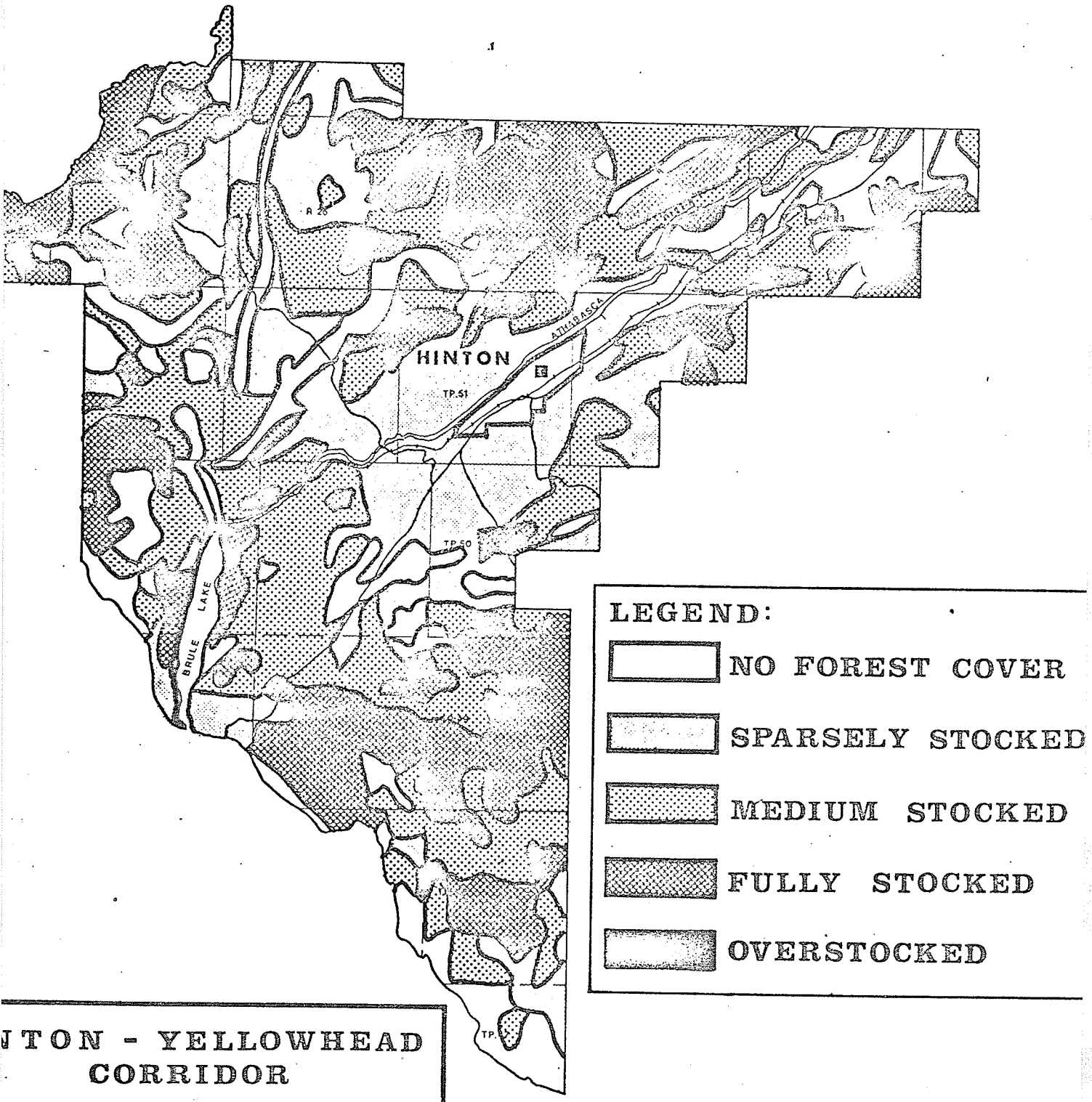
TON - YELLOWHEAD
CORRIDOR

VEGETATION

1 : 316,800 or 1 inch = 5 miles

ce: Provincial Planning Branch
rta Dept. of Municipal Affairs

Map 5



NTON - YELLOWHEAD CORRIDOR

FOREST DENSITY

E 1 : 316,800 1 inch = 5 miles

urce: Provincial Planning Branch
berta Dept. of Municipal Affairs

vegetation. The deciduous areas are predominantly aspen poplar (Populus tremuloides) and balsam poplar (Populus balsamifera). White birch (Betula papyrifera) may be found along the banks of rivers and in the moist wooded areas, while silverberry willow (Elaeagnus commutata) is common on the higher soils and dry hillsides. Pin cherry (Prunus pensylvaniea) and choke cherry (Prunus virginiana) are also found in the area.

Large fully-stocked stands of lodgepole pine (Pinus contortus) are found in the northwestern and southern portions of the region. The remainder of the coniferous covered areas are predominantly white spruce (Picea glauca) with some mixed stands of white spruce and black spruce (Picea mariana). Some balsam fir (Abies balsamea) and larch (Larix laricina) can also be found in the region.

A unique biotic area exists in many of the mountainous portions of the region. The alpine and sub-alpine meadows with their stunted shrubery, grasses and sedges exhibit a very delicate floral condition. These organisms require an undisturbed natural setting with sufficient sunlight and growing season in order to survive the harsh winters.

(vi) Fish and Wildlife

The main species of fish present in the region are rainbow trout, brook trout, and northern pike. Sport fishing in this area occurs mainly in small lakes although some stream fishing takes place in Jarvis and Drinnan Creeks. The most popular lakes for fishing are Wildhorse Lake, Kinky Lake, and those in the Jarvis

Lake chain. These lakes are usually stocked on an annual basis. Walleye eggs are being planted in the lower end of Jarvis Creek in an attempt to introduce this species to Gregg Lake. Northern pike are plentiful in Jarvis and Gregg Lakes.

The following species of big game animals are found in the region: Moose, Elk, Mule Deer, White-tailed Deer, Rocky Mountain Bighorn Sheep, Rocky Mountain Goat, Black Bear, and Grizzly Bear. Table 2 shows the estimated densities of big game ungulates in the study area.

TABLE 2

ESTIMATED* UNGULATE DENSITIES IN THE HINTON-YELLOWHEAD CORRIDOR

Species	Animals per square mile
Moose	0.6
Elk	0.5
Mule Deer	3.0
White-tailed Deer	0.5
Caribou	Traces
Rocky Mountain Bighorn Sheep	2.0
Rocky Mountain Goats	1.5

* Density estimates are based on averages of aerial big game population surveys and on the researcher's experience with the species and area involved.

Research information provided by: Mr. Gerry M. Lynch, Regional Wildlife Biologist, Fish and Wildlife Division, Department of Lands and Forests, Edson, Alberta.

Little is known about actual bear densities, but both black and grizzly bears are common in the study area.

Ruffed grouse and spruce grouse are the most abundant species of upland game birds in the Hinton-Yellowhead Corridor. Blue grouse and ptarmigan are also present in the area. Native grouse populations tend to be cyclic, peaking at approximate 10 year intervals. Waterfowl populations in the study area are of little significance.

Species of fur bearers found in the study area include Fisher, Martin, Red Squirrel, Mink, Weasel, and Varying Hare. Animals classed as carnivorous for bearers and present in the area include Timber Wolf, Fox, Coyote, Wolverine, Skunk and Porcupine.

(d) History of Settlement and Land Use:

The first white settlers were drawn to this heavily forested foothills area by the abundance of fur bearing animals, ripe for trapping. Several pack trails crossed through the area in these early days of the middle and late 1800's. The north-south trail, known as the Great Northern Trail followed along the foothills, through Rocky Mountain House, Luscar and up to Dawson Creek, B.C. This trail was the main route to the Peace River Country and established this area's main town, Hinton, as an outfitting centre. Another trail wound west through the area toward Jasper, Tete Jaune Cache and out to the Pacific Coast. This east-west route fell into temporary disuse after 1885 when the Canadian Pacific

Railway was built through Calgary, however it came back into focus around 1905 when it was surveyed as the route for two transcontinental railways, the Grand Trunk Pacific and the Canadian Northern.

The Town of Hinton experienced its first boom in 1912 as it became the headquarters for the firm responsible for the construction of the Grand Trunk Pacific Railway.

At the outbreak of World War I, the Grand Trunk Pacific was being constructed along the east shore of Brule Lake while the Canadian Northern was proceeding along the west shore. Both railways ran into financial difficulties and eventually went bankrupt. Parts of each newly built line were abandoned and a few months later, steel that had been laid a year or so earlier was taken up and shipped east and to Europe for wartime railways. The Canadian National Railway was later formed of the two bankrupt lines and was constructed along the west shore of Brule Lake since the east shore was found to be made inconvenient and hazardous by excessive amounts of continually blowing sand. Though no rails remain on the east shore, the ties, telegraph poles and a weather beaten railroad station of the Grand Trunk Pacific still remain as reminders of a great railway race across the prairies towards Canada's west coast.

