HUMAN PERCEPTION OF THE NATURAL ENVIRONMENT

by

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Graham Brawn and Associates

for

ALBERTA OIL SANDS ENVIRONMENTAL

RESEARCH PROGRAM

HS 50.1

May 1980

The Hon. J.W. (Jack) Cookson
Minister of the Environment
222 Legislative Building
Edmonton, Alberta

and

The Hon. John Roberts
Minister of the Environment
Environment Canada
Ottawa, Ontario

Sirs:

Enclosed is the report "Human Perception of the Natural Environment".

This report was prepared for the Alberta Oil Sands Environmental Research Program, through its Human System, under the Canada-Alberta Agreement of February 1975 (amended September 1977).

Respectfully,

W. Solodzuk, P.Eng.
Chairman, Steering Committee, AOSERP
Deputy Minister, Alberta Environment

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HUMAN PERCEPTION OF THE NATURAL ENVIRONMENT

DESCRIPTIVE SUMMARY

BACKGROUND

While many benefits can result from development of the Athabasca Oil Sands deposits, the associated technological and industrial growth has altered both the physical and social environment in the region. Research in the Human System of Alberta Oil Sands Environmental Research Program is designed to assess implications of this endeavour for local communities and to anticipate long-term changes in the region, in order to provide information relevant to planning of future oil sands development.

One of the objectives of Human System research is to better understand the relationship between people and their natural and man-made environment, a dimension of which is the relationship between perceptions of biophysical environment and human behaviour. The significance of understanding environmental perceptions rests in their potential to influence human attitudes toward environment and ultimately human behaviour. For instance, different perceptions of environmental characteristics, such as town layout, bush, wildlife, open spaces, etc., may have a bearing on the manner in which people will utilize available resources. This, in turn, may affect the degree to which they will impact their environment, and could be of importance to policy areas as management of resource use by the people, and the planning and design of new urban centres or recreational areas in the oil sands region.

Consequently, the purpose of the present study was to review the current state of knowledge on the effects that perceptions of biophysical environment may have on human behaviour. From that perspective, the study was also to define the conceptual and empirical issues involved in the relationship between people and their changing biophysical environment in the Athabasca Oil Sands region. This endeavour was to facilitate the development of possible future field research projects related to resource management and planning.

ASSESSMENT

The report entitled "Human Perceptions of the Natural Environment" was prepared by Mary Louise Marino, John Collins and Graham Brawn of Graham Brawn and Associates.

Initially the study was to deal with relationships between people and both their natural and man-made environments. However, limitations of time and budget did not permit an intensive review of human perceptions research dealing with the urban and architectural environments. The focus of this report is on the natural biophysical environment and man's use of it.

The audience to whom this report is directed includes planners, resource managers, and decision-makers who are familiar with the study area. The report is not specifically directed to scientists active in the field of environmental perception and behaviour, who might look for a more sophisticated presentation of theoretical and methodological issues.

The authors of this report have succeeded in a formidable task of reviewing and systematically presenting the available material on human perception of the natural environment. The Alberta Oil Sands Environmental Research Program thanks the authors for their contribution and effort, and recommends this document for limited distribution.

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ABSTRACT

The purpose of this study is to review the current state of knowledge on the effects that perceptions of biophysical environmental characteristics in the Athabasca Oil Sands region may have on human behaviour, and to define the conceptual and empirical issues involved in the relationship between people and their changing natural and man-made biophysical environment.

The report is organized into seven sections:

1. Introduction
2. Summary of conclusions--where general conclusions regarding factors, methods, and conceptual and empirical issues relevant to human perception and evaluation of the natural environment are presented.
3. State of the Art--where detailed consideration of context, definition, and methodology are put forward.
4. Air Quality--where research findings regarding human awareness and evaluation of air quality (in terms of air pollution) and their influence on behaviour are reviewed.
5. Land Quality--where research findings regarding human awareness, evaluation and behaviour vis à vis landscape appraisal and wilderness recreation are reviewed.
6. Water Quality--where research regarding awareness and evaluation of water quality is reviewed, with emphasis on personal factors influential in such human perceptions.
7. Bibliography

ACKNOWLEDGEMENTS

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1. INTRODUCTION

1.1 PURPOSE

The purpose of this project, as set out in the Terms of Reference, has been:

> To review the current state of knowledge on the effects that perceptions of biophysical environmental characteristics in the Athabasca Oil Sands regional may have on human behaviour, and to define the conceptual and empirical issues involved in the relationship between people and their changing natural and man-made biophysical environment.

The purpose of this report is to summarize and document those findings which are believed to be relevant to persons responsible for research, planning, and development in the Alberta Oil Sands Environmental Research Program (AOSERP) study area (Figure 1). The "audience" to whom this report is directed includes planners, resource managers, and decision-makers who are familiar with the study area. It is not specifically directed to researchers ("academics") active in the field of environmental perception and behaviour, who might look for more detailed presentation of research statistical findings or discussion of theoretical and methodological issues.

1.2 SCOPE

In the above-quoted purpose, the term "man-made biophysical environment" would suggest that this research review will deal with relationships between humans and their built environment, for example, residential and urban environments. In fact, when this project was proposed and initiated, it was believed that such subjects would be included. Regrettably, it was subsequently determined that neither time nor budget would permit an intensive review of the human perception research dealing with the urban and architectural environments. Such was due not only to the vastness of the body of literature dealing with the built environment, but also to the existence of several major comprehensive reviews of these matters

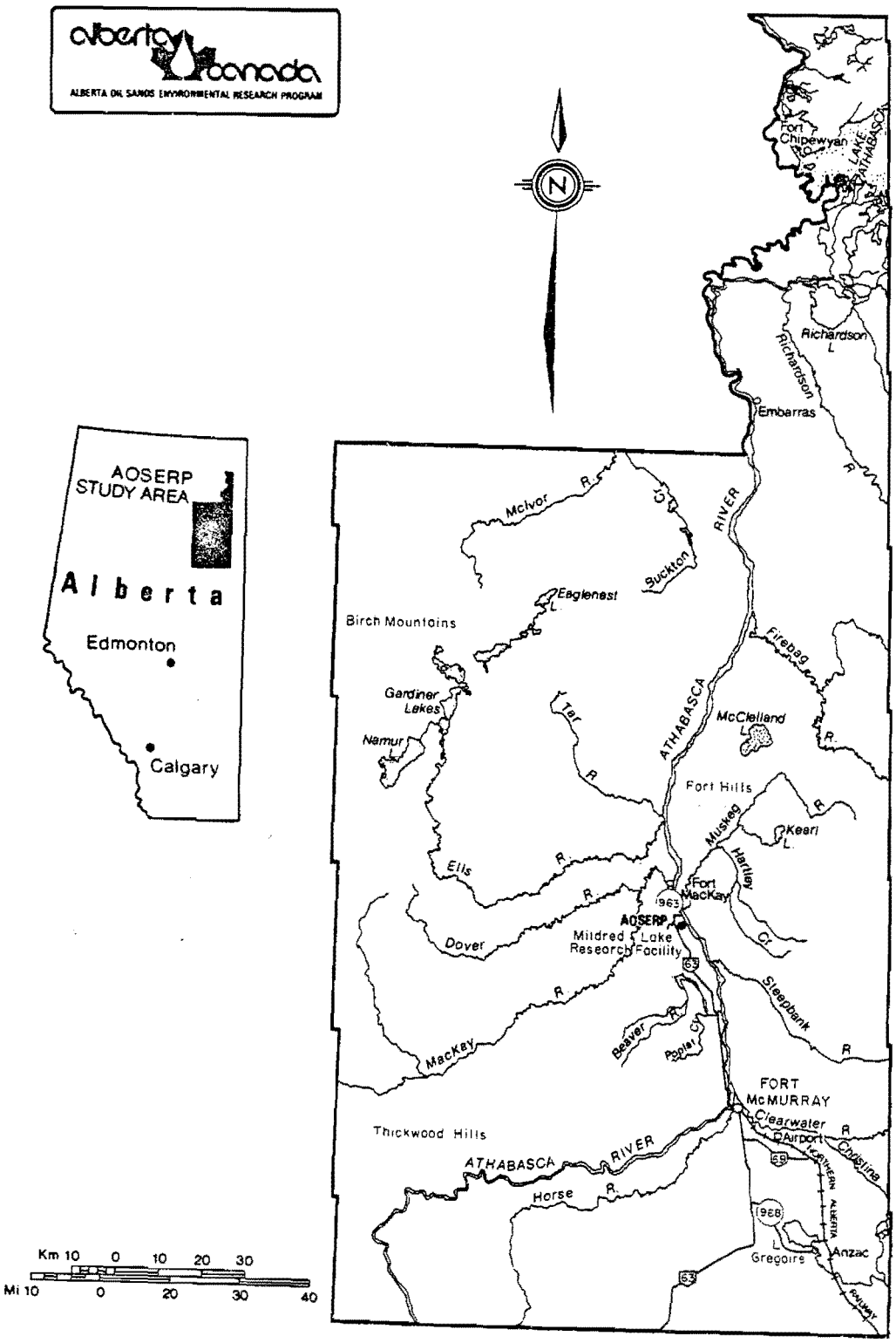


Figure 1. Map of the AOSERP study area.

(e.g., Rapoport 1977; Porteous 1977). Thus, the focus of this research review is on the "natural" biophysical environment (e.g., air, water, land) and man's use of it (e.g., through park and recreational development).

Several other areas that were initially considered for inclusion in this report have not been included because (a) they are being dealt with in other AOSERP projects, e.g., health effects of environmental degradation; or (b) because they are extensive bodies of literature which have been consolidated and reviewed elsewhere, e.g., perception of natural hazards (Burton et al. 1978) and the perception of place (Lynch 1960, 1976; Canter 1977; Relph 1976; Tuan 1974, 1977). Many of the latter studies have been phenomenological in approach and generally oriented to the urban environment. Therefore, their applicability to the AOSERP study area is questionable. Readers who are interested in a further understanding of human conceptions of place would find these authors enlightening.

1.3 ORGANIZATION OF THE REPORT

The report is organized into six sections following this introductory one: the second providing an overview of findings and conclusions; the third providing an overview of the state-of-the-art, including background, our definition of environment perception, and a discussion of research strategies and methods; the fourth through sixth sections review research findings regarding human awareness, evaluation, and behaviour vis à vis the three domains of air, water, and land; the last, a bibliography.

Readers--particularly those conversant with the field of environmental perception--may wonder why the research review has been organized into sections dealing with air, water, and land literature. Admittedly, differentiating the natural environment into categories of air, water, and land is artificial, but this has been done purposefully for two reasons: (a) these are categories which AOSERP has used for program management purposes; and (b) perhaps more importantly, these are categories which are believed to be most useful to the intended audience of this report. Persons who are responsible for

air quality management will be interested in reading the section on air, while perhaps having only a passing interest in landscape perception. Similarly, those responsible for land management will want to get into the land information, without having to search it out from among other generalized perception categories.

2. SUMMARY OF CONCLUSIONS

Following below are a number of findings, conclusions, and research implications based on the literature reviewed in subsequent sections. These conclusions are presented in order of the objectives set out in the Terms of Reference for the project.

2.1 ENVIRONMENTAL CHARACTERISTICS

Objective 1: On the basis of existing literature in general and previous work in northeastern Alberta specifically, and of research conducted by the Air, Water, Land, and Human Systems of AOSERP, identify the biophysical, both natural and man-made, environmental characteristics in the Athabasca Oil Sands region, from the point of view of their relevance to human perception.

1. One clear finding from the literature review is that people in general (laymen) identify environmental quality primarily on the basis of directly observable features, i.e., what they can see, smell, taste, hear, and touch. This reliance on sensory perception is especially true in human awareness and evaluation of air and water pollution, and in evaluation and preference for landscape and outdoor recreation sites.

2. The environmental characteristics of the AOSERP study area which may affect human perception and behaviour vis à vis the natural environment include the following:

   a. Overall, the region is a comparatively clean, undisturbed, and unpolluted environment. Residents of the area may not be aware of or concerned about pollution or other environmental degradation, except in the few locales (or on the few occasions) where it is observable, such as at mining operations, overused recreation sites (e.g., Gregoire Lake), and town sites where automobile exhaust emissions, dirt and dust, or litter are not controlled.

   b. The study area is vast (approximately 28 600 km^2), sparsely populated (approximately 1 person per km^2), remote, and scarcely touched by human activity. Even

the largest concentration of human population (Fort McMurray) is 445 km removed from the next nearest population centre (Edmonton), which contributes to a sense of remoteness and isolation. By some definitions (cf. Section 5.3.1), the region is a wilderness. Residents and visitors, who define wilderness in terms of remoteness and solitude, will perceive the region as a wilderness. Those who value wilderness highly will likely perceive and evaluate the region as one of opportunity. Whether others, who do not value wilderness highly, perceive it as a threat, is a matter for further study. A second question is whether those who are indigenous residents, who may see the recent influx of population as reducing the relative solitude and isolation, perceive the area as wilderness.

c. The climate, classified as "cold temperate", is characterized by long cold winters and short cool summers. Precipitation is about average compared with the rest of Alberta, but less than other regions such as southern British Columbia and Ontario. Hours of daylight vary considerably between the winter and summer solstices. In very general terms, the climate is similar to that of Edmonton. To persons familiar and experienced with similar climates, it is probably perceived as non-threatening, simply a fact of life. Whether it is perceived otherwise by persons not so experienced is a matter for further investigation.

d. The study area is comprised of a variety of physiographic regions, ranging from uplands (the Birch and Stony mountains) to extensive plains and lowlands. Valleys cut by the Athabasca River and its tributaries contribute further to the topographic variety. Such features, which have been shown to be highly associated with landscape preference, offer opportunities for recreational and aesthetic developments.

e. The area also offers a variety of water bodies, including a number of large and medium-sized lakes and thousands of small ponds, sloughs, beaver dams, and muskegs. The Athabasca River and its thirty-five or more tributaries also provide variety, as most of the streams contain slow, meandering sections in the lowlands near their junction with the Athabasca and in the highlands, with relatively steep, fast-flowing sections in between. From the perspective of human perception and preference, those particular water bodies which are clear and unaffected by algae, scum, oilslicks, weeds, and floating debris offer opportunities for recreational and aesthetic development.

f. A variety of vegetation communities have been identified throughout the study area, ranging from mixed forest stands of spruce and aspen, to jackpine forests with lichen ground cover, to wet sites such as fens and bogs. Although the matter is deserving of further study, those vegetation communities that offer some variety with order and spaciousness (e.g., the spruce-aspen forests with an uncluttered understory) are potential areas for aesthetic and recreational development.

g. The many species of wildlife, including ungulates (e.g., moose and caribou), furbearers (e.g., bear, wolves, beaver, muskrat), birds (waterfowl, grouse, eagles, and songbirds), and fish (trout, walleye, pike, goldeye, whitefish) are relevant to human perception in several ways. The presence of wildlife has been shown to be important to aesthetic satisfaction from recreational activities. It is also, obviously, important to those who value hunting and fishing for recreation or economic reasons. For such people, the continued presence of wildlife is essential. To others, however, the presence of wildlife, particularly bear and wolves, may be seen as threatening. The recent finding that Fort McMurray

residents thought the lack of animal control was a most serious problem may be indicative of such a perception (although it is more probable that they were concerned about neighbourhood dogs running loose). Perhaps the point to be made here is that one's perception (in this instance, of wildlife) depends a great deal upon one's past experience, one's intended use of the resource, and one's attitudes and values toward that resource.

3. Other characteristics of the environment that are not directly observable (such as nonvisible and nonodourous air or water pollutants, subsurface ground waters, and subsurface bitumen) are "perceived" through cognitive means, and their evaluation is influenced highly by knowledge and self-interest. For example, people will become aware and concerned about invisible pollution only if: (a) they have knowledge about its presence and potential for harm; and (b) they have some reason to believe it will affect them personally (e.g., because of a respiratory ailment or reliance on a groundwater source for drinking water).