In the mid 1920's, a coal mining operation at Hinton meant a population of 2,000, however an explosion wrecked the mine and

the future of Hinton by 1928. The town was reduced to a whistle stop.

It wasn't until 1954 that another boom was to be experienced by the Town of Hinton. This was in the form of pulpwood which has been referred to as "green gold". In the spring of 1954 the St. Regis Paper Company and North Canadian Oils Ltd. jointly announced plans for the financing and construction of a bleached sulphate pulp mill at Bliss townsite (later part of Hinton) to be known as North Western Pulp and Power. By 1955, construction had begun on the mill and Hinton saw its population jump from 180 to 3,000 in three years. Pulpwood cutting began early in 1956 and the official opening of the Hinton mill took place in 1957. The present population of the town is in excess of 5,000.

The doubling of the size of the mill operation between 1971 and 1973, the increased highway traffic along the recently opened Yellowhead Route and the numerous recreational opportunities to be found in this foothills setting, seem to indicate continued economic growth for Hinton and the surrounding area.

Existing Activities:

(a) Pulp production:

The whole of the study region falls within a vast area designed by the Provincial Government as a "Green Area".[65] The majority

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65 Ministerial Order 34/70, (June 3/70), describes the Green Area as being: Forest Lands not available for agriculture other than grazing. Provincial public lands are managed for multiple purposes including forest production, water, recreation, fish and wildlife, grazing and industrial development. Alberta Dept. of Lands and Forests.

of the region is covered by very good timber stands and the North Western Pulp and Power Company (NWPP) is consequently the major industry of the region.

Clear-cut methods are used to harvest the timber (at present coniferous only). Fully forested patches are left next to a clear cut patch. The clear cut patches are scarified (furrowed or tilled) such that seed cones from the fully forested patches may fall on a good seed bed. If natural regeneration is not sufficient after seven years, the company is required to undertake artificial planting.

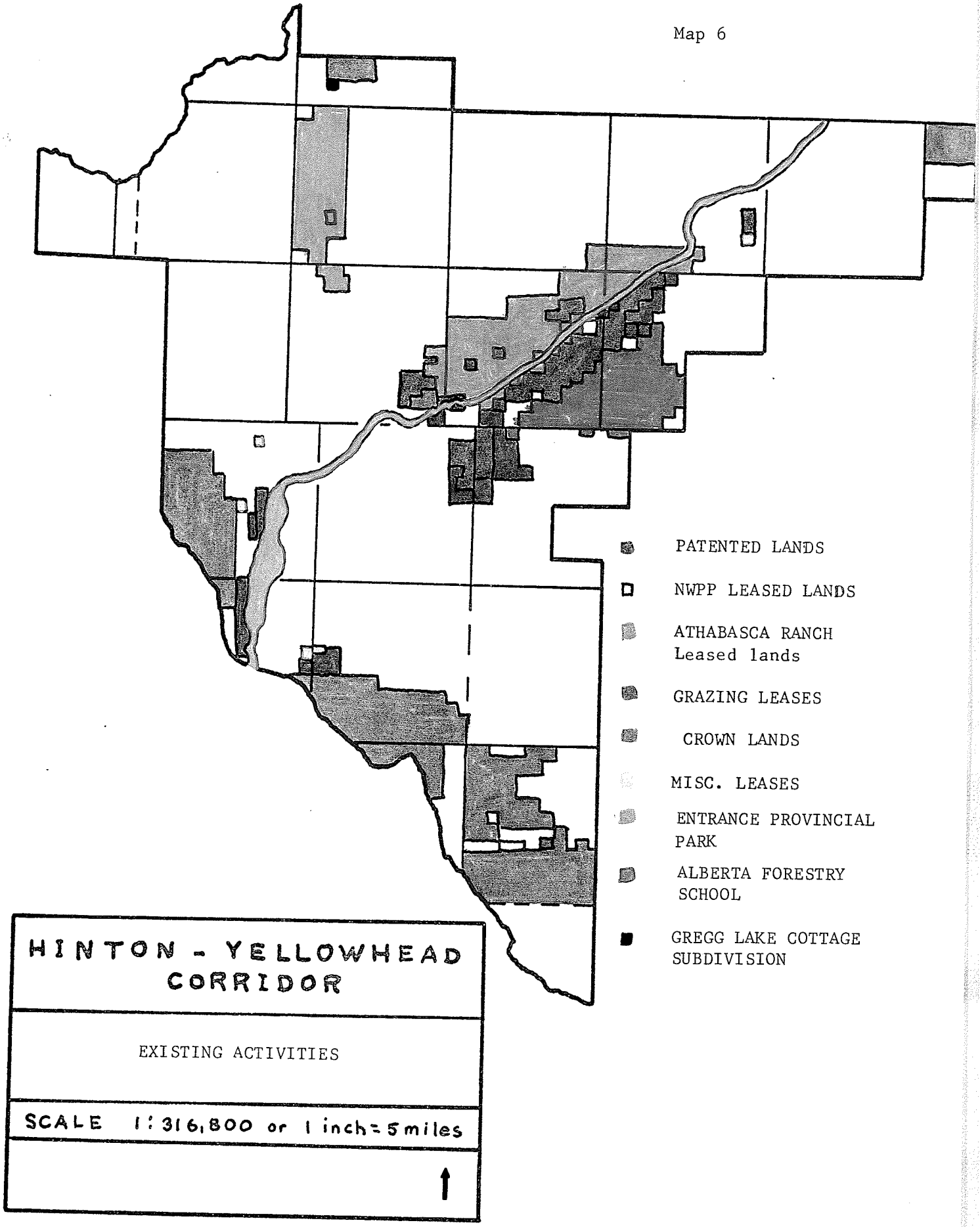
In general, NWPP leases land for a term of eighty years with an option to renew. It is expected that by the end of this term the areas cut over will have regenerated to the point where they will be ready for a new harvest.

Smaller companies who had leases, licenses or permits to cut timber in the region before NWPP established their plant and took out their lease, have for the most part been usurped by the new NWPP lease. Consequently, this company is the largest and possibly most influential land user in the study region.

(b) Public Lands - Parks and Recreation:

The second largest category of land disposition is land which remains as Crown or public land. In the western and especially the southern portions of the region there are large areas of Crown land. This land remains Crown mainly because the terrain is

Map 6


PATENTED LANDS
NWPP LEASED LANDS
ATHABASCA RANCH Leased lands
GRAZING LEASES
CROWN LANDS
MISC. LEASES
ENTRANCE PROVINCIAL PARK
ALBERTA FORESTRY SCHOOL
GREGG LAKE COTTAGE SUBDIVISION
HINTON - YELLOWHEAD CORRIDOR
EXISTING ACTIVITIES
SCALE 1:316,800 or 1 inch=5 miles

mountainous and the Provincial Government has been maintaining it as wilderness area.

Entrance Provincial Park is located in the north-central portion of the region. Jarvis and Blue Lakes are within the park boundaries. Boat launches and primitive campsites[66] are available to the general public while a Canadian Forces Survival School and an Outdoor Recreation Research Center serve as training and research facilities for more limited government concerns.

The Alberta Dept. of Highways maintains three primitive campsites along that portion of Highway 16 which runs through the study region. The author's research[67] regarding the users of these campsites revealed people from all walks of life employing all manner of camping equipment. Two very pertinent points derived from this research were:

(1) Over three quarters of those interviewed were just stopping

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66 The term primitive campsites will be used to indicate camping areas with such facilities as outdoor lavatories, picnic tables, campfire pits and limited shelter cook houses. Serviced campgrounds, in comparison, will be considered those with facilities such as: sewage dumping areas, showers, clothes washers and dryers, and possibly a store and gas station nearby.

67 One hundred campsite user questionnaires were distributed in the summer of 1970 by the author. This research was carried out while he was employed by the Alberta Provincial Planning Branch.

over either for a few hours or for one night enroute to or from Jasper National Park.

(2) More than one half of the campers expressed a desire for more serviced campgrounds, and were also willing to pay for the use of these facilities. (Dept. of Highways campsites are free of charge.)

Officials of Jasper Park are concerned with the continual overcrowding of the serviced campgrounds and overnight tourist facilities in their park during the summer months. Rather than expand these facilities within the park, the officials would prefer to have campers stay overnight outside of the park and then travel to the park proper on a day user basis. The Town of Jasper, which is the focal point for most tourists, is about thirty-five miles from the east gate of the park (western boundary of the Hinton-Yellowhead region). Miette Hot Springs, another tourist attraction in Jasper Park, is closer to the east gate than it is to the Town of Jasper. Park officials are therefore hopeful that overnight facilities can be developed in the study region to relieve pressure on the Park. This desire has been transmitted to the Provincial Government agencies responsible for parks, tourism, and recreation.

The Town of Hinton has purchased land within the town boundaries and with the aid of experts and students from the Alberta

Forestry School (in Hinton) are planning to design and build a large serviced campground to satisfy some of this need. The Town has also experienced a rapid rate of motel construction in the last few years.