2.2 EFFECTS OF PERCEPTION ON BEHAVIOUR; PARAMETERS

Objective 2: Review the existing literature and ongoing research dealing with the effects of different perceptions of those environmental characteristics on human behaviour and identify the parameters measured.

Detailed findings regarding human awareness and evaluation of air, water, and land resources are presented in subsequent sections. In summary are the following conclusions:

1. This objective, as phrased above, implies that the relationship between perception and behaviour is one-way; i.e., that humans perceive and evaluate environment and then act in some predictable manner. Evidence reported in subsequent sections suggests, instead, that the relationship between perception/evaluation and behaviour is interactive or transactional. Behaviour also influences perception and evaluation.

2. Furthermore, the relationship between humans and environment is also an interactive, bidirectional one. Humans do not merely act in or upon environment; they interact with it and in so doing are influenced by environment.

3. Related to the above is the conclusion that these relationships are dynamic and changing. As environments change, so will human perception, evaluation, and behaviour change; as humans change (grow older, gain knowledge or experience, modify attitudes and values) so will their perceptions of, and behaviours in, environment change.

In attempting to examine and understand these complex, dynamic, and interactive relationships, researchers have focussed upon and examined a variety of variables (parameters). In general terms, these variables can be categorized into three groups: (a) characteristics of environments (which influence human perception, evaluation, and behaviour); (b) characteristics of humans (which influence their perception, evaluation, and behaviour); and manifestations of these relationships. The second group regarding human characteristics will be discussed under Objective 3 below.

4. With respect to environmental characteristics, the "parameters" investigated have included the following:

a. Dimensions of environments relevant to human awareness and evaluation, e.g., environmental features which humans associate with air or water pollution or identify as being important to landscape preference.

b. Thresholds of such environmental dimensions, e.g., the level of concentration of SO_2 at which humans become aware of, or concerned about, air pollution.

c. Situational factors influencing perception and behaviour, e.g., other community, social, or environmental factors that have bearing on the relationship between perception/behaviour and the environment under study. For example, some investigators have examined the role of media, or of other community problems, in influencing perception and concern about specific environmental problems. It

is fair to conclude from such studies that situational factors are highly important; in other words, to examine the biophysical environment separate from the man-made and/or social environments is an artificial distinction to be avoided.

5. With respect to manifestations of the human/environment relationship, a variety of approaches have been taken:

a. Awareness studies, e.g., what do humans define as air or water pollution; to what extent does human awareness of air or water pollution correspond with measured levels of contaminants; and to what extent is awareness of environmental pollution or quality influenced by situational or personal variables.

b. Concern studies, usually of the public opinion poll type, which attempt to determine how concerned people are about environmental problems at national, regional, or local levels. Such investigations usually attempt to measure levels of seriousness of problems, and then relate these rankings to other factors such as actual existence of the problem, situational factors, or personal characteristics. Awareness and concern about air and water pollution have been found to be positively correlated with actual presence of pollutants, at least those which are directly observable.

c. Attitudinal studies, toward environmental problems in general or toward specific local conditions or problems. The Stehr and Pong (1975) study of environmental attitudes among young Albertans is illustrative, in that they examined how such attitudes were related to respondent characteristics, perceptions of environmental problems, etc.

d. Preference studies, which endeavour to specify what environmental features or settings individuals or groups prefer over others. Such studies have almost exclusively dealt with landscape and recreational settings. The

amenity values associated with air or water quality have received very little study.

e. Satisfaction studies are closely related to preference studies, except that they are usually conducted on-site among users of a resource and endeavour to specify what factors (environmental and personal) contribute to satisfaction in an environmental setting. Recreational satisfaction has received the most attention.

f. Anticipated behaviour studies, where the investigator asks the respondent how he would act under certain conditions or in a given environment. "Willingness to pay" studies are one example, where respondents are asked how much they would pay for improved air quality or preferred campsites.

g. Actual behaviour studies, where the investigator observes, or otherwise determines, how environments (or perceptions thereof) influence action or behaviour. Comparatively few such studies have been undertaken in the context of the natural environment, and these have dealt primarily with economic analyses of how much people will pay for a home in a cleaner environment or for preferred recreational sites.

2.3 SOCIO-CULTURAL FACTORS

Objective 3: Identify different social and cultural subgroups in the AOSERP study area, and assess the relevance of the socio-cultural factors to environmental perceptions.

As suggested under Objective 2, numerous researchers have investigated the role of observer characteristics in environmental awareness and evaluation. The variety of variables can be grouped as follows:

a. Demographic variables, such as age, sex, race, income level, educational level, and occupation;

b. Personal variables, such as personality characteristics, health condition, value orientations, environmental

attitudes, knowledge, experience, role, and self-interest; and

c. Socio-cultural variables (many of which overlap with or combine characteristics from the other two groupings), such as urban-rural background or lifestyle, social milieu, and cultural or racial background.

In very broad terms, the literature reviewed herein would support the following conclusions about such variables:

1. Demographic variables cannot be relied upon for strong or consistent prediction of environmental awareness, evaluation, or behaviour. A number of studies of general environmental concern have found that younger, more highly educated, and higher socio-economic status persons are more environmentally aware and concerned than those less well educated and financially endowed. However, as evidence in subsequent Sections illustrates, similar findings do not emerge when a specific environmental condition or concern is being addressed. That is, when dealing with a specific or local matter, such as local water problems, air pollution, or wilderness recreation, other variables (non-demographic) appear to be more salient or important.

2. Personal variables appear to be highly relevant to environmental perception and evaluation. Personal variables which appear to play key roles in environmental awareness and evaluation are: values and attitudes (e.g., toward nature, society, and industry); information and knowledge (e.g., about environmental problems and solutions); role (e.g., expert vs. non-expert); self-interest (e.g., property ownership); and experience (e.g., past exposure to air pollution or wilderness).

3. Cultural variables also play a role in environmental awareness and evaluation, but their significance is not as directly apparent as others. Cross-cultural studies have shown significant differences among groups in their perceptions and evaluations of environments; however, most of these have been studies of Eastern vs. Western cultures or industrialized vs. Third World cultures. These may be relevant to northeastern Alberta insofar as they suggest differences between natives and non-natives in environmental attitudes.

But what most such studies indicate is that the variables which contribute to cultural differences are those such as values, attitudes, knowledge and experience--those identified above as personal variables and which may be embedded in the cultural networks.

4. It would be premature and speculative to "identify different social and cultural subgroups in the AOSERP study area" on the basis of research reported herein. However, further research by AOSERP would probably reveal a set of groupings based on: (a) personal attitudes and values toward nature, industrial development, etc.; (b) personal knowledge and experience with that particular or similar environment, and (c) self-interest or intended behaviour vis à vis the environmental resource under study. In a sense, then, AOSERP's proposed matrix of social groups based on indigenousness, native culture, and permanence of residence is an hypothesis worthy of testing from the perspective of environmental awareness and evaluation.

2.4 INDICATORS OF HUMAN BEHAVIOUR

Objective 4: Evaluate indicators of human behaviour which are important to understanding the perceptions of biophysical environment in the oil sands region.

As indicated in the subsequent sections, this is one area that, although extremely important, is relatively unexplored in the context of the natural environment. Two areas of study can be mentioned:

1. Attitudinal indicators, which attempt to define those environmental attitudes that have bearing on an individual's environmental behaviour, have received some attention. For example, the Environmental Response Inventory (ERI) (McKechnie 1977) is a multiscale assessment instrument designed to measure differences in the ways persons habitually interact with the environment. The ERI has been applied in a variety of research studies, such as migration, family planning, architecture, and recreation. Other instruments, such as Kaplan's (1977c) Environmental Preference Inventory, have been developed to measure landscape and recreational preferences. Problems inherent in the use of attitudinal measures as indicators of behaviour

will be discussed in Section 3.6.

2. Behavioural indicators, which attempt to monitor human actions in various environmental contexts, have received very little attention vis à vis the large-scale natural environment. The only behaviours which have been examined are: economics or willingness-to-pay for environmental improvements or recreation; involvement in environmental action groups and activities; recreation choice and use of campground; and littering. Most researchers and theoreticians agree that there are most probably a handful of psychological factors--deep-seated, pervasive, and inferential--which so permeate human behaviour as to fundamentally influence (if not cause) the patterns of overt human behaviours at the environmental interface. Many candidates for this list of deep-seated variables have been proposed. Some of the more commonly referenced are:

a. Approach-avoidance behaviour: an individual tends to approach objects in his environment which are positively "valanced" (attract); and to avoid or shun objects with negative valance. The avoidance gradient is always steeper than the approach gradient.

b. Person-thing orientation: people differentiate themselves in terms of preferred orientation; some prefer associations with and the company of other persons, while others avoid persons and surround themselves with things, e.g., "collectors."

c. Stimulus-seeking: some people delight in seeking out new experiences and stimuli, and cast themselves gladly into the rush of new events and situations; others prefer the "tried and true" and choose continuing repetition of the familiar.

d. Field-dependent/independent: some people anchor their perception of events and objects in the perceptual field containing those objects; while others internalize their anchors, preferring to interpret the world from an internal frame of reference.

e. Pleasure/arousal dominance: people's orientations to and behaviours in the environment reduce to a three-fold set of dimensions: pleasure or displeasure; arousal or calm; and in control of or dominated by. Most all of an individual's responses to environmental cues can be interpreted and measured in this three-space.

f. Internal/external locus of control: people differ in perceiving where the source of control lies in their own lives; some choose to see control to be wholly within their own sphere of agency; while others believe that the control in one's life is exercised by luck, God, or City Hall Big Politicians.

To date, theorizing and conjecture have overshadowed empirical research which might illuminate those psychological variables which influence our day-to-day behaviour in the natural environment. Mehrabian and Russell (1974) have produced results of paper and pencil measures of a variety of presumed behavioural indices, and show that these measures correlate significantly, but moderately, with the pleasure/arousal dominance three-face.

In those cases where clear evidence does appear to confirm that behavioural indicators correlate with perceptions of and behaviour in the biophysical environment, AOSERP will usually find that the direct behavioural measure is a more parsimonious index of its own interest topics than are inferences about the behavioural indicators--always once removed. As indicated in Section 3.3, a variety of measures and techniques have been developed for use in architectural and urban settings. Their applicability to studies in the AOSERP study area is well worth further exploration.

2.5 METHODS

Objective 5: Identify methods of assessing environmental perceptions.

A variety of methods have been used to assess environmental awareness and evaluation and, to a lesser extent, behaviour. These range from self-report methods, such as interviews, questionnaires, and attitudinal measures, to observational, non-interventional techniques such as video-taping and tracking. Given such a vast array (Lozar 1975 listed over thirty) of potentially applicable methods, choosing from it for a particular research study can be difficult. As Craik (1970) has suggested, such choice is dependent upon answers to four questions:

a. Who will the observers be? (e.g., special competence groups, special user groups, general public);
b. What medium will be presented to them for assessment? (e.g., actual on-site experience or representations such as photographs or models);
c. How will their responses be recorded? (e.g., self-report formats or experimenter observation); and
d. What dimensions should they attend to? (e.g., dimensions of awareness, evaluation, preference or satisfaction).

2.6 CONCEPTUAL AND EMPIRICAL ISSUES

Objective 6: Define and categorize conceptual and empirical issues involved in the relationships between human perceptions of changing biophysical environment in the region and human behaviour.

A number of conceptual and empirical issues have been alluded to in the above discussions. In summary, the major such issues are:

1. The relationships between man and environment and between perception and behaviour are dynamic and transactional. Conceptually, most theorists agree and assert that this is a fact. Empirically, however, the concept presents problems for the researcher who must break into the cycle somewhere and who must define a perspective or focus for study. As Ittelson (1978:211) has said:

> We find ourselves dealing with contingent rather than lawful relationships, with things that did not have to be the way they are, and with future states that cannot be predicted from present conditions. This is not to say that prediction is impossible, but to open for study the question, along with many others, of what kinds of predictions can be made.

2. The relationship between attitudes and behaviours is inconclusive. Wicker (1969), for example, in reviewing a collection of studies regarding the relationship of verbal and overt behavioural responses to the same attitude object, found that attitudes do not show a consistently strong, positive relationship to overt behaviours. In other words, what people say they will do is often quite different from what they actually appear to do. Much of the methodological and conceptual work over the past two decades has endeavoured to reduce, or at least bring under control, this inconsistency. Two general implications arise from this issue: (a) measurement of attitudes will let one know what people claim they think or feel about something; inferences about their overt behaviour must be treated with caution; and (b) if the researcher is primarily interested in overt behaviour, he should examine emitted behaviour rather than intended behaviour or attitudes.

One of the major problems yet to be addressed is whether the slippage between people's stated attitudes (intentions and values) and their overt behaviours is due to inconsistencies in <u>their</u> thought processes or to faulty methodologies for collecting and analyzing the data. The most parsimonious hypothesis is (a) that human beings respond precisely as the survey instrument requires; (b) that they behave as they behave; and (c) when their behaviour fails to corroborate the survey responses, the problem lies most probably in the investigative procedures and not in the respondent's behaviour.

3. The role of demographic, personal and situational factors in environmental awareness, evaluation, and behaviour is unclear, although personal and situational factors seem more relevant than demographic factors. In dealing with the problem of attitude-behaviour inconsistency, Wicker (1969) proposed that the more similar the situation in which the two responses were obtained, the closer

the relationship. Subsequent research supports his notion. Moreover, the currently dominant paradigm in behavioural analysis is that Behaviour is a joint function of Person and Environment-cue-giving [B = f(P, E)]. Therefore, the behaviours observed by a person in environment A ought to differ from those in environment B because the cues given by the environment have changed even though the personal attributes remain constant.

One implication of this for AOSERP investigations is that attitudinal, preferential, and evaluative research should be conducted "in-situ," with the local population in their local habitat. One cannot infer environmental attitudes and behaviours on the basis of data gathered elsewhere, unless the situations and the people studied elsewhere can be documented as being similar; or unless the measures used have been proven to be reliable across broad populations.

4. A related issue addresses thresholds of both awareness and behaviour. Campbell (1963) proposed that behaviour is influenced by situational thresholds, where certain key forces outside the individual and the attitude object cause alternative behaviours to occur. Such key forces include peer group presence, social norms, crisis events, etc. Similarly, Burton et al. (1978) have hypothesized a hierarchy of behaviours (in response to natural and other hazards) which can be related to external events. Depending upon the research questions to which AOSERP needs answers, the notion of behavioural hierarchies and situational thresholds deserves consideration.

5. The role of personal factors in environmental awareness and evaluation also deserves attention. Although the relationships have not been precisely defined (and perhaps never will be due to the dynamic, transactional nature of the relationship), it is clear that personal factors do bear on environmental evaluation. Primary among such factors, which should be recognized and if possible accounted for in any research strategy, are:

a. values and attitudes;

b. knowledge and experience; and

c. role and self-interest.

6. In contrast to the above issues which emphasize the importance of individual and situational differences, a number of theorists in the field have proposed that it is possible to identify and verify commonalities in awareness and evaluation of environmental quality. In fact, one such group (cf. Craik and Zube 1976) have proposed the development of "Perceived Environmental Quality Indices," i.e., indices of environmental quality based on a consensus of observer appraisals. It is believed that, through appropriate research design and strategies (such as emphasizing "comparative appraisals" rather than "preferential judgments"--see Section 5.2.1), it will be possible to develop such indices. Whether their efforts will be applicable to the study area remains to be seen, but this is an emerging development which should be monitored.

2.7 FURTHER RESEARCH

Objective 7: On the basis of this study, recommend pertinent areas of research which could be followed by AOSERP to enhance understanding of the relationship between people and their biophysical environment in the oil sands region.