(c) Commercial Tourism:

The Alberta Department of Highways and Transport Planning Branch conducted an origin-destination analysis on Highway 16 west of Hinton in June, 1970. Of the 2547 vehicle occupants interviewed, 2082 or 81.7% were travelling to or from some form of social or recreational activity. It is no wonder that private individuals and groups are interested in such business ventures as motels and serviced campgrounds in the study region. These types of development have been confined to the Town of Hinton and an area near the east gate to Jasper Park known as Drystone Creek Commercial Site. The reason for this confinement is largely due to the desire of the Department of Highways and other government agencies to maintain a "green-corridor" along that portion of Highway 16 which runs through the study region.

The commercial activities at Drystone Creek include two guest ranches and a serviced campground with cabins for rent and a gas station.

Besides the transient tourist trade resulting from people passing through the region on their way to or from Jasper, hunters,

fishermen and those interested in other more passive forms of recreation can and have been finding the foothills setting of the study region an excellent attraction in itself. Many have indicated a desire to establish summer residences in the region. As of the summer of 1971, some 500 Albertans had submitted their names for summer cottages in this region. Of these, 353 were Edmonton residents (Edmonton is about 200 miles from this region).

(d) Private Summer Cottages:

The Alberta Department of Lands and Forests maintains rigid control over this form of development in the study region and in all areas of the Green Zone (see page 121). Areas are selected which appear to have good potential for cottage development; roads are constructed when required; and lots are surveyed by Lands Branch, Dept. of Lands and Forests. The means of disposing of lots and controlling development are as follows:

- any resident of Alberta interested in obtaining a lot records his name with the Lands Branch

- these names are, on a specific day, drawn from a hat, the first drawn having his choice of lots and so on until all lots are disposed of

- in order to maintain the lease, a cottage must be erected after the first two years, and this structure must meet minimum specifications similar to those of the National Building Code (see Appendix B)

- the individual has the option to buy the lot after the structure has been erected

- the usual cost to purchase the lot is ten times the yearly

rental

- if a cottage is not erected after the first two years, the rentor may have to forfeit his lot to someone else on the waiting list

Two such subdivisions have taken place at Gregg Lake near the northern boundary of the study region. Fifty-two lots have been surveyed and disposed of here and there are many names still on the waiting list for lots at this cottage subdivision. A second site has been suggested at Brule on Brule Lake however the road is poor and the site is not suited to this form of development. No subdivision has taken place for summer cottages at Brule.

Due to the difficulty in keeping roads clear in the winter months and in the general servicing of these sites (often without power or telephone), there is a regulation stating that these cottages may not be inhabited all year long.

(e) Country Residences:

This term is used here to describe a permanent year round residence outside of an established urban area. This form of land use is evident to a limited extent in the study region and is for the most part concentrated near Hinton and close to Highway 16.

In many cases, land being used in this manner is also used to raise horses and cattle. For example, a feedlot operation being installed on part of the land being leased to the Athabasca Ranch will be used to raise bulls for breeding purposes.

(f) Grazing:

Most of the land now being used for this purpose is leased either as a grazing lease or as a miscellaneous lease. This activity is not well developed in the study region as the climate is not especially suited to it and because the necessary marketing facilities are not available. Many of the people living in the Town of Hinton have expressed the desire for land on which to graze horses for their personal recreation. It has been suggested that a private stable would be the best means of providing for this need, however nothing as yet has been undertaken.

(g) Other Land Use Influences:

(i) Coal Strip-Mining

The Alberta foothills have extensive deposits of coal which was originally mined to provide fuel for the steam locomotives. Even before the railways converted to diesel engines, these original mining operations were beginning to close down due to inadequate markets. In recent years however coal has been strip-mined here for export to Japan. The two major mining areas of west-central Alberta are Grande Cache and Luscar. A new town is close to completion at Grande Cache, about 90 miles north-west of Hinton, and much of the equipment and supplies for that new town came through or was distributed from Hinton. The Luscar mine is in an area south-east of the study region which has for years been known as the Coalbranch. At present there is little or no accommodation for

the mine workers at Luscar and they are therefore transported via bus each day from and home to Hinton (approximately 40 miles).

The Canadian National Railway carries coal from the Coalbranch to the townsite of Brule where these car loads of coal meet with others brought from Grande Cache via the Alberta Northern Resources Railway. Here at Brule, "unit" coal trains are made up which will pass through the Rocky Mountains and on to the west coast where ships will carry the coal to Japan.

There seems little likelihood that coal mining will again take place in the study region, however, this activity in surrounding areas does affect this study region.

(ii) Oil and Gas

The oil and gas industry has been active in several ways within the study region for over a decade.

Firstly, the Transmountain Pipeline from Edmonton to the west coast passes through the study region.

Secondly, oil and gas exploration has been going on here for quite some time. Trees and brush are downed to form a "cut-line" along which seismic testing takes place in search of pockets of oil and, especially in this region, of gas. These cut-lines now criss-cross almost the entire region.

Finally, some drilling has taken place and it appears only a matter of time before gas wells will be quite common throughout

much of the region.

The drilling and even the exploration do not consume much actual land area and are usually only temporary uses of land. These activities do, however, affect and influence other more permanent land uses. The trees and brush downed in making cut-lines is often good quality timber which is rarely salvaged for use. This is of immediate concern to NWPP since the timber destroyed is likely on their leased lands. Compensation is often in the form of a cash settlement. Hydrogen Sulphide (H_2S), a poisonous gas, is common to many of the wells drilled in or near the study region. No human activity can take place safely in close proximity to a gas well giving off this "sour" gas. An expanded market for sulphur might make it feasible to salvage the gas, H_2S, and convert it to sulphur. In lieu of this, it appears that some other technological devise must be used to reduce this hazard.

There are several other minor activities being carried out in the study region, however, all of the major ones have been included in the above discussion.

Salient Interest Groups:

The following chart expresses the present and future interest groups likely to affect land use activity in the study region.

Salient Interest Groups	Existing Land Use Commitment	Aspirations (future land use needs and desires)
Alberta Forestry School	approx. 60 Crown quarter-sections	- desire to maintain present area of land for forest research and educational programs
Athabasca Ranch	approx. 80 leased quarter-sections	- some of this land currently being used for grazing and raising breeding bull cattle - desire to maintain present lease area for these activities
Commercial Tourism	approx. 5 leased or owned quarter-sections outside of Hinton	- this form of development confined mainly to Hinton and a commercial subdivision on Highway 16 at East Gate of Jasper Park - some interest in expanding these activities expecially along Highway 16
Country Residents	approx. 15 owned quarter-sections	- existing residents often raise riding horses as well and have expressed interest in subdividing some of their land, especially near Hinton, for residential or commercial purposes - real estate companies, Hinton's Development Officer and the Provincial Lands Branch all indicate that residents of the region and many non-residents desire to establish country residences
Dept. of Lands and Forests	approx. 340 Crown quarter-sections including approx. 50 quarter-sections forming Entrance Provincial Park	- desire to ensure that all Crown and Crown leased lands are used in an optimal environmental and economic manner - also a desire to ensure that there is sufficient area for public recreation and enjoyment

(cont'd)

Salient Interest Groups	Existing Land Use Commitment	Aspirations (future land use needs and desires)
Improvement District 14 (similar to Rural Municipality)	nil, however the whole of the study region is within the jurisdiction of this I.D.	- a desire to control development such that the municipal services required for all land uses can be constructed and maintained in the most efficient and safe manner possible
North Western Pulp and Power	approx. 1700 leased quarter-sections	- the companies lease area extends will beyond the study region - no desire to extend leased land within the region - the company has expressed a desire to cooperate with government agencies in investigating locations within their lease area which might best be suited for recreational development
Summer Cottagers	approx. 2 leased and owned quarter-sections	- Lands Branch records names of those desiring summer cottages on Crown land and there are close to 275 names of persons desiring such lots in the study region - the majority of potential summer cottagers have expressed a desire for lots on or near Gregg Lake
Town council of Hinton	approx. 25 patented quarter-sections in town boundary	- interested in any form of development which would result in an increase in population and/or economic activity for the region and especially for the town

Resource Analysis:

Generally, this analysis indicated that the region's resources might be categorized as follows:

- Commercial forestry
- Private and public recreation including tourism plus fish and wildlife
- Grazing of cattle and horses (to a limited extent)
- Natural gas and some oil
- Coal (to a limited extent)

Prospective Land Uses:

In view of the existing activities, the resource analysis and the investigation of salient interest groups, the following land uses can be expected to be desiring location within the study region: These categories of land use are those which have been identified by the Provincial Planning Branch, however the list could be extended or diminished if conditions were to change.

(1) Country residential development

(2) Summer cottage development

(3) Public parks and recreation

(4) Commercial forestry

These are broad categories of land use and consequently the supply of land for each will be somewhat generalized. Further analysis on a more detailed basis will be necessary to determine exact type of land use and the possibilities of multiple use of land by compatible land uses.