A variety of further research studies regarding the relationships among environment, human perception, evaluation, and behaviour have been suggested above and in subsequent sections. Whatever hypotheses AOSERP wishes to pursue must, however, incorporate two points: (a) to what extent are residents of the study area different from other populations with respect to their environmental attitudes, values, and perceptions, and (b) to what extent can subgroups in the study area be defined in terms of environmental attitudes, values, and perceptions and/or personal factors such as knowledge, experience, role, and self-interest. Such study carried out by AOSERP, perhaps utilizing an attitudinal instrument such as the ERI, could serve as a point of departure, not only for further research, but also for planners and managers who often wonder how study area residents are similar to or different from residents of other areas.

3. STATE OF THE ART

3.1 CONTEXT

The study of environmental perception is ancient, yet very young. Philosophers and others, Eastern and Western, have contemplated, examined, and debated questions of man's relationship with nature and his world. Such scholars may not have titled their works "Environmental Perception", but they were most surely dealing with issues of man's perceptions, understandings, and values vis à vis nature and his environs, both biophysical and social.

But as a field of study, defined in terms of number of researchers, graduate courses, research grants, and documents carrying a title of "Environmental Perception", it is only two decades old. As one reviewer recently said, "the study of environmental perception . . . is still in a very primitive stage" (Ittelson 1978:195), and does suffer the many problems of an embryo--lack of singular definition and form, lack of a substantial and co-ordinated body of knowledge, and lack of self-knowledge and understanding.

Before dealing with issues of definition, theory and form, it is illuminating to explore the genesis of the field of study. Such understanding explains not only why it has been variously defined, but also why it has developed and taken shape as quickly as it has. In this regard, three interrelated matters will be addressed:

1. The study of environmental perception is multi-disciplinary;
2. It has grown out of, and is a substudy of, the broader field of human-environment relations; and
3. Its primary base is in environmental psychology.

3.1.1 The Multi-Disciplinary Roots of Environmental Perception

During the past several decades, scholars in a number of disciplines (in the social sciences of anthropology, geography, sociology, psychology; in the "design" fields of architecture, urban planning, and landscape architecture) have dealt with people's

perceptions of the environment. Three streams of study exemplify the breadth of study. In geography, researchers such as Gilbert White, Robert Kates and Ian Burton (e.g., Burton et al. 1978) began working on human perception of natural hazards as early as 1945 and continue to this date. Also in geography, David Lowenthal (e.g., Lowenthal 1968) and others during the 1950's and 1960's became increasingly interested in perception of landscape, looking at changing conceptions of the environment over historical time, and differing conceptions across cultures and social groups. A third major influence, this one in urban planning, was the seminal work of Kevin Lynch (1960), which generated innumerable studies of the "image" of cities around the world. As well, researchers in anthropology and sociology have contributed to the development of methods for the cross-cultural and sociological study of human attitudes and functioning within various environments, although their studies have been less concerned with the physical aspects of such environments than those of the geographers and planners.

3.1.2 The Place of Environmental Perception within Human-Environment Relations

The increasing attention to environmental perception can perhaps best be viewed from the perspective of the emergence of the study of human-environment relations. Prior to the 1960's, psychologists, geographers, and others interested in perception carried out their work in relative isolation. During the sixties, however, as the "doomsayers" alerted the public to the threats of an increasing population vying for decreasing natural resources, these researchers emerged from their laboratories with the realization not only that they had a contribution to make to the solution of these problems, but also that they might get farther faster by working together toward such solutions. So, for example, in the early 1970's the Association for the Study of Man-Environment Relations (ASMER) was established to provide a cross-disciplinary forum for communication among those carrying on research on human behaviour and those responsible for designing and managing environmental resources, both

natural and man-made. At about the same time, the Environmental Design Research Association (EDRA) was established to promote exchange of research findings among behavioural scientists, planners, and architects. With similar intentions to promote inter-disciplinary communication and co-operation, numerous university programs were established.

The expansion of environmental perception as a topic of study paralleled, or grew within, the study of man-environment relations. Facing issues of resource utilization and conservation, resource managers increasingly have turned to the behavioural sciences with such questions as: what do people value in the environment sufficiently to conserve, even preserve, it; what is causing stress and vandalism in our urban settings and what can be done to relieve that stress; and what do people think about the rapidly deteriorating environment around them--or do they even think about it at all. Findings from the work of planners on urban images and from the geographers' work on hazard perception and landscape tastes were brought to bear on these issues. As more questions were raised, more behavioural scientists entered the picture to try to find out what people valued in the environment. Thus the field burgeoned.

3.1.3 Environmental Psychology as the Base of Environmental Perception

While many of the behavioural and social sciences contributed to the growth of environmental perception, the main surge came from psychology, where the study of human perception has a long-standing experimental base. However, even within psychology, environmental perception, per se, has existed for less than 10 years. The International Encyclopedia of the Social Sciences (Anonymous 1968). while devoting over 50 pages to perception, made no reference to environmental perception, except tangentially in a subsection dealing with social perception. To understand the emergence of environmental perception as a legitimate topic of research, it is necessary to acknowledge and understand the growth of environmental psychology as a division of study within the discipline of psychology.

It is generally agreed that environmental psychology emerged as such in the early 1970's, interest having accelerated through the sixties in parallel with the broader interest in environmental problems and man-environment relations. Psychology, it should be pointed out, has always had scientific interest in man's relationship with environment, the latter being the micro-environment of the laboratory and/or stimulus objects in the environment. As Stokols (1978:256) recently observed in a review of environmental psychology, "Suddenly psychologists 'rediscovered' the large-scale, physical environment and . . . became increasingly involved in studying its impact on behavior".

Among the seminal works marking the birth of the field were a 1970 collection of readings in environmental psychology (Proshansky et al. 1970, 1976); a new journal entitled "Environment and Behavior"; and the first review of environmental psychology to appear in the "Annual Review of Psychology" (Craik 1973). The growth of the field since those early works has been phenomenal. As Stokols (1978:253) points out, between 1972 and 1977, "no fewer than ten textbooks . . . six edited readers . . . two multiple-volume series . . . more than 30 'state-of-the-art' monographs and edited volumes . . . appeared". While Stokols did not tally the many journal articles, research reports, and book chapters which also appeared, his own bibliography included nearly 500 entries.

Stokols (1978:254-255) addressed the question of what distinguishes environmental psychology from other subareas of psychology. While the boundaries are not neat, environmental psychology:

1. Operates from an ecological perspective, wherein "the environment is construed in multi-dimensional, molar terms, and the focus of analysis generally is on the interrelations among people and their socio-physical milieu . . .";
2. Tends to place greater emphasis "on the utilization of scientific strategies in developing solutions to community-environmental problems . . ."; and

3. Tends to be "inter-disciplinary in both its scope and implementation".

What makes it different from other disciplines, such as human ecology, environmental sociology, and behavioural geography is its "relatively greater emphasis on basic psychological processes (e.g., cognition . . . personality . . .) and on individual and group (vs. societal) levels of analysis".

Topics of research carried out by environmental psychologists vary widely, ranging from perception of noise as a stressor; to studies of privacy, personal space, territoriality, and crowding. In an attempt to provide an integrative structure within which to view these varied topics of concern, Stokols utilized a transactional model of human-environment relationships, where "transactional" refers to the bidirectional dynamic relationship between environment and behaviour. Humans do not simply behave in an environment or act upon an environment; they interact with environment and, in so doing, their understandings and behaviours are influenced by environment. The man-environment relationship is a reciprocal, systemic one. From this theoretical perspective, Stokols (1978:259ff) defined four modes of human-environment transaction:

1. Interpretive, involving the individual's understanding and representation of the environment (e.g., studies of cognitive mapping and urban images);
2. Evaluative, involving the individual's evaluation of a situation against some predefined standard of quality (e.g., studies of environmental attitudes and residential preferences);
3. Operative, involving the individual's movement through or impact upon the environment (e.g., studies of littering behaviour, personal space); and
4. Responsive, involving the environment's effects on the individual's behaviour and well-being (e.g., studies of environmental stress).

While Stokols' framework is a useful tool for conceptualizing and organizing the research taken under the umbrella of environmental

psychology, it does not indicate clearly where environmental perception fits into the picture.

3.2 DEFINING ENVIRONMENTAL PERCEPTION

The definition of environmental perception that will be used to explain and structure the subsequent discussion of research findings is broad. It is an amalgam of definitions put forward by two recognized authorities in the area: W. H. Ittelson, one of the "fathers" of environmental psychology, and Amos Rapoport, a scholar in urban and regional planning.

Rapoport (1977) has devoted considerable care to defining and clarifying past, current and desirable uses of the term "environmental perception." He (1977:31) proposed, in essence, to view the "constructing of a perceived environment" as a continuum of processes which lead to, or have bearing upon, human behaviour or action:

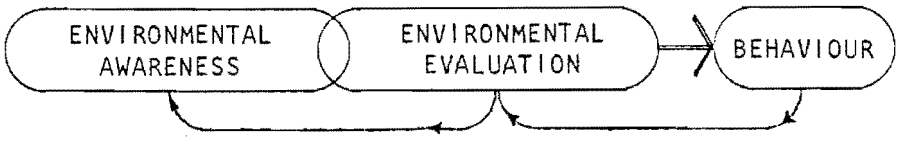
where: Perception "describes the direct sensory experience of the environment for those who are in it at a given time";
Cognition describes "the way in which people understand, structure and learn the environment and use mental maps to negotiate it"; and
Evaluation describes "the evaluation of the environment, i.e., perception of environmental quality"; with
Actions being such as "migration (choice), behaviour, decisions."

Ittelson (1978:197) summarized the current work on environmental perception as:

> . . . a coherent body of studies which have redefined the concept of perception to include perceptual, cognitive, imaginal, affective, and value aspects studied by a wide range of methodologies and techniques. Environmental perception is not only dependent upon the physical, interpersonal, and cultural aspects of the environment, but also upon the status of the person, including needs, actions, motives, cognitive processes, etc.

Ittelson (1978:198) further defined environmental perception as "the experienced significance of the person-environment system" and made the case that the individual is "an integral part of and an active participant in" the environment. The individual is not simply observing and reacting to the environment; he is acting upon it. These actions serve not only to modify the environment, but also his experience of the environment and his future behaviour.

For the purposes of this paper, that is, to determine "the effects that perceptions . . . may have on behaviour", two aspects of environmental perception, as they interrelate with behaviour, will be focussed upon:



where: Environmental Awareness refers to the individual's (or group's) observations and understandings of features and factors in the environment. It includes, or can include, both processes of sensory perception and cognition.[1] Thus, for example, a person can become aware of some environmental feature (e.g., air pollution or cold weather) through direct sensory experience (e.g., the smell of foul air or the feel of the coldness) and/or through some cognitive or learned process (e.g., reading in the newspaper that the air pollution index is in the "dangerous" zone, or seeing that the thermometer is at -30°C). What will be emphasized in subsequent discussion of environmental awareness will be those dimensions of environment that are salient to human awareness.

Environmental Evaluation implies an intermediary phase between awareness of environmental dimensions and action. It includes those aspects which Stokols referred to under his Evaluative mode of transaction, e.g., attitudes,

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[1] For a recent "state of the art" review of environmental cognition, the reader is directed to Moore (1979).

preferences, appraisals, assessments of environmental features and factors. It includes "affective responses" to the environment, such as likes and dislikes, satisfactions and dissatisfactions.

Behaviour, in this model, represents overt behaviour, or action, taken in response to some perceived and evaluated aspect of the environment.

This "model" of environmental awareness and evaluation has been arrived at not only because it seems to fit with those of other theorists (e.g., Stokols, Ittelson, Rapoport), but more so because it appeared to be the best way to structure the literature dealing with perception of the natural environment. For example, with respect to air quality, numerous studies exist regarding public concern, attitudes about air pollution and the physical factors contributing to awareness of pollution, but relatively little regarding effects on behaviour, and virtually none on "amenity" values associated with air. In contrast, with respect to land, there were virtually no research findings regarding concern about "land pollution", but there does exist a large body of research on preferences for landscape, wilderness and outdoor recreation, as well as how such preferences and perceptions influence behaviours such as camping.

3.3 MEASURING ENVIRONMENTAL PERCEPTION

There has been a considerable evolution in the content, inventory, and methodology of work on human perception in the biophysical environment in the two decades that such a branch of social science has been an identifiable component. For the several decades preceding the 1950's, the great proportion of the literature consisted of philosophical treatises, speculative musings, introspective musings and occasionally a proposal (in research terminology) regarding how some particular problem might be formulated into a set of testable propositions. A fair number of highly insightful conjectures were raised during those decades, even though no one chose to reduce conjecture to testable research.

3.3.1 A Research Paradigm

Many authors have complained of the lack of a framework for organizing the results of recent findings in human-environment relations. Others have offered long lists of findings, problems, and topics, but without any apparent logical super-structure. In one of the first comprehensive literature reviews to appear, Craik (1970) went a very long way to solving the "lack-of-framework" problem and offered his "Paradigm for Research on the Comprehension of Environmental Displays". In one swift stroke, he brought simplicity and order to a young science confused by the richness of its own progress. Craik (1970) proposed that the multiplicity of conceptual issues be reduced to set of four simple questions:

1. Who are the observers?
2. What is presented to them for assessment?
3. How are they to report their responses?
4. What are they to attend to?

The 1970 paradigm itself, with representative entries, appears in Figure 2. The formative nature of the paradigm is evident in reviewing the literature since 1970: more often than not, authors writing since that time offer as part of their introductory rationale just which dimensions of the paradigm their current research or writing addresses. For those authors who do not, it is now a simple matter for the reader to judge for himself where the author's work is properly targeted.

3.3.2 Subject-Agent Distinctions and Environmental Issues

Despite the great organizing utility of the paradigm, a certain amount of classificatory confusion has remained--particularly in the realm of Environmental Dimensions--because of the failure of authors and researchers to make clear whether they viewed man as the cause or the recipient of environmental forces. Both approaches are necessary, but where dissent among authors of "Environmental Issues" has raised more heat than light, it has most often resulted from the failure to make clear their premise regarding:

Man as the agent of environmental change; or

Man as the subject of environmental change.

Observers	Media of Presentation	Response Formats	Environmental Dimensions
Special competence groups architects geographers planners and designers real estate appraisers building and "space" managers interior decorators landscape artists and painters natural resources managers Special user-client groups elderly persons migrant workers college students wilderness area campers flood plain dwellers Groups formed on the basis of relevant personality measures Everyman, the general public	Direct presentation looking at walking around and through driving around and through aerial views living in Representation sketches, drawings, maps models, replicas photography cinema television Imaginal presentation	Descriptive responses free standardized ratings adjective checklists mood and activity checklists Q-sort decks Global responses thematic potential analysis empathic interpretation symbolic and multisensory equivalence graphic presentation Inferential responses Attitudinal responses Preferential responses	Taxonomy of everyday language Objective physical and geographic measures Sequential notational systems Modal behavioral attributes descriptive assessments evaluative assessments predictive assessments
(1)	(2)	(3)	(4)

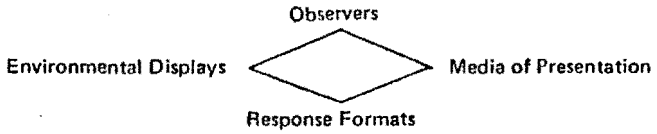

Figure 2. A paradigm for research on the comprehension of environmental displays (Craik 1970).