Environmental Criteria:

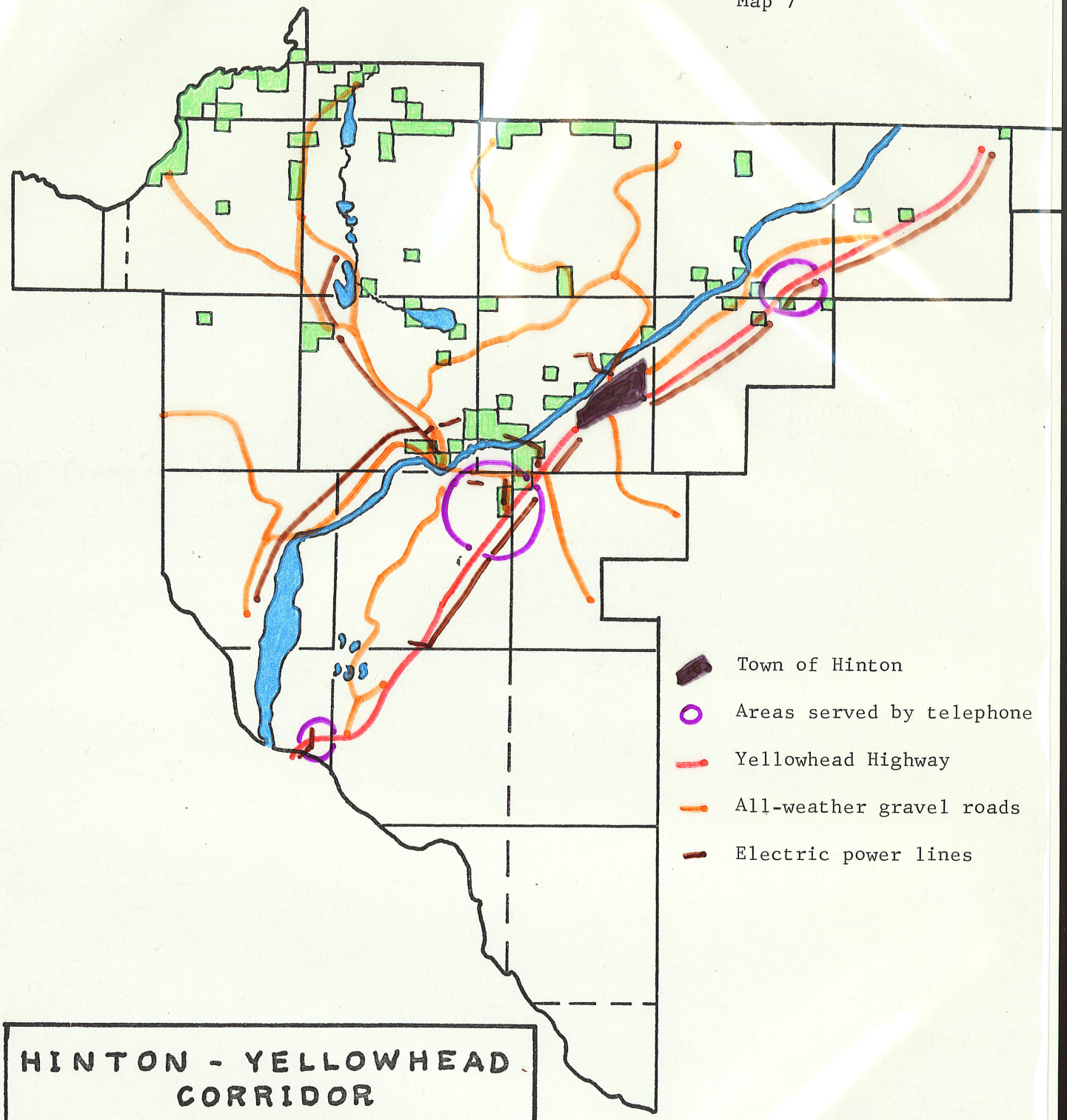
With the aid of the information obtained during the resource analysis, (see Appendix A), experts on land use and environmental suitability have decided which quarter-sections are physically suited to each of the four prospective land uses. Maps 7, 8, 9 and 10 are hand drawn representations of the results obtained from SYMAP runs. The overlays indicate the infrastructure necessary for each of the prospective uses and they allow one to determine those sites suited both physically and infrastructurally to each use*. They also enable one to distinguish quarter-sections which though physically suited, are not infrastructurally suited to the prospective uses. Consequently a general grouping or ranking of quarter-sections, according to attractability, is possible.

* Commercial forestry has no overlay since roads are all that is required for this activity and the region is well criss-crossed with seasonal roads built for this purpose by North Western Pulp and Power.

Economic Criteria:

The author has attempted to quantify the volume of human satisfaction (as earlier defined) likely to result from each of the four prospective land uses. If more accurate measures of the aspects considered here become known or if other aspects are included, they could be accomodated in a similar structure to that which follows on page 140.