Examine the following list of "Environmental Issues" and note how drastically the implications of each entry change as each treats (first) man as the agent of change, and (second) man as the subject of change. Each entry in the list has been the topic at one time or another of an "Environmental Issue":

1. Environmental Hazards: floods, earthquake, drought, winds;
2. Adapting the Environment: razing forests, draining marshland, damming waterways, cultivating wastelands, changing shorelines;
3. Environmental Sustenance: . . . "the earth will provide . . ."; all tools necessary for survival are built into the environment;
4. Environmental Stimulus Seeking: full and sustained interplay between self and environment actualizes one's potential;
5. Environmental Preservation: all environmental features ought to be preserved in their unaltered and pristine state, humans are to live in and among, but not to change, alter or modify;
6. Environmental Antiquarianism: the landscape exists and extends both spatially and temporally, and is revealed by the objects, treasures, sanctuaries it contains, both old and new;
7. Urbanism: sufficient diversity and complexity are found only in the city where high social velocity is the means to the cosmopolitan atmosphere--the true destiny of human living;
8. Pastoralism: peace, seclusion of the natural and country landscape allows close contact with natural cycles of the day and season;
9. Need for Privacy: respite from too frequent contact with others. Neighbouring should be a rare and precious interchange;

10. Environmental Resources of Recreation and Leisure Time: the environment is the ultimate source of joy, fun, play with its varied forms, climates, scopes and objects;
11. Human Spatial Behaviour: crowding, territory markers, social dominance, home-range;
12. Environmental Design in Architecture and City Planning;
13. Behaviour Setting and Undermanning Theory: each human behaviour must happen in a "place" with one or more people present. Each such setting demands a number of roles which are divided among the people present. Undermanning the setting requires each person to be competent in more roles than overmanned settings; and
14. Ergonomics and Human Factors: each task or chore requires that there be a 'match' between the task and the person performing it. If the match is poor, errors occur. The best matches occur when the machinery of the task is engineered to capitalize on human factors.

The senior authors of articles treating various of these environmental issues have had little difficulty recognizing that the cause→effect conceptualization is too simplistic and that each of these issues must treat the cause/effect or subject/agent distinction as interactive and mutually co-causal rather than linearly cause→effect linked. It is an important comment on the current state-of-the-art understanding that the co-causal interpretation has not yet percolated down to universal acceptance among the junior authors.

3.3.3 Methods of Assessing Environmental Perceptions

One may speculate whether progress in a specialty field advances only so fast as new methodologies emerge, or whether the methodology advances only after there is a new insight to investigate. In either case, much of the progress in human environmental studies can be read in improvements in the study strategies.

Throughout its history, environmental perception research has drawn heavily on other disciplines for its investigative procedures.

Notably, the techniques of Personality Assessment (e.g., Craik 1972b) have been adapted for use in studies of environmental assessment and perception. Simultaneously, ecological and ergonomical methods have been used to study the role of humans as actors and agents of change in environmental settings (e.g., Barker 1968).

A common and salient criticism of all investigations using humans as subjects is that the presence of an experimenter and his paraphernalia alters the very behaviours in question. While this same problem exists in all branches of systematic investigation (reactive observations), it is especially troublesome in the study of human behaviour.

Ostrander (1975) has offered a useful list of the more common methods of assessing human perceptions and behaviours in a wide range of environmental contexts. Moreover, he has gone an important step further in arranging this list of methods in order of their "obtrusiveness" into the experimental setting. Figure 3 reproduces his list of 20 techniques and their respective level of obtrusiveness. His own discussion follows below:

> . . . both observational data and information obtained through personal interaction are desirable and often supplement each other. In line with this view, instruments and techniques can be arranged along a continuum that runs from visually obtrusive techniques, that is, the person whose behavior is being studied can see or is made aware that he is under observation, or is a research subject, to visually unobtrusive techniques, where the person is not aware of his role as a research subject. Paralleling the extent of observer-visibility is another dimension. This second dimension is the degree of researcher intervention requiring that the person being studied do cognitive work. For example, observing a person's behavior through a concealed one-way vision screen is unobtrusive and the subject does not know that he is being observed. He is not required to do any mental work for the benefit of the researcher. On the other hand, many techniques for getting information about people's behaviors, attitudes, and preferences demand judgments and considerable cognitive work as well as oral or written expression of the judgments. The hidden camera would be another example of an unobtrusive technique while the Q-Sort for evaluating a room is both obtrusive and requires

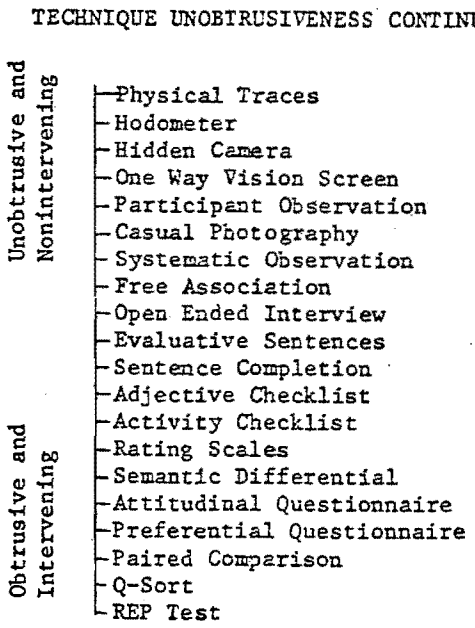

Figure 3. Methods of assessing human perceptions and behaviours, in order of degree of obtrusiveness (Ostrander 1975).

> considerable cognitive work. There are also techniques for recording behavior such as motion picture or still photography that are obtrusive, but relatively non-intervening.

Ostrander might well have gone further (although he did not) to point out that the more obtrusive a technique becomes, the more it must be considered an integral part of the experimental manipulation itself, rather than merely the means by which the effects of the experimental manipulation are recorded. Thus, obtrusive experimentation must be interpreted as holistic experimentation. Consider, for instance, attitude or preference questionnaires which cause the subject to entertain issues which had never before occurred to him--thereby changing the very nature of the attitudes under study. Thus one might say that the obtrusion creates the experimental effect, rather than merely measuring it.

Some writers have argued against the use of any method which obtrudes, but theirs is probably an overly doctrinaire position. Obtrusive procedures do not produce "bad" results--but rather different results; ones in which the experimental issues are elevated to the level of overt consciousness in the subject as well as the experimenter. Self-report studies are by far the most common kind of investigative procedure in environmental perception studies.

Lozar (1975) classified a list of 29 frequently used and similar investigative procedures into a double system: (1) whether the procedure necessitates self-reports from the subjects, and (2) the environmental scale at which the techniques have been successfully used. Figure 4 reproduces that listing. An addendum to that listing shows those techniques that have been reported within the AOSERP study region to date in order to investigate various human perceptions and behaviours in the biophysical environment. About half of the 29 are represented. If studies on wildlife, landscape and resource exploration were included as well, nearly all 29 would appear.

The principal conclusions to be drawn from Figure 4 are that (1) a substantial variety of experimental procedures exists, (2) study methodologies range widely across all of them rather than using the same few over and over; and (3) studies within the AOSERP study area are

MEASUREMENT TECHNIQUE	SCALE OF OBSERVATION						RESPONSE CATEGORY				Used AOSERP
							OVERT		COVERT		
Self Report Methods	CLUSTER	SITE	BUILDING	CONNECTOR	ROOM	FURNITURE	PHYS	SOC	PHYS	SOC	
1 Survey Attitude Instruments											
1.1 Open-ended Question			X		X	X			X	X	X
1.2 Directed Question			X	X	X	X			X	X	X
1.3 Likert Scales	X		X		X	X			X	X	X
1.4 Semantic Differential			X						X	X	X
1.5 Guttman Scaling			X	X	X				X	X	
1.6 Correlation Mapping			X	X	X				X	X	X
1.7 Cognitive Mapping	X		X						X	X	
1.8 Diaries-Activity Log	X	X	X		X		X				X
1.9 Simulation Mechanisms											
1.10 Photographic Simulation					X				X		
1.11 Games			X		X	X			X		X
1.12 Scale Models			X		X				X		X
1.13 Video Simulation (experiential)	X	X							X		
1.14 Video Simulation (interior)					X	X			X		
2 Interview Techniques											
2.1 Unstructured	X	X	X						X		X
2.2 Structured	X	X	X				X	X	X	X	X
2.3 Participant Interview					X	X	X		X	X	X
2.4 Content Analysis	X								X	X	X
2.5 Q-Sort			X						X		
Non-Self Report Methods											
3 Instrumented Observation											
3.1 Hodometer					X		X	X			
3.2 Timelapse Film					X	X	X	X			
3.3 Still Photography			X	X	X		X	X			X
3.4 Video-taping		X	X	X	X		X	X			
4 Direct Observation											
4.1 Behavior Setting	X	X	X				X	X	X	X	
4.2 Proxemics					X		X	X	X	X	
4.3 Personal Space					X		X	X			
4.4 Time Sampling	X	X	X				X	X			X
4.5 Mapping				X	X		X	X			X
4.6 Structured Observation	X	X					X	X			
4.7 Speciman Record			X				X	X			
5 Sensory Stimuli Observation											
5.1 Lighting					X				X		
5.2 Noise					X		X		X		
5.3 Thermal Comfort					X		X		X		
6 Indirect Methods											
6.1 Tracks					X	X	X	X			
6.2 Records	X	X	X	X			X	X			X
6.3 Miscellaneous											

Figure 4. Measurement techniques used in human-environment research (Lozar 1975).

commensurate and current with the state of the art except for some of the time and money intensive simulation methods. Scales similar to "cluster", "site", and "building" are in the same scale range as the biophysical issues of concern to AOSERP.

3.3.4 Indicators and Parameters

Lozar's procedure allows for an additional form of expanded analysis that is particularly useful to state-of-the-art analysis in two ways:

1. Whatever the research method, the data must be summarized and analyzed. Weak analysis allows for descriptive summarization only, strong analysis enables inferences, projection and generalization to other and larger populations elsewhere; and
2. The data items collected must be understood as indicators of human preferences, attitudes, choices, perceptions, judgments, movement, behaviour, etc., to be of any practical use to the planner, policy maker, politician and so on.

Lozar has reported varying perspectives for the same 29 techniques in order to illustrate how each technique can be used to:

1. Integrate several different kinds of data units;
2. Support inferences among different behavioural indicators;
3. Allow for analytical and statistical treatments at multiple levels of sophistication; and
4. Support inferences toward both more atomistic and more global levels of interpretation.

Figures 5 and 6 present this analysis of state-of-the-art methodologies in separate charts for self-report and for unobtrusive (non-self report) methods.

The relevance of Lozar's analysis of current methodologies to the AOSERP study projects include the following points:

1. It constitutes a second, independent and more detailed inventory than is Ostrander's, yet corroborates its essential completeness (to date);

MEASUREMENT TECHNIQUE Self Report Methods		Man-Environment Interrelations and Dimensions Tapped	Measurement Device or Instrument Used	Data Units presented in the Form of	DATA ANALYSIS TECHNIQUE USE OF STATISTICS, MAPPING, OR STANDARD FORMULAS									
					Frequency Counts	Cross Tabulations	Significance Tests	Correlational Analysis	Factor Analysis	Cluster Analysis	Regression Analysis	Diagrams Mapping	Standard Formulas	
1 Survey Attitude Instruments	Author													
1.1 Open-ended Question	Brauer, Roger	General attitudes	Questionnaire	Narrative Description	●									
1.2 Directed Question	Ostrander, Edward	General attitudes	Questionnaire	Raw scores, rankings	●									
1.3 Likert Scales	Brauer, Roger	Attitude, preferences	Questionnaire	Raw scores, rankings		●	●	●						
1.4 Semantic Differential	Hershberger, R.	Factors of Perception	Slides & questionnaire	Raw scores, 7-point scale				●	●					
1.5 Guttman Scaling	Markus, Thomas, ed	Circulation, perception	Questionnaire	Scaleogram	●	●		●						
1.6 Correlation Mapping	Canter, David	Attitude and location	Questionnaire	Raw scores, plans	●			●						
1.7 Cognitive Mapping	Downs, Roger	Attitude factors	Questionnaire	Raw scores				●	●					
1.8 Diaries-Activity Log	Brauer, Roger	Time in daily activities	Questionnaire	Recalled time units	●	●								
1.9 Simulation Mechanisms														
1.10 Photographic simulation	Canter, David	Perception of drawings	Questionnaire	Raw scores					●					
1.11 Games	Sanoff, Henry	Choice under constraints	Pictograms on questionnaire	Rank ordering	●									
1.12 Scale Models	Lau, J.	Perception of models	Questionnaire	Raw scores	●		●							
1.13 Video Simulation(experientia	Craik & Appleyard	Perception of landscape	Questionnaire & others	Raw scores	NA									
1.14 Video Simulation (Interior)	Sassanoff & Bonstee	Validity of TV simulation	TV cameras & scale models	Raw scores	●		●							
2 Interview Techniques														
2.1 Unstructured	Lynch, K.	Perception of urban setting	Interviewer & tape recorder	Sequences of description	NA									
2.2 Structured	Cooper, Clare	Attitudes to public housing	Questionnaire for interviewer	Raw scores	●	●								
2.3 Participant Interview	Gibbs & Cramer	Attitudes to dining hall	Interviewer & questionnaire	Raw scores	●	●	●	●						
2.4 Content Analysis	Lozar & Winkelhake	Attitudes are inferred	Interview & transcription	Raw scores, ordering	●									
2.5 Q-Sort	Ostrander, Ed	Judgments of situation	Sorting cards	Raw scores, frequency distr.	●									

Figure 5. Self-report techniques, their referents, instrumentation and analysis (Lozar 1975).

MEASUREMENT TECHNIQUE Non-Self Report Methods		Man-Environment Interrelations and Dimensions Tapped	Measurement Device or Instrument Used	Data Units presented in the form of	DATA ANALYSIS TECHNIQUE USE OF STATISTICS, MAPPING, OR STANDARD FORMULAS									
					Frequency Counts	Cross Tabulations	Significance Tests	Correlational Analysis	Factor Analysis	Cluster Analysis	Regression Analysis	Diagrams Mapping	Standard Formulas	
3 Instrumented Observation	Author													
3.1 Hodometer	Bechtel, Robert	Overt behavioral movement	Electrical micro-switches	Frequency counts	●									
3.2 Timelapse Film	Lozar, Charles	Movement patterns	Timelapse super 8 camera	Film frames at 4 sec interval	●							●		
3.3 Still Photography	Davis & Eyer	Movement & use patterns	Still & timelapse camera	Sequences & individual frames	NA									
3.4 Video-taping	Preiser, Wolfgang	Mapping of movement patterns	Video tape recordings	f counts-staged intervals	●	●	●	●						
4 Direct Observation														
4.1 Behavior Setting	Bechtel, Robert	Environmental quality	Behavior observation system	Levels of social involvement	●					●		●		
4.2 Proxemics	Sloan, Sam	Personal territory & intrusion	ed Hall's proxemic notation	nistance, personality factors	●							●		
4.3 Personal Space	Sommer, Robert	Personal space & territory	Author's person	Distance between persons	●							●		
4.4 Time Sampling	Salle, David, et.al	Movement & use patterns	Researcher-observer	Occurrence of certain behavior	●	●						●		
4.5 Mapping	Proshansky, et.al	Activities of residents	Researcher time-sampling	Time & occurrence of activities	●							●		
4.6 Structured Observation	Cooper, C.	Movement patterns	Trained observers	Time-space maps	●	●	●					●		
4.7 Specimen Record	Wright, H.	Daily activity sequences	Trained observer	Behavioral sequences	●									
5 Sensory Stimuli Observation														
5.1 Lighting	Blasdel, Hugo	ight level related to attitude	Questionnaire	Correlations	●	●		●			●		●	
5.2 Noise	Halldane, John	Design and sound interface	Electronic instrumentation	Data from sensors								●	●	
5.3 Thermal Comfort	Fanger, P.O.	actors of thermal comfort	Combination of devices	Various physiologic units				●					●	
6 Indirect Methods														
6.1 Tracks	Lozar, Charles	irculation paths	Carpet wear	Variance in color & texture								●		
6.2 Records	Newman, Oscar	rime occurrence	Public crime records	No. of occurrences & location				●				●		
6.3 Miscellaneous	Webb, Eugene J.	various methods	Tracking methods	Various subjects	NA									

Figure 6. Non-self report techniques, their referents, instrumentation and analysis (Lozar 1975).

2. It distinguishes and documents the differences between self-report and non-self-report strategies--particularly important to AOSERP's need to study wide-area tracts by means of "trace" behaviours, i.e., evidence left behind after the subject has left the study area;
3. It offers an inventory of the behavioural dimensions (Craik's fourth column) which have been investigated in a representative sampling of research studies performed prior to 1975;
4. The wide variety of measuring tools and instruments is documented;
5. The data units are documented in the form in which they were initially collected. A great amount of study remains to be done in inventorying, ordering, and rationalizing the "data unit" dimension. To form an efficient and useful data recovery system, the scale at which the data are collected--atomistic to global--must be part of the data recovery system itself. Glass (1976) have discussed the advantages of so doing in their extensive treatments of meta-analysis in the social sciences; and
6. The analytical techniques applied to the data are documented allowing for an indication of the degree of extrapolation and generalization made from the subject sample to other groups.

The specific studies which form the data base for Lozar's analysis of techniques do not contain research from the AOSERP study area (since Lozar's work was completed prior to AOSERP's inception), nevertheless his analysis is an excellent way to organize and rationalize a large number of studies each of which proceeded on its own, independent terms of reference. The Human System sub-group at AOSERP would be well advised to summarize its own research efforts in a similar framework, in anticipation that the basic research now already collected will form the basis for near-future data recovery information. In the ideal case, such an analysis would integrate

AOSERP research from the Air, Land, Water and Human Systems in an effort to document the interrelatedness of method, measurement, as well as content.

3.3.5 Imaginal Presentations

Conspicuously absent from the research reported to date are reports of how people imagine, expect, anticipate, or conceptualize life in the oil sands region to be like.

Appleyard and Craik (1972) have reported extensive research on on the validity of imaginal approaches to the perception of the bio-physical environment as one of a series of simulations of alternate development strategies of the Nicasio Valley. Surprisingly high validity measures were obtained for imaginal methods, even when the subjects represented groups as diversified as residents, Sierra Club members, land developers, or regional planners.

There will always be some slippage between what people imagine conditions to be like, and their perceptions of what conditions actually are, but imaginal presentation strategies may offer very considerable savings of time, effort, and wastage when conducted among some of the following groups:

1. People who have already contracted to work in the AOSERP study area, but who have not moved there;
2. People who habitually work in project camps by moving from one work project to the next; and
3. People who have lived in similar rapidly developing communities before, during, and after the developmental phases.

The Human System Seminar on Research Results of 6 December 1979 afforded instance after instance that imaginal approaches are used on a casual hit-or-miss basis by many of the research consultants. An important decision needs to be addressed; namely, whether to assign the secondary analysis task of summarizing and abstracting Human Systems research already completed to draw together the current findings elicited by imaginal methods, and to sketch a prospectus of "Life as it is Expected to be in the Athabasca Oil Sands Region".

3.3.6 Summary of Conclusions

Progress in the state of the art in studying the Human System in general and in the AOSERP study region in particular has progressed along four principle frontiers:

1. Selecting better observers: observers who are more sensitive to the phenomenon in question, or who are more representative of the eventual population to be served, or who embody distinctive characteristics in question (native-non-native, indigenous-non-permanent, immigrant);
2. Presenting more exacting display media: taking people to the actual study area, asking those who already live there, showing comprehensive aerial views, presenting models of facilities under consideration, building mock-ups of proposed changes to the landscape, computer simulations of changes in the wildlife species profile due to development;
3. Improved response formats: better questions, more specifically defined behavioural indicators, using previously validated attitude instruments, inclusion of indices of behavioural adaptations to harsh, exotic or remote living environments; and
4. More specifically identified and defined environmental dimensions: validated checklists of factors which do and do not make any real difference in perceiving and behaving in particular environments, partially validated lists of environmental equivalences (willingness to pay to reduce pollution, isolation pay, removal expenses, etc.), activity patterns, recreational and leisure time usage, landscape preferences.

It is clear in summarizing the research studies done under the AOSERP aegis as well as those done elsewhere in North America that three or four strong recommendations emerge--all having to do with obtaining more defensible data, extracting more information from the

analytic techniques used, and generalizing and extrapolating beyond the particular subjects investigated.

1. Study objectives need to be clearer, more precise, better defined and (usually) more modest. No single study can answer all questions, sample all possible people, investigate attitudes and behaviours and activity patterns and inter-individual differences, etc.;
2. The investigative procedure needs to be agreed upon in advance by the commissioning agency and the research consultant so that the analytical sophistication is within the range of both;
3. Research needs to answer specific hypotheses. Studies which are the most efficient, cost-effective and useful are those which begin at the outset with specific questions to which there are clear answers--often of the yes or no variety. Studies without such specific questions often run on for years (and dollars) for lack of knowing where to go, how to get there and when to quit; and
4. Each individual project needs to be a part of a well-defined research matrix.

4. AIR QUALITY

4.1 INTRODUCTION

During the past 20 years, researchers have wondered about and investigated the public's awareness of and attitudes toward the quality of the air they breathe. By and large, such research has dealt with air quality in terms of air pollution, i.e., what people perceive to be degraded air. Only in the past several years have researchers proposed work on the "amenity attributes" of air, e.g., public conceptions of favourable climates, beautiful days, and fine-smelling air (Craik and Zube 1976; Barker 1976). At the time of writing, such proposals have not been carried out.

Research to date has combined perceptual aspects of air quality with attitudes about that quality. Therefore, it is difficult to separate human perceptions or awareness of air quality from their evaluation of that quality. Also, relatively little research has dealt specifically with behavioural responses to air quality. However, given such constraints, the literature will be discussed in terms of:

1. Awareness of air quality--research dealing with questions such as what people define as polluted air, what attributes people identify with air pollution, and at what threshold levels such attributes become noticeable;
2. Evaluation of air quality--dealing with such questions as whether concern about air pollution is correlated with actual exposure to pollution levels (or alternatively, whether people "adapt" to polluted air); and whether concern about air pollution is correlated with, and can be predicted by, characteristics of the observer or situation; and
3. Behavioural response to air quality--dealing with such questions as to what extent are people willing to pay for clean air; and how much does the threat of serious air pollution (or the promise of clean air) influence migration patterns.

4.2 AWARENESS OF AIR QUALITY

4.2.1 Factors in Awareness of Air Quality

When people perceive that their air quality is poor, what do they mean and what features are they referring to? Several researchers have directly, or indirectly, addressed this question.

Crowe (1968) asked residents of Johnstown, Pennsylvania, to define what the term "air pollution" meant to them and found that their responses could be grouped into the following categories:

1. Causal: those naming a source such as industries or cars;
2. Effectual: those noting an effect such as difficulty in breathing, eye irritation, dirty windows or damage to property;
3. Specifics: those mentioning pollutants such as smoke or gases; and,
4. Combinatorial: those mentioning a grouping of other categories such as "smoke from the mill dirties my windows."

Crowe found that many respondents ("about one half") defined air pollution in terms of "specific" contaminants that they could see or smell; that a "sizable proportion" defined air pollution in "causal" terms; and that relatively few referred to "effects."

Wall (1972, 1973), in his studies of six communities in or adjacent to the coal fields in southwestern England, used the definitional categories employed by Crowe, and found that half of the respondents offered "combinatorial" definitions, such as "smuts from the factory spoil my wash." Wall also found that when asked "What are the pollutants?" most respondents mentioned particulates ("smuts, smoke").

Other studies which have attempted to identify the manifestations of bother associated with air pollution similarly have found that the primary factor in awareness of degraded air quality is the presence of dust, dirt, and odours, i.e., what people can see and smell. Schusky (1966), for example, in a study of air pollution in

and around St. Louis, found that people most often cited odours (including vehicular exhaust fumes), smoke, and dust and dirt as the most important indicators of air problems. Other studies in Toronto (Barnes 1968), Birmingham, Alabama (Stalker and Robison 1967) and Detroit (Jacoby 1972) confirm that suspended particulates, dustfall, and malodours are the leading factors in perception of air pollution.

In addition, other factors contribute to public awareness of air quality degradation. These include:

1. Property effects such as soiling of exteriors and interiors of homes, corrosion of materials, paint deterioration (Wall 1973; Smith et al. 1964);
2. Health effects such as irritation of eyes, nose and throat (Barnes 1968; Medalia and Finker 1965);
3. Public education and media exposure (Auliciems and Burton 1971; Swan 1972; Wall 1973). Auliciems and Burton, for example, found that air pollution was considered the "most important urban issue in Toronto", but they concluded that this was related more to exposure of the issue through the media than to actual awareness of pollutants in the air; and
4. Seasonal behaviour of people. A number of studies (Schusky 1966; Hewings 1975) have linked awareness of air pollution to seasonal behaviour. Auliciems and Burton (1971), for example, found that Torontonians considered summer air to be the most polluted, a perception not substantiated by actual evidence. The authors suggest that people are more aware of air quality during those seasons when they wish and tend to be out of doors.

While dust, dirt, and odours are the chief factors in perception of poor air quality, their presence in some amount is a normal, natural feature which most people tolerate. The problem facing managers of air quality is two-fold: (a) at what point do people become aware of the presence of pollutants; and (b) how much of a pollutant will they tolerate before they consider its presence

to be noxious or until they take some action to eliminate it. In the following section, the matter of thresholds of awareness will be addressed; questions of levels of concern and seriousness will be addressed thereafter.

4.2.2 Thresholds of Awareness

4.2.2.1 Odour thresholds. Measurement of thresholds of awareness of air quality stimuli is not a simple matter. It is one thing to measure odour thresholds under laboratory conditions; it is another to do so in real-world environments where such factors as (a) dispersion and diffusion by wind and other climatic conditions, and (b) masking by other odours, have major effects on odour thresholds.

Much of the work on odour thresholds has been carried out in the context of industries recognized for their noxious odours, for example the pulp and paper industry (Lindvall 1974) and the meat and fish packing industries (Prokop 1974). Because such research does not appear relevant to northeastern Alberta at the present time (although a pulp and paper industry may emerge at some time in the future), these studies will not be reported in depth.

More relevant is work carried on in conjunction with the chemical industry. Chief among this research is the effort sponsored by the Manufacturing Chemists Association (Leonardos et al. 1969) to identify the odour threshold values of 53 commercial chemicals, i.e., the level of concentration at which observers can perceive the presence of odour. Table 1 presents odour thresholds for selected chemicals which have been associated with emissions from oil sands plants (Mann, personal communication). The table illustrates the magnitude of difference in odour thresholds of various chemicals. For example, hydrogen sulphide can be perceived when present at only a level of about five parts per billion, whereas ammonia can be present in far greater concentrations (50 parts per million) before it is detected by a trained observer. Leonardos et al. (1969) have not made qualitative assessments of these odours, i.e., whether they are considered

Table 1. Odour thresholds for chemicals associated with the oil sands industry and/or urban areas.[a]

Chemical[a]	Name	Odour Threshold[b] (ppm vol.in air)	Odour Description[b]
SO_2	Sulphur dioxide	0.47	-
H_2S			
. as gas	Hydrogen sulphide	0.00047	eggy sulphide
. from Na_2S	Hydrogen sulphide	0.0047	eggy sulphide
HC	Light hydrocarbons	-	
. CH_4	Methane	n.a.	
. CH_3OH	Methanol	100.00	sweet
. C_6H_6	Benzene	4.68	solvent
. $C_6H_5CH_3$	Toluene	2.14	mothballs, rubbery
. C_6H_5OH	Phenol	0.047	medicinal
RCHO	Aldehydes	-	-
. HCHO	Formaldehyde	1.0	hay/strawlike, pungent
. CH_2=CHCHO	Acrolein	0:21	burnt sweet, pungent
. CH_3CHO	Acetaldehyde	0.21	green,sweet
NH_3	Ammonia	46.8	pungent
NO_x	Nitrogen oxides	n.a. 1.0-3.0[c]	n.a.
O_3	Ozone	0.02-0.05[c]	n.a.

[a]Source: AOSERP

[b]Source: Leonardos et al. (1969)

[c]Source: Stern (1968)

n.a. = not available

noxious or pleasant by the observer. Nor have they specifically addressed the question of toxicity, the primary examples of which are sulphur dioxide (SO_2), which may have physiological effects (respiratory and eye irritation) at concentrations lower than that at which it is perceived as an odour, and carbon monoxide which has no odour at all.

It may be of some interest to cite one example of how these thresholds have been applied in a practical situation. In 1973, the San Francisco Bay Air Pollution Control District established emission standards for five specific odourous substances (trimethylamine, phenol, methyl mercaptan, dimethylsulphide, and ammonia) associated with industries (refineries, chemical plants, and meat processors) about which the District had received numerous complaints. On the basis of dilution and meteorological information specific to the Bay area, a maximum allowable emission of 100 times the odour threshold established by Leonardos et al. (1969) was used for purposes of regulation. After one year's experience with the regulation and proposed control devices, the emissions were reduced and "significantly, the odour complaints . . . decreased" (Feldstein et al. 1974:313).

4.2.2.2 Other thresholds. People also perceive, and complain about, eye or respiratory irritation associated with poor air. Table 2 presents a summary of thresholds at which selected chemicals cause eye or respiratory irritation. In brief, the main eye irritants are the aldehydes, which in photochemical smog can cause eye irritation at relatively low concentrations (less than 1 ppm). Sulphur dioxide and nitrogen dioxide can also produce eye irritation, but only at levels rarely found in ambient air (more than 10 ppm). Ozone, SO_2, and the nitrogen oxides can also make themselves known through irritation of the nose and throat, but their thresholds vary considerably, due to differences in observer sensitivity.

Thresholds for observer awareness of dirt and haze have not been specified in the literature in any detail. As will be discussed in a subsequent section, levels of concern about air quality increase proportionally with the measured amount of suspended particulates

Table 2. Irritation thresholds for selected chemicals associated with the oil sands industry and/or urban areas.

Chemical		Irritation Type
Formaldehyde (pure)[a]	10.7	Eye irritant
Formaldehyde (in smog)[a]	0.96	Eye irritant
Acrolein (pure)[a]	0.90	Eye irritant
"Oxidant"[b]	0.10 - 0.15	Eye irritant
Ozone[c]	0.05 - 0.10	Nose and throat
Nitrogen dioxide (pure)[c]	5.00 -50.00	Nose and eye
Sulphur dioxide (pure)[c]	0.3;1.0;10.0	Taste; respiratory; eye

[a]Source: Jones (1972)

[b]Source: Altshuller (1977)

[c]Source: Stern (1968)

found in the area. A study in St. Louis indicated that 30% of the sample population was aware of pollution when the annual geometric mean of suspended particles was 80 Mg/m^3; no concern was expressed when levels were less than 50 Mg/m^3 (Schusky 1966). Another study dealing with dustfall found that one-third of the sample population considered air pollution a nuisance when dustfall exceeded thirty tons/square mile/month (Stalker and Robison 1967).

4.3 EVALUATION OF AIR QUALITY

That North Americans have become increasingly aware and concerned about air pollution over the past 10 to 15 years is not startling. A number of public opinion polls verify that many people recognize air pollution as a problem, with as many as 90% of residents of cities considering it to be serious or very serious (Erskine 1972). In Alberta, 60% of respondents considered the air pollution problem to be "quite", "very", or "extremely" serious in Edmonton (Stehr and Pong 1975). But it is also true that people vary in their perceptions of the seriousness of air quality problems. Levels of concern about air pollution can be influenced not only by the actual degree of exposure to air pollutants, but also by the characteristics of the respondent and by situational factors. These types of influence on evaluation of air quality will be discussed below.

4.3.1 Levels of Concern Related to Exposure to Contaminants

Surveys of public concern about air pollution carried out in a number of cities during the past 15 years consistently show a positive relationship between public concern about air quality and measured levels of air pollution.