Map 7



HINTON - YELLOWHEAD CORRIDOR

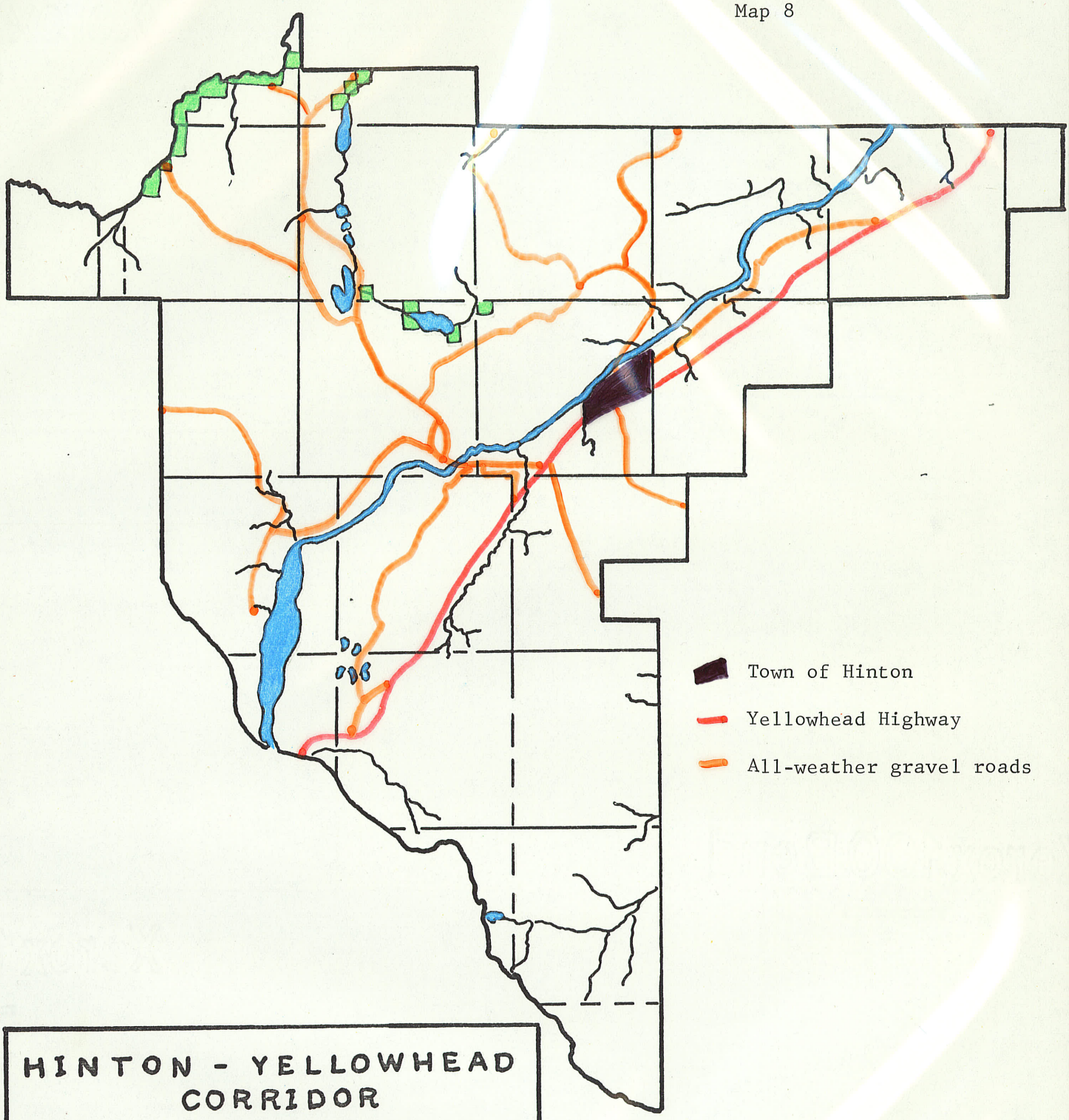
areas physically suited to

COUNTRY RESIDENCES

SCALE 1:316,800 or 1 inch = 5 miles

Source: Provincial Planning Branch
Alberta Dept. of Municipal Affairs

Map 8



HINTON - YELLOWHEAD CORRIDOR

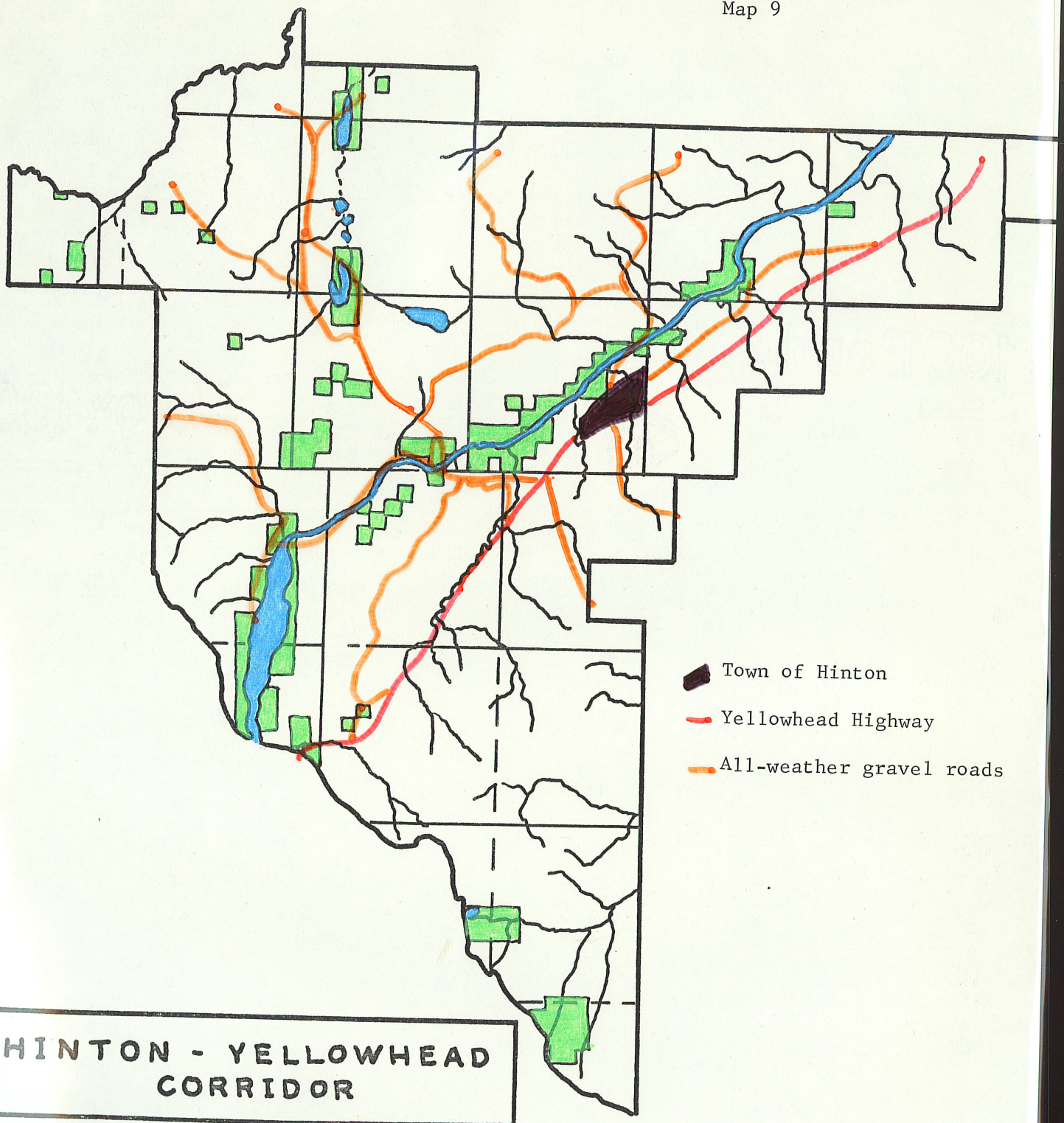
areas physically suited to

SUMMER COTTAGES

SCALE 1:316,800 or 1 inch = 5 miles

Source: Provincial Planning Branch
Alberta Dept. of Municipal Affairs

Map 9



HINTON - YELLOWHEAD CORRIDOR

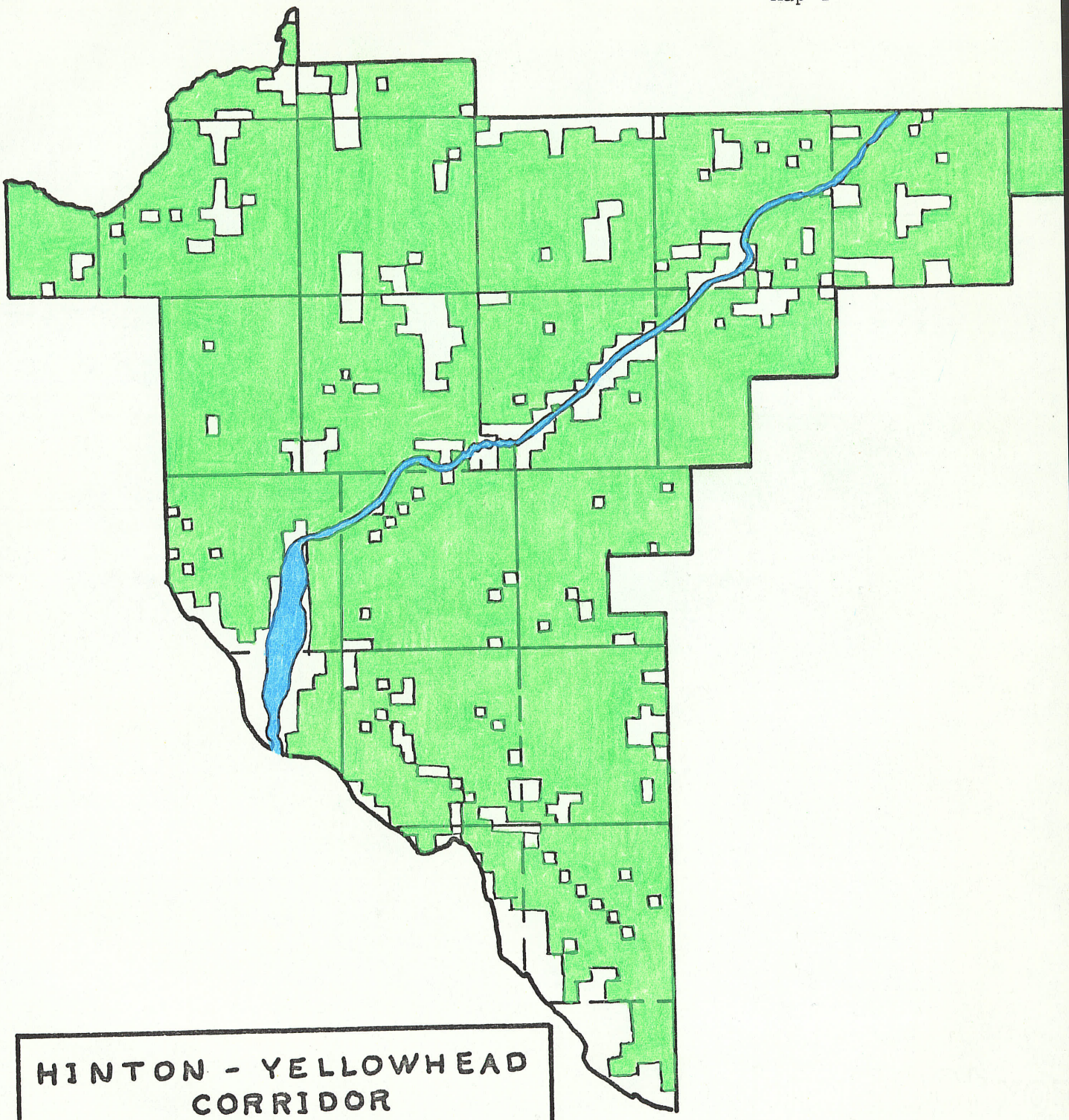
areas physically suited to

PUBLIC PARKS AND RECREATION

SCALE 1:316,800 or 1 inch = 5 miles

Source: Provincial Planning Branch
Alberta Dept. of Municipal Affairs

Map 10



HINTON - YELLOWHEAD CORRIDOR

areas physically suited to

COMMERCIAL FORESTRY

SCALE 1:316,800 or 1 inch = 5 miles

Source: Provincial Planning Branch
Alberta Dept. of Municipal Affairs

(a) Volume of human satisfaction likely to accrue to the use of land for country residential development.

Assuming people are willing to pay $700. per acre for land suited to this use which is located within 5 miles of Hinton and can easily be serviced by power and telephone, and that* the average size of the site would be about 10 acres:

$$700 \times 10 = \$7000. \text{ per site}$$

Further, if this sum were borrowed at 8% interest and amortized over 20 years:

$$\underset{\text{(average interest)}}{7000 \times .04} + \underset{\text{(amount of principal)}}{\frac{7000}{20}} = \$630. \text{ /site/year}$$

The average quarter-section physically suited to this use in this area would likely yield 5 such sites.[69]

Therefore:

$$630 \times 5 = \$3150. \text{ /quarter-section/year}$$

is the total volume of human satisfaction (as defined in this thesis) likely to accrue to land used for this purpose.