One of the earliest studies to attempt to relate public opinion about air pollution with actual measures of pollutants in the community was carried out in 1958 in Nashville, Tennessee (Smith et al. 1964). The study is of interest not only because the opinion survey was conducted before air pollution was receiving major media coverage, but also because the researchers endeavoured to "conceal the air

pollution orientation of the study and thereby avoid bias". Opinion data were gathered from 2835 households (about 4% of the total) throughout the metropolitan area, regarding health conditions in the area and regarding bother from smells, dirt, haze in the area. Aerometric data, measuring annual and winter sulphation, dustfall, soiling, and sulphur dioxide were obtained from 123 air sampling stations. These data were grouped into areas of high, medium, and low pollution, and respondents were assigned to a group. A weak positive relationship between pollution levels and concern about health was found to exist. Stronger (significant at the 1% level) positive relationships were found between physical measures and "nuisance" responses regarding soiling, haze, and property damage. The pollution level indicators most closely related to concern were the annual and winter "2 + days" which measured the number of days when the 24-hourly values of both soiling and sulphur dioxide were above arbitrarily selected, high values (2.0 Cohs/1000 linear feet and 0.035 ppm). The authors conclude that the opinions of people were more influenced by the frequency of days of unusually high pollution than by monthly, seasonal, or annual average pollution levels. Other studies support the Nashville finding that public dissatisfaction with, or concern about, air pollution increases as levels of particulates increase (DeGroot et al. 1966); Stalker and Robison 1967; Jacoby 1972; Barnes 1968; Auliciems and Burton 1971; Wall 1973).

While the relationship between concern and particulate matter (what people can see) has been consistently shown to be positively related, the relationship between concern and gaseous pollutants is, as Barker (1976) has pointed out, "more obscure". The Stalker and Robison (1967) Birmingham study found no significant relationship between concern and gaseous pollutants such as aldehydes, sulphur dioxide, and nitrogen dioxide; however, they point out that aldehydes and sulphur dioxide were very low in most instances. The Buffalo study (DeGroot et al. 1966) measured sulphation levels as well as particulates and dustfall, but combined them into one total score because the three were "highly similarly distributed". Thus, the effect of sulphation could not be specifically related to concern.

In the Nashville study (Smith et al. 1964), the findings regarding sulphation and sulphur dioxide were not as clearcut as those regarding particulates, partly due to lack of comparable data. Jacoby, in his Detroit study, found a significant correlation between concern and sulphur dioxide ($r=0.32$; $p<0.001$), but this was not as strong as the relationship with dustfall and particulates. It seems reasonable to conclude that, because the gaseous pollutants (sulphur dioxide and nitrogen oxides) must be present in relatively high proportions before they are perceived as odours (see Table 1), their relationships with concern are the result of the coincidence of sulphation with particulates and dustfall. Put another way, people can be directly aware of and increasingly concerned about particulates and dust; the existence of a parallel relationship with gaseous pollutants (which they cannot see or smell except in high concentrations) is coincidental.

In addition to addressing the question of the relationship between intensity of exposure and level of concern, several researchers have also examined whether duration of exposure has any bearing on degree of concern, duration usually being measured in terms of length of residence in the community. In Clarkston, Washington, researchers found that long-time residents showed more concern about air pollution than did short-term residents. The authors theorized that "increasing length of exposure to what is defined as a noxious environmental condition produces increasing exacerbation rather than habituation to it" (Medalia and Finker 1965, cited in Jacoby 1972:31-32). Jacoby (1972) similarly found significant correlations between level of concern, level of exposure, and duration of exposure, the latter measured in terms of (a) whether the person grew up in the city, and (b) whether he had lived in his dwelling a fairly long time. Jacoby (1972:iii) concluded that "people do not adapt to deteriorating environmental quality".

4.3.2. Influences on Evaluation of Air Pollution

Awareness and concern about air pollution, although positively related to actual presence of observable contaminants, vary among individuals and groups. A number of researchers have attempted

to identify what other factors may influence concern about air pollution. Observer appraisals of air quality have been examined in relation to: demographic or socioeconomic characteristics; personality or individual differences; and situational factors.

4.3.2.1 Demographic factors. In general, studies of the relationship between demographic or socioeconomic factors and concern about air pollution are inconclusive. Researchers in Buffalo found that "variables such as age, sex, race, socioeconomic status and education were not significantly related to concern about air pollution" (DeGroot et al. 1966:246). Similar non-relationships have been found in other studies (Jacoby 1972; Hewings 1975). On the other hand, some researchers present findings which indicate that concern about air pollution is influenced by some such characteristics of respondents. Demographic variables which have been considered in the literature include the following:

1. Age. While Jacoby, DeGroot and a poll carried out across the U.S. in 1969 all indicated that age is not related to concern about air pollution, two studies from Europe and one in the U.S. have found that age appears to influence level of concern. McEvoy (1973) found that young adults were more concerned about air pollution than older age groups. On the other hand, Jonsson (1963, cited in Jacoby 1972:76) in Sweden found that the older the person, the more annoyed he was with pollution.
2. Sex. Several studies have indicated that females are more annoyed and/or concerned about air pollution than males. Jonsson (1963) in Sweden hypothesized that women would be more annoyed by air pollution because they tend to be more neurotic than men; he did find that women were more frequently annoyed than men, but did not convincingly prove their annoyance was due to neurosis. Smith et al. (1964:422) in Nashville found that women were more bothered by pollution than males,

although this finding may have been confounded by the unusually high proportion of females in their sample; they observed that this finding was not unexpected due to the type of questions (regarding windows and laundry getting soiled) and the "more intimate contact of women with the matters involved". McEvoy (1973:145) in his U.S. national survey similarly found that women were more likely to be concerned about air pollution than were men; this he attributed to their being "differentially affected" by it, e.g., by the increased burden of having to keep young children indoors during "smog alerts".

3. Marital Status. Jonsson (1963) found married people to be more concerned about pollution; this has not been supported elsewhere.
4. Educational Level. There is some evidence that level of education is positively related to degree of concern about environmental degradation and pollution in general (Buttel and Flinn 1978). With respect to air pollution, DeGroot found no relationship. McEvoy (1973), on the other hand, found that more respondents (40%) with college educations were concerned about air pollution than those (29%) with only grade school education.
5. Race. The few studies that have dealt with racial influences on concern about air pollution have looked at white/black differences, and generally found no significant relationships. Swan (1970), for example, found no significant differences in concern levels between black and white high school students, although he did find that more white students gave air pollution a higher priority (relative to other problems) and were more interested in doing something about it than blacks.
6. Socio-economic Status. Comparisons of studies regarding socio-economic status are difficult to make because of different measures used to define status groups, e.g.,

income level, occupation, education, or a combination of factors. A number of studies have found no relationship between socio-economic level and concern for air pollution (Jonsson 1963; Jacoby 1972; DeGroot et al. 1966), and those that have found a significant relationship are conflicting. Eastham (1978) found that the lowest socio-economic groups were most concerned about adverse health effects of air pollution; Kirkby (1972) found that the most concerned group was middle-class, followed by pensioners; Smith et al. (1964) found that, at low levels of exposure, "low socio-economic women" were more concerned and at high levels of exposure, "high socio-economic women" were more concerned.

7. Occupation. Here again, the evidence is not clearcut. Kirby (1972) found the most concern among middle-aged skilled workers. Medalia and Finker (1965) found the most concern among professionals and managers. Barker (1974) found no differences in concern about air pollution among five specialist groups (students in law, medicine, engineering, economics, and geography) in Toronto. Miller (1972) found that business and labour leaders were more concerned about air pollution problems than were religious and civic leaders.

Clearly, then, no demographic or socio-economic variable has been proven to be related to concern about air pollution to the extent that it could be used as a predictor of concern. However, as several investigators and reviewers have speculated, there does appear to be a complex of factors interacting to influence concern about air quality. Kirkby (1972) concludes that age, socio-economic status, and neighbourhood interact to influence perception and concern. Barker (1976:195) similarly concludes that "social status and personal health appear to play important roles" in concern, but she does not specify precisely what these roles are, nor what measures of social status are relevant.

4.3.2.2 Personal factors. Personality factors may influence awareness and concern about air pollution, but this area has received very little attention. As Barker (1976:193) has summarized:

> . . . existing studies have focused upon personal theories and beliefs about how events are caused (attribution of causality) and degree of personal control over one's life (Swan, 1970; Kirkby, 1972). It has been hypothesized that people who believe that air pollution is an inescapable act of God or fate will take few measures to protect themselves. On the other hand, people who believe that they are in control of their own destiny may be more likely to take more effective measures to protect themselves. . . . No significant relationships have been found between either attribution of causality or external-internal locus of control and responses to air pollution. Both Swan and Kirkby concluded that deficiencies in the psychological tests and sample sizes used prevented a rigorous testing of these notions.

Several researchers have hypothesized--or discussed their findings in terms of--the idea that an individual's knowledge about air pollution, technological controls, and other solutions will influence his level of concern. Rankin (1969:567), for example, found a highly significant relationship between level of concern about air pollution and belief in the possibility of control of air pollution--which he suggested means "that those most concerned do not perceive the situation as hopeless". However, he also found that very few of the respondents were aware of activities being undertaken by various agencies to control air pollution, nor were they aware of actions they themselves could undertake to improve air quality. Rankin concluded that, if the average citizen appears apathetic, it is more due to his lack of knowledge about what is being or can be done about air pollution than to his recognition of the existence of the problem. Two other studies (Swan 1970; Stehr and Pong 1975) have found that, although not statistically significant, the relationship between knowledge and concern about air pollution was slightly negative. Stehr and Pong (1975:82) suggested that "the more knowledgeable a person is the less likely he finds fault with the overall environmental quality of the city". Swan, like Rankin, made the point that what is important is

not how much knowledge one has about air pollution per se but rather knowledge about what action or role one can take toward solution.

A factor closely related to knowledge is experience, a variable which has not been investigated extensively. Swan, in his 1970 study among high school students, found that inner city residents were significantly less aware of air pollution when shown a series of slides representing a continuum of visible air quality. Swan (1972:69) speculated that "lower socioeconomic status students have had less chance to escape from the smoke-filled skies of Detroit and have come to accept brownish-blue as a normal sky color, while their more affluent fellow students have probably had more opportunity to see rural blue skies". The role of individual experience is surely one area deserving further attention, as it may provide clues about the complex of interacting factors influencing attitudes about air quality.

Stehr and Pong (1975:83-84), in their investigation of environmental attitudes among young Albertans, examined attitudes of respondents in relation to their perceptions of air pollution in the City of Edmonton. Although the relationships were weak, the authors found that "the more strongly a person desires to live in harmony with nature, the more critical he tends to be toward the city's environment . . . the higher the value a person places on industrial development and economic growth, the more likely he finds the environment of the city acceptable". Stehr and Pong acknowledge that further research would be required in order to clarify the possible causal relationship among the variables.

One final area of interest is whether one's personal health condition tends to influence one's concern about air pollution. Only one study is known to have addressed this topic. DeGroot, in his Buffalo survey, found that more people with severe respiratory impairment (measured by breathing capacity) said that air pollution was "serious" compared to other respondents.

4.3.2.3 Situational factors. One situational factor, the actual presence of air pollutants, has already been discussed as one, perhaps

the major, factor in air pollution concern studies. Other situational factors that have been discussed in the literature are location, salience of other community problems, and publicity or media coverage.

Locational factors have been considered in several studies. McEvoy (1973), for example, found a linear increase in concern about air pollution as size of the respondent's community of residence increased; concern in cities of over 1 million population was more than twice as great as in areas of less than 2500 persons. Other studies, e.g., Smith et al. (1964), similarly have shown that inner city residents tend to be more concerned about air pollution than their suburban counterparts. This clearly is a reflection of the actual presence of contaminants in the traffic congested and industrial cores of many North American cities. Stehr and Pong's finding regarding Albertans identifying air pollution as the major problem of Edmonton, but not of the Province as a whole, is consistent with these other findings, i.e., that urbanites are more concerned about air pollution than others in small communities and rural areas. If this finding holds true for the study area, one could expect residents of northeastern Alberta to be less concerned about air pollution than are residents of larger metropolitan areas.

Many urban areas in North America have a host of problems, only one of which is air pollution. A number of surveys (e.g., DeGroot et al. 1966; Jacoby 1972) have compared concern about air pollution with concern for other urban problems, such as unemployment, juvenile delinquency, traffic congestion, recreation, schools, and other local services. Findings have generally shown that, in inner-city areas where such problems may be intense, concern about air pollution is ranked lower in importance than other problems. However, when compared with other environmental problems, such as water pollution and pesticides, air pollution has been ranked as the most important problem (McEvoy 1972; Barnes 1968; Auliciems and Burton 1971), except in Tucson, Arizona (Saarinen and Cooke 1971) and in Alberta (Stehr and Pong 1975) where littering was ranked higher than air pollution as a local problem. This latter finding is likely a

reflection of the fact that air pollution (in terms of dirt, haze, and odours) is not salient in Alberta.

Several studies (Auliciems and Burton 1971; Barker 1976) have pointed to the role that media or "public relations" can have on public concern about air pollution. Wall (1972), for example, found that, although both Edinburgh and Sheffield experienced very similar levels of air pollution (measured by smoke concentration), residents of the two cities varied considerably in their assessments of the air pollution problem, with twice as many respondents in Edinburgh considering air pollution a problem than Sheffield residents. Wall's explanation for this difference was Sheffield's major publicity campaign to bolster the "clean air now" image of the city, a campaign which encouraged residents to regard air pollution as a problem which had been overcome.

In summary, a number of factors have been linked with concern about air pollution, some more solidly than others. Actual exposure to pollutants, especially observable ones such as particulates, is the most well-proven indicator of concern. Several other factors that have been positively associated with concern, such as community size and location, are in a sense surrogate measures for actual exposure, since persons living in large cities are more likely to experience high levels of pollution. Other factors, such as media coverage and salience of other problems, tend to be situation-specific and thus probably cannot be used to predict concern about air pollution in other situations. However, several of the personal factors, such as environmental attitudes, health condition, knowledge, and experience, offer potential as predictive measures. Further research on such factors would be necessary to specify and clarify their roles, but such efforts would likely bear fruit.

4.4 AIR QUALITY AND BEHAVIOUR

Research about what people do about air quality, or how they behave once they have perceived a condition of degraded air quality, is slim. Heimstra and McFarling (1974:171) have said ". . . virtually no research has been conducted on the effects of

pollution on behavior". Since 1974, however, a few studies have come to light, dealing with such behavioural responses as complaint rates, willingness to pay for clean air, and restriction of activities in the presence of pollution.

One study which specifically dealt with "alternative adjustments" to air pollution is deserving of attention. Wall, in his 1972 survey of three communities in the coalfields of South Yorkshire, England, asked respondents a two-part question: first, what they would do when air pollution was particularly bad; and second, whether they would be willing to make certain adjustments in the face of air pollution. Wall's findings are summarized in Table 3. He has pointed out that the second part of the question presented difficulties for analysis and probably overestimated the willingness to take certain actions in a real air pollution situation; such overestimation may also be true for the first part of the question. In summarizing the findings, Wall observed that a surprisingly high proportion (more than a quarter) of respondents had no ideas about what they could do when pollution was bad; also, "many others doubted how effective their actions would be". Many respondents indicated that they would reduce their exposure to the pollution by staying indoors, closing their windows, or wearing a mask. Moving away from the area, either temporarily or permanently, was not "a feasible proposition" for most. Only a few were prepared to restrict their fires (emissions). And while some thought they might complain in order to get some relief, many were frightened of the publicity that might result, others indicated they did not know who to approach, and others had doubts about those in authority.