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*The assumptions made here were derived from personal interviews with real estate companies and from the the existing country residents in the area around the Town of Hinton.

69 The Peers Whitecourt Land Use Study (1970) carried out by the Alberta Provincial Planning Branch Research Section discovered that five sites per quarter-section was a realistic number for the type of physical environment encountered in their study area which in turn is very similar to the region being considered in this thesis.

(b) Volume of human satisfaction likely to accrue to the use of land for summer cottage development.

Assume an average cost per lot of $300.[70]

$300 \times .04 + \frac{300}{20} = \$43.$ /lot/year

Assume 50 lots per quarter-section
43 x 50 = $2150 /quarter-section/year

Also assume that each summer cottager makes 5 trips per year to his cottage (250 miles from Edmonton where the demand is greatest). The amount per quarter-section per year accruing to transportation might be

500 miles x 5 trips	= 2500 miles
@20 miles/gal.	= 125 gallons
@50¢/gal.	= 62.50 per cottager per year or
62.50 x 50	= $3125./quarter-section/year

Therefore the total human satisfaction (as defined in this thesis) likely to be derived from the use of land for this purpose might be

2150 + 3125 = $5275./quarter-section/year.

(c) Human satisfaction likely to be derived from the use of land for commercial forestry (pulpwood production).

Assuming the total cost of producing pulp from one cord of wood is $17.70.[71] Also assume 20 cords per acre average yield or 20 x 160 = 3200 cords per quarter-section. Finally assume it takes 80 years before the trees may be harvested again, the volume of human satisfaction (as defined in this thesis) per quarter-section per year derived from this form of commercial forestry might be

$\frac{3200 \times 17.70}{80}$ = $96.00 per quarter-section/year.

(d) Human satisfaction likely to be derived from the use of lands for public parks and recreation areas will not be attempted here however Appendix C indicates the type of economic analysis which could be carried out for the study region.

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[70] This is the average price per lot in the Gregg Lake Subdivision

[71] Gutherie, J. (1961) Western Forest Industry an economic outlook The John Hopkins Press, Baltimore. p.115.

For the purpose of this thesis, the use of land for public parks and recreation will be assumed to produce a greater volume of human satisfaction than pulpwood production and country residential development but less than summer cottage development.

Ranking of Prospective Land Uses:

The ranking below indicates the prospective use (top) which will likely produce the largest volume of human satisfaction per quarter-section per year down to the use likely to produce the least volume (bottom).

(1) Summer Cottage Development

(2) Public Parks and Recreation

(3) Country Residential Development

(4) Commercial Forestry (pulpwood production)

This ranking will attempt to ensure that the conflict between competing land uses can be resolved according to the economic rational explained in this thesis.

Combination of Supply and Prospective Land Use Rankings:

Two factors pervade the creative thinking required at this stage of the model. One is time and the other might be termed concept. The time factor is often handled by what is referred to as staging. For example, stage one of a developer's plan might be to assemble the land, stage two involves clearing the site, etc. For the purpose of this thesis, any staging would be moving towards

the objective of ensuring that land was being used for the highest and best uses which can be determined from the preceding analysis. In this respect, there are probably only two alternatives. In other words, land might be held in its natural state as a reserve until such time as the highest and best use is ready land to a lesser land use until the highest and best use is ready to be put into effect.

The concept factor refers to the ways in which control can be exercised. For example, large scale zoning, compulsory green belts, spot zoning, development controls etc. are all different concepts which could be used in conjunction with the staging or time factor in developing alternative plans.

Two combinations of these factors have been assembled here and constitute two possible alternative plans to guide land use decision-making for the study region.

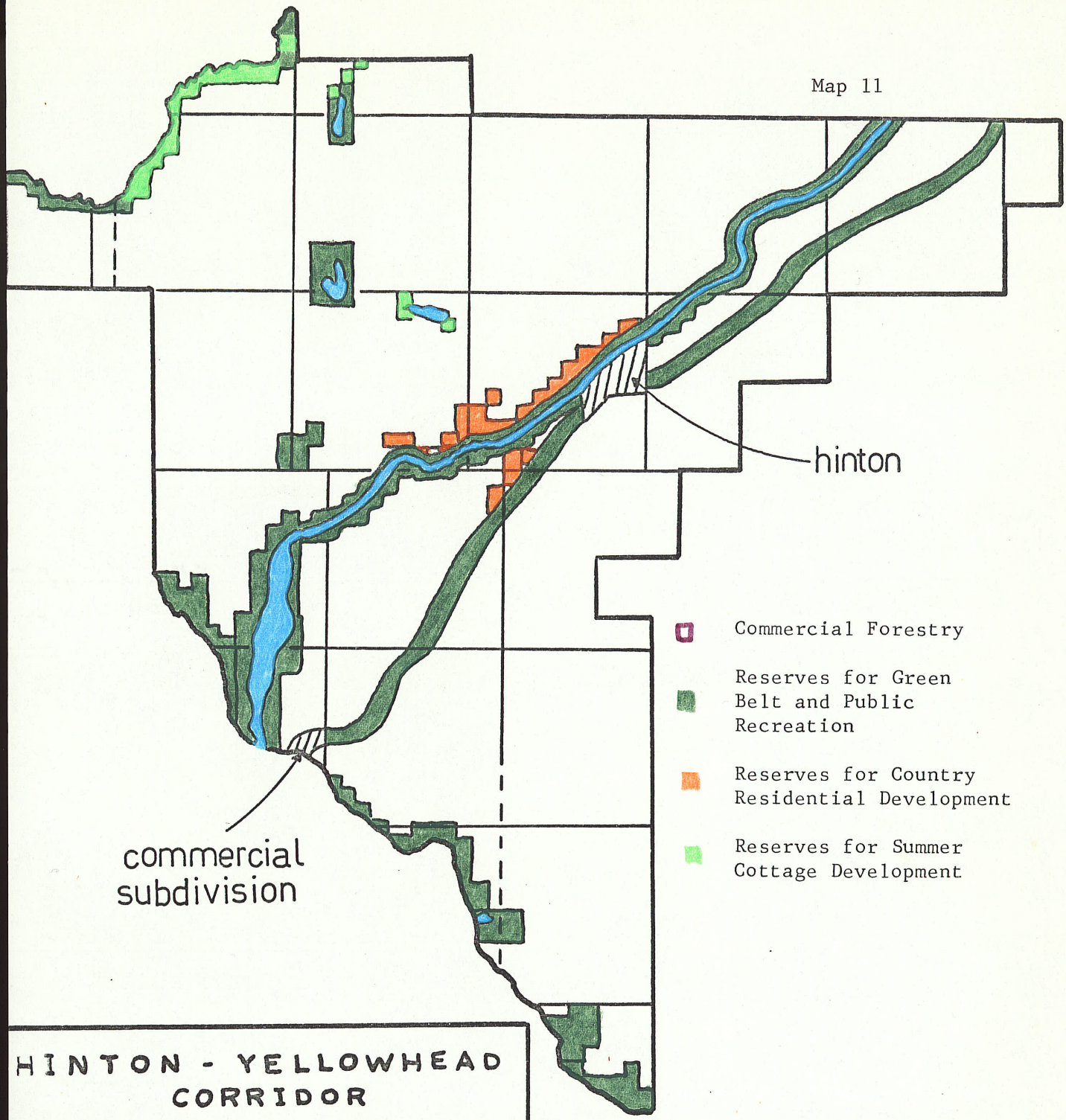
Alternative I:

This alternative incorporates the reserve method for coping with the time factor. It also suggests large scale zoning and a system of green belts for Highway 16 and for Brule Lake and the Athabasca River.

Alternative II:

This alternative suggests areas presently suited to the various land uses both in terms of suitability and available infrastructure.