Wall's study highlights one issue with which other analysts have struggled, i.e., that attempts to identify behavioural responses to air pollution are thwarted because many people do not know what they could--much less should--do about it, on either a short-term or long-term basis. DeGroot's (1966) study in Buffalo found that, while nearly everyone felt that something should be done about air pollution, fully 75% did not know what could be done. Similarly, Rankin (1969) found in Charleston, West Virginia that the "average citizen, while

Table 3. Adjustments people in South Yorkshire, England might make when air pollution is perceived to be particularly bad.[a]

What can a person do?		No.	%	Would you be willing to... ?	No. yes	% yes
Don't know/nothing		32		Stay indoors	95	(79.2)
Stay indoors		43	(27.9)	Keep children indoors	100	(84.7)
Wear a mask	31 (30.1%)	25	(16.2)	Keep windows closed	111	(93.3)
... over nose and mouth		6	(3.9)	Wear a mask	76	(63.3)
Close windows, doors		19	(12.3)	Don't hang out washing	116	(96.7)
Complain		17	(n.o.)	See a doctor	51	(42.5)
Leave area		11	(7.1)	Complain to authority	78	(65.0)
Restrict fires		11	(7.1)	Write to an M.P.	49	(40.8)
Change fuel		3	(1.9)	Write to newspaper	39	(32.5)
Other		19	(12.3)	Move out temporarily	39	(33.1)
				Move out permanently	61	(51.3)
				Stop using coal fire	56	(46.7)
				Switch to smokeless fuel	63	(52.5)
				Stop using car	29	(24.2)
				Stop burning rubbish	107	(89.2)
				Stop smoking	74	(62.7)

[a]Adapted from Wall (1973:245-246)

recognizing the problem, was unfamiliar with what could be done". As these studies were carried out more than ten years ago, it would be interesting to determine whether such a lack of knowledge about "alternative adjustment" continues to be the case.

Complaining to authorities is one behavioural response which has been considered by a number of researchers. One common finding is that few people ever bother to register complaints with authorities even if they recognize the existence of an air quality problem. DeGroot et al. (1966) found that, while 25% of their sample wanted to complain, only 5% ever did; Rankin reported very similar findings (25% wanting to complain; 5% actually doing so); and Samuels (1971) found that, although a very high proportion of Staten Island residents were concerned about pollution, fewer than 1% ever complained to authorities. Both Rankin and Samuels explored reasons why people did not complain: many respondents felt it would do no good to complain; others did not know to whom to complain; and others felt that others had already complained, making their own actions superfluous.

In general, the studies of complaints indicate that there is a positive relationship with actual exposure to air pollution and to concern about it, i.e., as air pollution and concern increase, so will the complaint level. However, complaint level cannot be relied on as a direct indicator of level of concern, i.e., one cannot say that, since only five % of the population have complained about air quality, only five % are concerned about it. Campbell's (1963) notion of behavioural thresholds is probably applicable here, insofar as people may complain (in the sense of expressing dissatisfaction) at a relatively low pollution level, but only complain (lodge formal grievances) when pollution becomes severe, or otherwise salient.

It is one thing to be concerned about air quality and to say that something should be done about it. It is another to commit effort or money to such improvements. Several researchers have addressed this issue in studies of "willingness to pay" for air control and cleanup. Schusky (1966) found in St. Louis that 85% of respondents were willing to pay $5.00 in cost-of-living increase. Rankin found similar percentages of willingness to clean up the air;

80 to 90% willing to pay $1.00; 60 to 80% willing to pay $5.00. Closer to home is a study carried out by the Peace River Regional Planning Commission (1972) which found that 90% of the respondents did not want air pollution even if it would mean increases of $5000 in annual income. This Peace River study is especially relevant because it asked not what one would pay to clean up an existing problem, but rather what one would forego in order to retain clean air. It thus addressed the value of clean air.

Admittedly, there is a distinction to be made between willingness to pay and actually paying. To get at this issue, a number of economists have examined the relationship between air quality and property values, i.e., how much more people will pay for a home in a clean area. Such research is fraught with methodological problems, but there is general agreement that people will pay more for cleaner air. Rubinfeld (1978), for example, estimated that the marginal willingness to pay (in the Boston area) averaged over all individuals could be as high as $2040 or as low as $1187; the National Academy of Sciences (cited in Rubinfeld 1978) estimated an average willingness to pay for a marginal improvement in air quality in the order of $2052 ($161 per year). The point to be made here is not the dollar amount, but rather that individuals are willing to pay some costs for improved air, even when all other factors are held equal.

A few researchers have examined other behavioural responses to air pollution. Two such studies (Rivlin, person communication; Peterson 1975) used outdoor activity as a dependent variable, on the assumption that, when air pollution is high, people will stay indoors more. Rivlin's study found no support for this among children in New York City; Peterson's findings, which were more complex, indicated that restriction of recreational outdoor activities depended in part on the specific type of activity under consideration. One might also hypothesize that people who are concerned about air pollution (and understand the contribution of automobile emissions to pollution) would modify their use of automobiles and/or the type of car purchased. Stehr and Pong (1975) asked their respondents whether concern about air pollution influenced the type of car they purchased

and whether such concern would influence their future car purchase. The majority of respondents (60% of adults and 68% of students) who had purchased a car in the past indicated that consideration of emission control systems, engine size, etc. had not been important in their choice of a car. On the other hand, a majority (76% of adults; 70% of students) indicated that such considerations would be important in future car purchases. Whether such intentions would be borne out indeed is a matter of speculation.

Perhaps the most drastic measure an individual or family can make in response to perceived air pollution is to move away from it. As Wall observed, moving away either temporarily or permanently was an adjustment that few people were willing to take. The Nashville study (Smith et al. 1964) found that no one intended to move away because of air pollution. Although Heimstra and McFarling (1974) said that "more people are now leaving California each day than are moving in . . . and many . . . say that their primary reason for the move is California's air pollution", they provided no empirical evidence in support of their statement. While poor air quality may not motivate a person to leave an area, there is some evidence that clean air can be an important reason for moving to an area. Matthiasson's (1971) study of Fort McMurray is a case in point. When asked the reason for moving to Fort McMurray, respondents indicated their primary motive was job opportunity, followed closely by ecological reasons, which presumably included the cleanliness of the air. Illustrative also is a quotation from a Fort McMurray woman when rumours of toxic acid fogs were circulating in the town: "Dear God, it's frightening to think what might happen . . . My husband and I moved away from all that traffic and pollution in the city. Now . . . I just don't know" (Macleans, 15 December 1975, p. 56).

4.5 SUMMARY AND CONCLUSIONS

The primary or salient factors in awareness and evaluation of air quality are what people can see or smell. This is evidenced by the common finding that people identify dirt, dust, smoke, and malodours with air pollution; and by the general finding that, as

measured levels of dust-fall and suspended particulates increase, so does public concern about air pollution. Other contributors to air pollution, such as non-odorous toxic gases, which cannot be perceived directly through sensory organs, can only be known and evaluated through such cognitive processes as observing effects on health and materials, through understanding air quality indices, and through public information programs.

Evaluation of air quality, as measured by degree of concern about air pollution, is highly related to actual presence of pollutants, particularly those that are directly observable through the senses. But also, concern about air pollution can be influenced by other personal and situational factors, such as health condition, attitudes toward nature and economic development, knowledge about air pollution effects and solutions, and experience. The latter influence, experience, illustrates the role that behaviour can take in influencing awareness and evaluation of air quality. The homemaker who has to clean up the dust and dirt or has to keep the children indoors during smog alerts is likely to be more aware and concerned about air pollution than those not so exposed. Similarly, joggers or other outdoor recreationists may be more aware and concerned about air quality than those who do not partake of such activities.

The impact of perception of air quality on human behaviour has not been investigated extensively. Some studies have suggested--and it seems commonsensical to conclude--that under conditions of acute air pollution individuals would refrain from certain activities such as jogging or outdoor play. Other types of behaviour, such as migration, have not been investigated, although such would be of value to planners in northeastern Alberta.

Compared to North American cities where most of the air quality perception research has taken place, Fort McMurray and the rest of the study area has clean air. Residents of the area can be expected to have relatively low levels of concern about air pollution. Indeed, their only complaint is about the dirt in the streets (Van Dyke and Loberg 1978). Given this situation, AOSERP could contribute to the growing body of knowledge about perception and evaluation of

air quality by undertaking research on the "amenity value" of air quality, e.g., the extent to which the promise of clean air influences one's decision to move to the area or remain there. Such a study could also explore personality, attitudinal, experiential, and behavioural factors related to air quality evaluation, thus providing some indicators for future use in, e.g., employee recruitment. Another potential area for further research is that regarding the social or economic trade-offs that residents are willing, or not willing, to make in order to retain a clean air environment. A very simple example of this would be a small study of how much residents are "willing to pay" to clean up the streets of Fort McMurray--whether in terms of increased taxes for street cleaning and litter pickup; whether in terms of increased costs of living created by regulating the trucking and construction businesses in the area; or whether in terms of personal involvement through use of lead-free gasoline or non-polluting heating fuel.

5. LAND QUALITY

5.1 INTRODUCTION

In contrast to air quality, research on perception and preference for land has been approached not as a pollution problem, but as an amenity protection problem. That is, what are the qualities or attributes of our land resources that are particularly valued and therefore worth protecting, either through preservation or through good management practices. Studies of perception and attitudes toward land have arisen from and dealt with two major land-use concerns:

1. Landscape preferences, i.e., what are the qualities, primarily visual, of landscape that people value for scenic viewing purposes. Such studies have dealt not only with what one usually thinks of as "landscape", i.e., rural, country scenes, but also with urban landscapes. With respect to the latter, researchers have attempted to define preferences for landscape for purposes of application to the design of urban and non-urban highways, storm drainage systems, pedestrian circulation systems, and parks.
2. In the context of recreation planning and management, researchers have addressed questions of the attributes or qualities of land that people prefer for various outdoor recreational uses. Examples include preferences for and satisfactions derived from campsite selection, hiking trails, park design, and management.

The following sections will deal with these two topics--firstly, landscape appraisal, and secondly, wilderness recreation.

5.2 LANDSCAPE APPRAISAL

5.2.1 Background

Perhaps no other aspect of the natural environment has received as much attention as landscape appraisal and assessment.

This body of research and current interest in landscape appraisal has emerged from an extensive history of landscape study, rooted in such disciplines as geography, history, literature, fine arts, architecture, and design. Numerous writers, such as Thoreau, Santayana, Rousseau, have over the centuries explored the relationships of man with nature, man in nature. During the twentieth century, geographers such as David Lowenthal (1968) have studied "tastes" for landscape, as they have changed over time and as they differ across cultures. Landscape architects have explored not only the forces that influence change in the landscape, but also the values attached to land resources. The recent and current attention to landscape preference has grown out of concerns regarding urban, regional, highway, and park planning. Better understanding of human awareness and preference for landscape can contribute to such land planning issues in northeastern Alberta as park design, highway and road design, and land reclamation. Subsequent sections will review research findings that have bearing on these issues.

At the outset, it should be recognized that landscape appraisal is multi-sensory. An individual experiences the land through several senses, and his evaluation of it is a composite of visual, olfactory, auditory and even tactile sensations. For example, the heard presence of a loon, the smell of wet spruce, and the feel of a cool summer breeze can contribute to an individual's positive and satisfying experience in an otherwise visually neutral place; conversely, a setting that is visually aesthetically appealing can be experienced negatively if it smells like a dump, has aircraft booming overhead, or is windy and wet. Although many researchers have acknowledged the importance of the multi-modal experience of landscapes, virtually no one has addressed the question of the relative value of auditory, olfactory or tactile sensations in landscape appraisal. Thus, the following discussions deal solely with visual awareness and preference for landscape.

Related to this emphasis on visual quality of landscape is a methodological issue: much of the research reported below is based on observer appraisals of landscapes represented through photographs

or slides. Some researchers have investigated whether such presentation formats (simulations) do indeed provide an accurate and reliable appraisal that can be applied to real-life situations. Studies that have compared on-site appraisals with simulated appraisals, by and large, show high correlations between the two modes (Coughlin and Goldstein 1970; Zube 1974; Rabinowitz and Coughlin 1971; Shafer and Richards 1974).

Another methodological/theoretical question deals with the problem of whether landscape preference is a totally individual matter, or whether there are commonalities among people in their preferences for surroundings. As the research findings presented below indicate, there do exist common characteristics of landscape which many people prefer. To determine what such features are, researchers recently have begun making a distinction between "preferential judgements" and "comparative appraisals". As Craik and Zube (1976:9-10) describe this distinction:

> Preferential judgements express an entirely personal, subjective appreciation of (or repugnance for) specific environments, while comparative appraisals judge the relative quality of specific environments against some implicit or explicit standard of comparison. . . . If a panel of observers examines 20 suburban residential communities, the members may differ widely in their personal preferences and in their likes and dislikes. However, when asked to appraise the communities comparatively against the standard of "an excellent suburban development," they may very well display greater agreement. The conceptual criteria for establishing the distinction can be readily specified, for example: Preferential judgements and comparative appraisals constitute distinct, nonredundant measures; greater consensus among observers is displayed in comparative appraisals than in preferential judgements; preferential judgements reflect a wider range of observer characteristics and predispositions; and greater agreement between experts and non-experts is found in comparative appraisals than in preferential judgements.

Although, as Craik and Zube point out, very little of the existing research has incorporated this distinction, it is a useful concept to keep in mind if research on landscape preference is to be carried out in northeastern Alberta.

5.2.2 Awareness of Landscape Quality

Land and landscape cannot be broken easily into constituent parts for analysis of awareness and evaluation. It is one matter to ask people what types of landscape they prefer; it is another to determine the salient dimensions which contribute to that preference. As a hypothetical example, an experimenter may find (as did Rabinowitz and Coughlin 1971) that a majority of subjects prefer a landscape with a large tree in it. It would be simplistic to conclude that "people prefer large trees". Although there might be some truth to that (presence of vegetation is highly correlated with preference), other dimensions might contribute to the total scenic quality, such as the contrast between the tree and its surroundings, the shape of the tree (offering meanings such as age, a place of refuge, a challenge to climb), its spatial location within the scene, or the landforms adjacent to it. As a number of researchers have pointed out (S. Kaplan 1979; Shafer 1969; Litton 1972; Laurie 1975), scenic quality depends not only on the presence of "things" in the landscape, but also upon the interrelationships among those things (contrast, spatial relationships) and the relationships (spatial and meaning) with the viewer. Dimensionalizing these features and relationships has been the interest of a number of researchers, who have approached the matter from different perspectives. Two such approaches, with their findings, will be discussed below.

5.2.2.1 Physical dimensions of the landscape. One approach has been that of landscape architects, geographers, and other experts who have relied upon their own insight and analysis to determine the physical dimensions of the landscape relevant to preference. For example, Zube et al. (1975:165), after surveying the research and planning literature on characteristics of scenic quality, identified more than 20 landscape dimensions which could be quantified, measured, and depicted in map form. Their major categories and dimensions were the following:

Landform

Relative relief ratio:
the range of vertical elevations (based on sample points) per unit area.

Absolute relative relief:
the range of vertical elevations (based on sample points) within the view area.

Mean slope distribution:
the mean of a random sample of slopes, the steepness of landform.

Topographic texture:
the degree of dissection of the land surface, the drainage density.

Ruggedness number:
the roughness of landform based on absolute relative relief, mean slope, and topographic texture.

Spatial definition index:
the amount of enclosure created by landform.

Land Use

Land-use diversity:
the relative areal distribution of land uses within the view.

Naturalism index:
the degree of naturalism as indicated by land use.

Percentage tree cover:
the amount of land covered by trees per unit area.

Edges

Land-use edge density:
the amount of edge created by adjacent land uses per unit area.

Land-use edge variety:
the variety of land uses as indicated by the number of edge types per view.

Land-use compatibility:
an indication of the visual congruence of adjacent land uses.

Contrast Height contrast:
the difference in height of the dominant elements of adjacent land uses.
Grain contrast:
the difference in the size of the individual elements of adjacent land uses.
Spacing contrast:
the difference in the spatial distribution of the elements of adjacent land uses.
Evenness contrast:
the difference in size, distribution, and height of elements of adjacent land uses.
Naturalism contrast:
the difference in naturalism of adjacent land uses.

Water Water-edge density:
the amount of land/water edge per unit area.
Percentage water area:
the amount of surface water per unit area.

View Area of view:
the size of the view area.
Length of view:
the maximum length of view.
Viewer position:
the relative vertical position of the viewer to the view.