Map 11

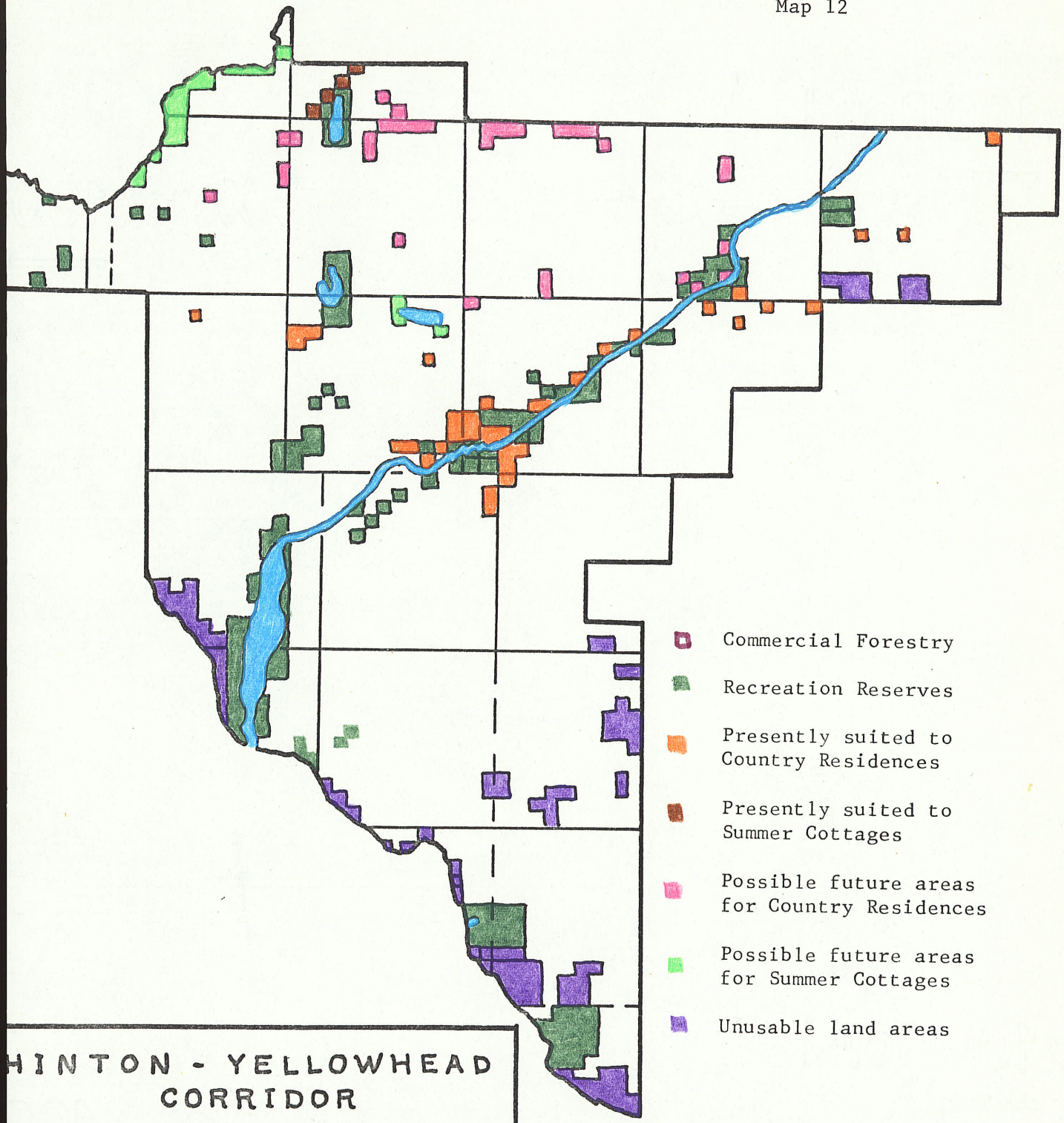


HINTON - YELLOWHEAD CORRIDOR

ALTERNATIVE I

SCALE 1:316,800 or 1 inch = 5 miles

Map 12



HINTON - YELLOWHEAD CORRIDOR

ALTERNATIVE II

SCALE 1:316,800 or 1 inch = 5 miles

The lease method of staging is therefore to be understood for this alternative. The concept might best be described as spot zoning or may be simply considered as development control (ensuring that the "best" form of development is located in the "best" location).

Further combinations of the time and concept factors could quite easily result in any number of alternatives. Evaluation of these alternatives would be the next step in the planning process and a step which must be of a political nature. A planner evaluating his own plan does not appear to the author to be a good situation at all. Those who are to be affected by the plan and those who will be responsible for administering it must be the ones who do the evaluating. Once a suitable alternative has been decided upon, recommendations for action must be made to ensure the plan is carried out. Finally, constant monitoring and review must take place to ensure that the controls and the plan remain realistic and in line with the original goals.

CONCLUSIONS

Conclusion:

The theory investigated in this thesis was purposely biased in scope. A systems view of the physical environment and planning as a process was the framework within which the author chose to work. The model developed and the criteria selected constitute the major effort of the thesis and since they represent many of the author's personal views, they are most vulnerable to criticism.

The evolution of conservation and development provided the background for arriving at the environmental criteria. These criteria, based upon intrinsic suitability, could have been considered under a broader set of economic criteria. The author's limited knowledge of economics, however, necessitated as simple a set of economic criteria as possible.

Both sets of criteria became crucial decision-making points in the model developed here. The model stressed the importance of the three systems which influence or should influence land use decisions. These three systems - social, economic and environmental - were portrayed in the model structure and their interrelationships were investigated.

The model structure which was proposed here hopefully indicates an appreciation for some of the factors involved in land use decision-making. When used, the model demonstrated how alternatives might be developed. Because of the systematic approach to decision-making inherent in the model, any decision can be justified thereby reducing arbit-

rariness. Further, the cyclical nature of the planning process, into which the model fits, ensures constant updating and review.

The testing of the model indicated some of the specific factors and systems which the author feels must be considered in making land use decisions. It is hoped that reading this thesis will benefit others as much as the writing of benefitted the author. The main value of this thesis is the attempt made to order the chosen land use influences and the suggestions offered as to how these influences might be controlled to result in a better basis for decision-making regarding disposition of Crown land.

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APPENDICES

APPENDIX A

SUMMARY OF DATA TYPE AND SOURCE

Brackets represent the way they are listed on sample data sheet immediately following.

DATA	SOURCE
(1) Soil Capability for Agriculture (Ag. Cap.)	Alberta Soil Survey Research Council of Alberta University of Alberta
(2) Land Capability for Forestry (F. Cap.)	Land Classification Section Forest Land Use Branch Alberta Forest Service Department of Lands & Forests
(3) Present Land Use (P.L. Use)	Technical Division Department of Lands & Forests
(4) Land Capability for Wildlife-Ungulates (U. Cap.)	Fish & Wildlife Division Department of Lands & Forests
(5) Land Capability for Wildlife-Waterfowl (W. Cap.)	Canadian Wildlife Service Department of Indian Affairs & Northern Development (Government of Canada)
(6) Density of Forest Cover (Density)	Alberta Forest Service Department of Lands & Forests
(7) Species of Forest Cover (Species (F))	Alberta Forest Service Department of Lands & Forests
(8) Land Disposition (Disp.)	Lands Division Department of Lands & Forests
(9) Minerals (Minerals)	Department of Mines & Minerals
(10) Recreation Facilities (Rec. F.)	Parks Planning Branch Provincial Parks Division Department of Lands & Forests

DATA		SOURCE
(11) Soil Group	(Soil Gp.)	
(12) Subsoil	(Subsoil)	
(13) Texture	(Texture)	Field Service Branch
(14) Topography	(Topog)	Department of Municipal Affairs
(15) Stones	(Stones)	
(16) Miscellaneous Acres	(Misc.)	
(17) Land Capability for Outdoor Recreation	(Rec. Cap.)	Parks Planning Branch Provincial Parks Division Department of Lands & Forests
(18) Final Percentage	(Final %)	
(19) Arable Acres	(Arable A.)	
(20) Pasture Acres	(Pasture A.)	Field Service Branch
(21) Bush Acres	(Bush A.)	Department of Municipal Affairs
(22) Land Value	(Land V.)	
(23) Sport Fish Capability	(Sport Fish)	Fish and Wildlife Division Department of Lands & Forests
(24) Watershed Protection Areas	(Water Res.)	Water Resources Division The Department of the Environment
(25) Highway Location	(Hwy. Loc.)	Provincial Planning Branch Department of Municipal Affairs
(26) Terrain Roughness	(T.R.)	Provincial Planning Branch Department of Municipal Affairs
(27) Soils Subgroup		
(28) Soils Mapping Unit		
(29) Soils Series		Soils Division
(30) Soils Topography		Research Council of Alberta
(31) Soils Stones		
(32) Soils Drainage		
(33) Soils Depth of Nonconforming Layer		
(34) Scenery Classification	(Scenery)	Provincial Planning Branch Department of Municipal Affairs

HINTON YELLOWHEAD STUDY

Numbers

bbMA#RCb	Rec. Cap.
bbMA#FPb	Final %
bbMA#AAb	Arable A.
bbMA#PAb	Pasture A.
bbMA#BAb	Bush A.
bbMA#LVb	Land V.
bbMA#SFb	Sport Fish
bbMA#WRb	Water Res.
bbMA#HLb	Hwy Loc.
bbMA#TRb	Terr. Rough.
bbMA#SBb	Soil Subgroup
bbMA#MUb	Soil M.U.
bbMA#SEb	Soil Series
bbMA#TYb	Soil Top.
bbMA#SNb	Soil Stones
bbMA#DRb	Soil Drainage
bbMA#DLb	Soil Depth to Non-conformi Layer
bbMA#	
bbMA#	

1 6 10 15 20 25 30 35 40

APPENDIX B

GOVERNMENT OF THE PROVINCE OF ALBERTA

Department of Lands and Forests

MINIMUM SPECIFICATIONS FOR CABINS OR COTTAGES

It is not the purpose of these specifications to impose any hardship upon persons erecting buildings within provincial subdivisions but merely to prevent the development of shacks and buildings that will be detrimental to the appearance of the subdivision.

FOUNDATION: To be of concrete, mortared brick, stone, or cement block construction, either continuous footing or sufficient pillar support.

FLOOR JOISTS: The following table indicates the maximum clear span for floor joists single bridging.

DIMENSION:	SPRUCE				FIR			
	12" o.c.	16" o.c.	20" o.c.	24" o.c.	12" o.c.	16" o.c.	20" o.c.	24" o.c.
2" x 6"	9'2" Span	8' Span	7'1" Span	6'6" Span	11' Span	10' Span	9'4" Span	8'8" Span
2" x 8"	13'4" "	12' "	11'2" "	10'4" "	15' "	13'7" "	12'8" "	11'11" "
2" x 10"	16'10" "	15'2" "	14'2" "	13' "	19' "	17'4" "	16' "	15'1" "

FLOOR SPACE: A minimum of 300 square feet exclusive of verandah area.

WALL FRAMING: Minimum studding - 2" x 4" x 8' - 16" o.c.

ROOF: Gable or cottage type only, unless permission obtained from the Department to construct a building, having a sloped or flat roof. To be finished with either asphalt or cedar shingles. Cedar shingles to be painted or stained (rolled asphalt roofing on departmental approved flat roof only).

CHIMNEY: Either brick, cement block, metal asbestos, selkirk, or such other type of chimney approved by the Department. To be 2" from all woodwork for fire protection and prevention.

WINDOWS: To contain a total area of not less than 10 percent of the floor space.

DOORS: Each cabin or cottage shall contain a front and rear entrance for reasons of health, and fire protection, unless the building is specifically designed where a side entrance only will suffice.

- 2 -

EXTERIOR FINISH: To be of some recognized building siding, either manufactured wood material, asphalt or asbestos. In the case of wood product to be painted or varnished.

LOCATION OF BUILDING LOT: The building shall be set back not less than twenty feet from the front boundary of the lot and the distance between the building and either side boundary of the lot must not be less than 10% of the width of the lot. On lake-front lots the building shall be so situated as to have its greatest dimensions facing the lake (unless otherwise approved by the Department) and due regard must be given to cottages on either side of the lot so as not to obstruct their view.

PLANS: One copy of the floor plan, on a proper application form, showing all dimensions must be filed with the Department, and construction must not start until the plan has been approved by the said Department.

COSTS: An estimated cost of the building must be given;

1. cost of materials
2. cost of labour.

APPENDIX C

ECONOMIC IMPACT OF THE ASESSIPPI PROVINCIAL PARK DEVELOPMENT 1971-1990

by

D.B. McCloy

January, 1971
Winnipeg, Manitoba

Department of Tourism, Recreatio
& Cultural Affairs
Research and Planning Branch
Gordon D. Taylor, Director

SUMMARY

1. Total expenditure by day visitors, and campers is estimated at $56,920 in 1971 and increases to $413,400 in 1990.
2. Capital construction costs of the park are estimated at $338,000 in the years prior to and including 1971.
3. Direct personal income as a result of local purchases and parks branch wages is estimated to be in the order of $20,000 in 1971 and $100,600 in 1990.
4. Wages as a result of capital expenditures in the park are estimated to be $50,700 in years prior to and including 1971.
5. The income multiplier is approximately 1.18 which means that for every dollar of direct income $1.18 will be contributed to the total income of the area.
6. The total contribution to the personal income of the area is approximately $84,000 in the years prior to and including 1971. As mentioned previously the major portion of this income is derived in the construction of the park.
7. In the years following 1971 the total contribution to personal income is approximately $26,000 (1972) and increases to about $119,000 by 1990.
8. The input to the region is estimated to be 5 man years of labour in 1972 and increases to 9 man years by 1990 (one man year is the equivalent of 200 working days.)

TABLE 1

EXPECTED VISITATION TO ASSESSIPPI PARK

(VISITOR DAYS)

	Day Visitors	Campers
1971	10,500	9,500
1972	11,340	10,250
1973	12,250	11,000
1974	13,225	11,975
1975	14,280	12,925
1976	15,425	13,960
1977	16,660	15,100
1978	18,000	16,280
1979	19,400	17,580
1980	20,990	19,000
1985	30,800	27,900
1990	45,300	41,000

1) Includes out of province visitors as well as residents. (20% of visits by out of province visitors).

2) Average annual increase is estimated at 8%.

TABLE 2

EXPENDITURES IN IMPACT AREA

	Day Visitors	Campers	Capital Construction	Total Expenditures Excluding Capital Costs
1971	$ 20,160	$ 36,760	$338,000	$ 56,920
1972	22,380	40,800		63,180
1973	24,840	45,300		70,140
1974	27,570	50,300		77,870
1975	30,600	55,800		86,400
1976	33,900	61,900		95,800
1977	37,700	68,800		106,500
1978	41,850	76,300		118,150
1979	46,450	84,700		131,150
1900	51,570	94,000		145,570
1985	86,900	158,500		245,400
1990	146,400	267,000		413,400

1) Expenditures increase @ 11% to account for increase in visitation plus increase in cost of living.

2) Initial Expenditures are: DAY VISITORS: $1.10 per visitor day in park and $1.92 in all of impact area.

CAMPER VISITORS: $2.21 per visitor day in park and a total of $3.87 in all of impact area.

3) Capital construction in years prior to and including 1971 has all been included in 1971.

TABLE 3

DIRECT PERSONAL INCOME TO IMPACT

AREA

	Total Expenditures Excluding Capital Costs	Less Transfer Payments	Net Purchases	Salaries Wages Etc.	Parks Branch Wages	Wages as a Result Capital Outlay	Direct Personal Income to Impact Area
1971	$ 56,920	$ 24,250	$ 32,670	$ 8,200	$12,000	$50,700	$ 70,900
1972	63,180	26,125	37,055	9,300	12,600		21,900
1973	70,140	28,215	41,925	10,500	13,230		23,730
1974	77,870	30,470	47,400	11,850	13,890		25,740
1975	86,400	32,900	53,500	13,375	14,580		27,955
1976	95,800	35,500	60,300	15,100	15,300		30,400
1977	106,500	38,390	68,110	17,000	16,100		33,100
1978	118,150	41,450	76,700	19,200	16,900		36,100
1979	131,150	44,775	86,375	21,600	17,700		39,300
1980	145,570	48,350	97,220	24,300	18,600		42,900
1985	245,400	71,050	174,450	43,600	23,800		67,400
1990	413,400	104,400	309,000	77,300	30,300		100,600

1) Transfer Payments:
   a) Daily and Seasonal Entrances
   b) Camping Permits

2) Salaries, Wages, and Proprietors Income- 25% of Net Purchases.

3) Parks Branch Wages increase @ 5% per year.

4) Wages as a result of capital outlay are 15% of capital cutlay.

5) Wages earned in Park construction prior to and including 1971 have all been included in 1971 which accounts for abnormally high Direct Personal Income. This however does not alter the total impact to the area.

TABLE 4

INCOME MULTIPLIER

Parks Branch Salaries and Wages	
Re-Spent (60% of $12,000)[1]	$ 7,200
Wages Earned in Construction	
of Park (60% of %50,700)	30,420
Plus NET PURCHASES	32,670
Total NET PURCHASES	$70,290

[1]Transfer Payments out of circulation
a) 20% tax rate
b) 5% saving
c) 15% exported income

Of the $70,290:

CYCLE 1: 25% goes to wages, salaries and proprietors. $17,570

60% of $17,570 is re-spent in impact area or $10,540.

Of the $10,540:

CYCLE 2:

25% goes to wages, salaries and proprietors. 2,635

60% of $2,635 is re-spent in impact area or $1,580.

Of the $1,580:

CYCLE 3:

25% goes to wages, salaries and proprietors. 395

60% is re-spent in the impact area or $237.

Of the $237:

CYCLE 4:

25% goes to wages, salaries and proprietors.	60
	$20,660
Plus Parks Branch	
Wages and wages earned in construction of park	62,700
TOTAL CONTRIBTION TO PERSONAL INCOME	$83,360

Income Multiplier $\frac{\$83,360}{\$70,900} = 1.18$

TABLE 5

TOTAL CONTRIBUTION TO PERSONAL INCOME

	Direct Personal Income to Impact Area	Income Multiplier	Total Contribution To Personal Income	Average Income	# of Man Years or Labour
1971	$ 70,900	1.18	$ 83,660	$ 5,400	15
1972	21,900	1.18	25,840	5,700	5
1973	23,730	1.18	28,000	6,000	5
1974	25,740	1.18	30,400	6,300	5
1975	27,955	1.18	33,000	6,600	5
1976	30,400	1.18	35,900	6,900	5
1977	33,100	1.18	39,000	7,200	5
1978	36,100	1.18	42,600	7,600	6
1979	39,300	1.18	46,400	8,000	6
1980	42,900	1.18	50,600	8,400	6
1985	67,400	1.18	79,500	10,700	7
1990	100,600	1.18	118,700	13,600	9

1) Average annual income = average income per worker. Estimated at $5,400 in 1971 with annual increase of 5%.

2) Man year of Labour - one man for one year.

3) The number of man years of Labour represents the total available input to the area and does not specifically imply that a designated number of individuals are to receive the income. It will infact be dispersed among thousands of individuals.