As will be discussed below, Zube et al. have found that these dimensions can be correlated with scenic quality.

5.2.2.2 Psychological dimensions of landscape. Another approach to identifying the dimensions of landscape relevant to preference has been that of the psychologists, whose point of departure is the lay observer. The observer is shown a photo of a landscape--or taken to or through a landscape--and is asked to describe what he observes

(i.e., to identify the salient dimensions of the scene). Various means have been used: (1) open-ended descriptions of the scene (e.g., Rabinowitz and Coughlin 1971); (2) adjective checklists (Craik 1975); and (3) semantic differential scales (Zube 1974; Zube et al. 1975; Lowenthal and Riel 1972; Calvin et al. 1972). Subject responses are then analyzed to determine common factors which contribute to awareness. For example, Zube (1974) analyzed the responses of three different groups of subjects to a set of landscape scenes, as they rated them on the semantic differential scales in Table 4. Three primary factors, or dimensions, were specified:

1. Scenic quality (e.g., beautiful-ugly; pleasant-unpleasant);
2. Land use spatial structure (e.g., urban-rural; natural-man-made); and
3. Physical-landscape/landform (e.g., flat-mountainous).

Zube also found that, when the same three groups were asked to write free descriptions of selected scenes, the descriptive dimensions most consistently used by all three groups were:

1. Land form (e.g., rolling, flat, mountainous);
2. Landscape materials or features (e.g., trees, streams, roadside details); and
3. Land use (e.g., forestry, farms, roads).

Other "content categories" such as atmosphere, colour, development pattern, spatial, or compositional characteristics were less frequently or consistently used to describe the scenes.

In summary, it would appear that, whether approached from the perspective of analytical analysis by landscape experts or from the perspective of lay observer, the salient features of landscape are not only the forms (e.g., topography) and things (e.g., vegetation and water bodies) in the environment, but also their interrelationships and meanings (e.g., land use) to the observer.

5.2.3 Landscape Preferences

Forms, things, and their interrelationships contribute to awareness of and preference for landscape. Some forms and some

Table 4. Example of a semantic-differential scale used in landscape assessment.[a]

Simple	Complex	Natural	Manmade
Beautiful.....	Ugly	Colourless	Colourful
Diverse vegetation cover	Uniform vegetation cover	Great	Small
Bright	Dull	Closed	Open
Varied	Monotonous	Irregular	Rounded
Inviting	Uninviting	Artificial	Natural
Hard	Soft	Unity	Variety
Flat	Mountainous	Obvious	Mysterious
Urban	Rural	Dynamic	Static
Orderly	Chaotic	Wet	Dry
Distant	Intimate	Pleasant	Unpleasant
High scenic value	Low scenic value	Like	Dislike
Smooth	Rough		

[a] Source: Zube (1974:73)

things are more highly or generally preferred than others. For example, the presence of water--lakes, streams, etc.--has been found to be highly correlated with preference (Brush and Shafer 1975; Zube et al. 1975; Rabinowitz and Coughlin 1971; O'Brien-Marchand 1976). Presence of vegetation, especially large and varied trees, is also a usual necessary component to preference (Rabinowitz and Coughlin 1971; Gallagher 1977), and contrasting or variable land forms generally are preferred (Berry and Steiker 1974; Brush and Shafer 1975). But these all appear to be commonsensical. The difficult questions arise when one asks how much or what kind are necessary (or not) to contribute to landscape preference.

One key aspect of preference, and one that is not yet conclusively answered, is that of degree of "naturalness". An early study by S. Kaplan et al. (1972) found a general preference for natural landscapes over those nearer to the man-made end of the scale. But subsequent work by the Kaplans and by others (Rabinowitz and Coughlin 1970; Zube 1974) has indicated that the scenes that are the "most liked" are not necessarily, or even generally, the ones that are the "most natural", in the sense of being the most wild. As R. Kaplan (1977a:286) has pointed out, "the highest preference ratings seem to be reserved for scenes that include a well-kept, orderly component to them", that is, man-influenced or parklike.

Numerous researchers have addressed and investigated various aspects of landscape preference. For the purposes of this review, only two of these approaches will be reviewed, the first being the work of Ervin Zube, who has approached the problem from the perspective of what landforms and land interrelationships appear to be related to scenic quality; the second approach being that of Stephen and Rachel Kaplan, who have developed their work on landscape preference out of a basic psychological, information-processing model.

5.2.3.1 Scenic resource values. As indicated in Section 5.2.2.1, Zube and his co-workers at the University of Massachusetts developed a set of landscape dimensions relevant to perception of scenic quality. Their work was carried out over a four-year period in

connection with the North Atlantic Regional Water Resource Study (see Zube et al. 1975 for further discussion of the full project, its assumptions, and findings). With reference to landscape dimensions, their major findings were (Zube et al. 1975:165-166):

1. Essentially all of the landform dimensions are positively related to the scenic resource values, which suggests that, generally, as landform becomes more rugged and more pronounced scenic resource value increases.

2. Land-use diversity and land-use edge variety are both negatively related to scenic resource value, which suggests that as these dimensions increase scenic resource value decreases.

3. Naturalism index and percentage of tree cover are both positively related to scenic resource value, which suggests that as an area becomes more natural or more tree covered its scenic resource value increases.

4. Land-use compatibility is negatively related to scenic resource value, which suggests that as adjacent land uses become more compatible scenic resource value increases [sic].

5. Land-use edge density varies in relationship, but is generally positively related when cubed. This suggests that at the extremes of the dimensions as edge density increases scenic resource value increases, but in the midrange the effect is indeterminate.

6. Height contrast is positively related to scenic resource value, which suggests that as height contrast increases scenic resource values increase. Grain, spacing, evenness, and naturalism contrast are negatively related, which suggests that as these dimensions increase scenic resource value decreases.

7. The two water dimensions are positively related to scenic resource value. As water area or water edge increases, scenic resource value increases.

8. The two size-of-view dimensions are positively related to scenic resource value, which suggests that as area or length of view increases scenic resource value increases.

9. Viewer position was negatively related to scenic resource value, which suggests that the viewer inferior position enhances scenic quality more than the viewer superior position.

Zube et al. (1975:166) pointed out that most of these findings supported their "intuitive feelings" about the dimensions, with the exception of the land-use diversity and land-use edge variety. They suggested that "context" (e.g., scale and the man-made/naturalism issue) is a confounding factor. For example, "the interjection of a small subdivision into the context of a forest or agricultural landscape may add to diversity and detract from scenic value". They conclude that "better predictions may be possible if attention is given to . . . scale of the view area and/or the extent of naturalism or of the impact of man".

5.2.3.2 Human preference for landscape. Rachel and Stephen Kaplan, with their colleagues and graduate students at the University of Michigan, have been carrying out research on landscape preference for the past 10 years. Their work is deserving of special attention for at least the following reasons:

1. It is grounded in behavioural, psychological theory and addresses what lay observers (non-experts) prefer in the landscape;
2. The environments considered have not been "spectacular" tourist-attraction landscapes, but rather "near-by", every-day landscapes such as storm drainage systems in a residential area, rural and forest regions in northern Michigan, a "bog" wildlife preserve, and an urban park (seemingly similar to the University Farm and West 240 in Edmonton);
3. The findings are consistent with those of other researchers; and
4. The methods and test instruments, which are relatively simple and inexpensive to use, could be adapted for use in northeastern Alberta.

The theoretical framework underlying the Kaplan research (S. Kaplan 1975) is derived from basic perception research and is based on two themes:

1. That perception is oriented to getting along in the world, to making sense of the environment; and
2. That the process of perception is highly inferential, i.e., that knowledge, experience and interpretation are involved.

Accordingly, then, the basic assumptions are:

1. Information is essential to survival (to find food, shelter, etc.);
2. Information that aids in making sense of the environment is likely to be salient;
3. Information that allows a person to make inferences about his whereabouts is highly valued; and
4. Also valued is the possibility of gaining new information, i.e., acquisition of knowledge.

From these assumptions (modified by empirical research), Stephen Kaplan (1975) identified six variables that are active in the prediction of preference for landscape. One set concerns the order or structure apparent in the scene, i.e., "legibility" factors that enable a viewer to make sense out of or understand the scene. The four legibility factors identified by Kaplan were: coherence, identifiability, texture, and spaciousness. The second set of factors concerns the amount of information that appears to be available or likely to become available as one moves into the scene, what Kaplan called "the promise of further information." These two factors were: complexity and mystery.

The methods and instruments used in their research have been relatively simple. One area of methodological interest has been the development and testing of an Environmental Preference Questionnaire (R. Kaplan 1973b; 1977c), which assesses individual patterns of satisfaction and preference pertaining to various environmental settings. On the basis of responses to such questions as "what is your preference for such . . . a setting as a totally woodland area

. . . ", people can be scored on seven scales: Nature, Romantic Escape, Modern Development, Suburbs, Social, Passive Reaction to Stress, and City. These scales can be used in conjunction with other measures to see how personality or environmental orientation influences behaviour or preference for particular settings or landscapes.

The second major technique used in the Kaplan research has been the "photoquestionnaire"--a set of black and white photographs which respondents are asked to rate on a five-point scale of preference, i.e., like to dislike. Although selection of landscape scenes for inclusion in the photoquestionnaire is a critical part of the research exercise, the instrument is proving to be a useful and reliable method of assessing local preferences for landscape (R. Kaplan 1979).

Findings from the Kaplan research can be summarized in terms of the following five general points:

1. Content. As others have shown, the presence of certain things in the landscape contributes to preference. Gallagher (1977) indicated that the size and number of trees was positively related to preference; Hammitt (1978) reported that distinct or novel "landmark" features were important to preference in a "bog" scene.

2. Spaciousness. Two studies by R. Kaplan have indicated the importance of spaciousness in enhancing landscape preference. One study of roadside scenes (R. Kaplan 1977b:238) indicated preference for "transparency over opaqueness", i.e., that more open forest scenes were preferred over dense, less penetrable scenes. Another study of a storm drain running through a residential area similarly revealed that spaciousness enhanced preference, i.e., a "creek in a parklike setting" was preferred over a "backyard creek" which was seen as "blocking passage" through the scene (R. Kaplan 1977b:244). However, while spaciousness tends to be preferred over dense, impenetrable forest or grass scenes, total open space--for example, an open bog mat--lacking content features (or other contrasting features) was not necessarily preferred (Hammitt 1978). As S. Kaplan (1979) recently summarized, there appear to be four types of spatial configuration that are related to preference:

a. Open, undefined scenes (low preference) which are flat, lack depth, lack informational cues as to what could be done in the scene;
b. Spacious, well-structured scenes (high preference) which include trees and other "things," provide depth and places to go and move, and contain potential for action;
c. Enclosed scenes (not uniformly preferred) which provide a screened, protected area of a size where one might hide a van; their potential for action is to offer respite, refuge, escape; and
d. Blocked views (low preference) which prevent visual surveillance and action.

The importance of spaciousness or "open space" has also been identified by other researchers, such as Brush (1978) who found that "large, enclosed spaces and spaces created by thinning well stocked [forest] stands were perceived to be more attractive than unbounded openings and dense, overstocked stands", not only by forest landowners but also by forestry students.

3. Legibility or orderliness. "Legibility" refers to aspects of a scene which lend coherence, structure, order and understanding to it. R. Kaplan's storm drain study (1977b) indicated the importance of "orderliness" insofar as well-mowed lawns were more highly liked than "unkempt" or wild scenes. Earlier studies by Rabinowitz and Coughlin (1970) similarly found a preference for orderly, "man-influenced" scenes.

4. Promised information or "mystery". In the Kaplan studies, scenes containing hidden, promised information--"mystery"--were highly preferred. Such scenes invite the observer to move into the scene, to explore a creek, climb around a rock, walk through a stand of trees beyond which a clearing is suspected to lie. Shafer and Mietz (1969) similarly found that the most preferred hiking trails were those that were varied and invited exploration of the next bend or landform.

5. Familiarity. Familiarity, which is related to orderliness and legibility, also influences preference (R. Kaplan 1977b; Herzog et al. 1976). But as R. Kaplan (1977b:245) pointed out, familiarity is ambivalent. ". . . familiarity sometimes appears to aid the 'making-sense' domain while at other times it appears to detract from the 'information-promised' domain". In discussing the intricacies of this variable and its implications for planners and designers, R. Kaplan (1977b:246) observed:

> Since everyday nature involves the familiar, changes in everyday nature necessarily involve changes in the environment one knows well. When this is a preferred environment, proposals for change are easily threatening. But when it is low on redeeming qualities, familiarity might be an important component in the acceptance of almost any proposed modification.

5.2.3.3 Landscape preference and observer characteristics. By and large, the research evidence supports the contention that "there is a high degree of consensus among individuals in making evaluative appraisals of scenic quality" (Brush 1976:52). Indeed, the focus and intent of much of the research on landscape preference has been to identify those features or factors in the landscape that are commonly preferred or appraised highly. On the other hand, there does exist a small body of literature indicating that some characteristics of the perceiver/observer do influence or modify scenic preference. These can be summarized in five points:

1. Differences in scenic preferences do not appear to be related directly to demographic or socio-economic measures. O'Brien-Marchand (1976:187), in a study of aesthetic judgements of 23 stream basins in Pennsylvania, found "no evidence that age, sex, education, occupation, degree of involvement in outdoor activities, or conservation interest significantly influence aesthetic evaluation . . . that aesthetic judgements transgress social boundaries". Similarly, Zube et al. (1975) found that there was high and consistent agreement among 13 subgroups (e.g., residents of several communities, professional engineers and designers, high school students) who were asked to

asked to describe and evaluate non-urban New England landscapes. Zube et al. concluded from this not only that there was "congruence" between expert and non-expert values, but also that profession did not seem to be related to landscape perception and evaluation.

2. However, while the relatively easily measured, overt characteristics such as age, sex, and occupation are not predictive of landscape preference, other personality-type variables do appear to be related: Craik (1975), for example, found that differences among respondents in assessing a specific California landscape could be accounted for and grouped according to individual difference variables such as personal background, environmental attitudes, social attitudes, and leisure activities. In this particular study, Craik was able to identify 14 different "types" of landscape descriptions and find common personal characteristics associated with each type.

3. Scenic preferences are influenced by cultural background and cultural factors. Zube et al. (1975) found one subgroup out of the thirteen that differed from the others: a small group of inner-city residents who tended to view man-made structures more positively than the other groups. These authors suggested that their distinctive pattern might be accounted for by cultural factors. Lowenthal and colleagues in their classic works on landscape tastes found substantial differences between British and North American people in their preference for landscapes--the British preferring the bucolic, the picturesque, the deciduous, the tidy, facadism, antiquarianism, and the uniqueness of each place (Lowenthal and Prince 1965), while Americans tended to prefer the remote, the spectacular, the glorious future or the idealized past, and individual features (Lowenthal 1968). Other writers (e.g., Tuan 1974) have explored cultural differences in landscape appreciation arising from differences in beliefs and attitudes about nature, the cosmos, religion, natural resources, etc. Empirical research to support these theses is not extensive, but one study is illustrative: Joseph Sonnenfeld, a geographer, spent several years conducting cross-cultural research on environmental perception among and between Arctic and Delaware residents. Overall, he found that populations preferred landscapes

similar to their home environments. As Sonnenfeld (1966:72) summarized his arctic research:

> Among the arctic populations tested, non-natives differed significantly from natives in having more extreme preferences: for the landscapes with more rugged relief, for more heavily wooded land, and even, oddly enough, for the colder environments. But there were also differences among non-native groups which appear to be in part a function of previous environmental experience. There were differences between married and non-married non-natives; and between short-term and long-term residents. The influence of environmental experience was apparent for native as well as for non-native groups: those Eskimo with non-Arctic experience differed significantly from natives without non-Arctic experience, and in a direction consistent with the landscape preferences of non-native Arctic populations.

Sonnenfeld goes on to suggest that, while cultural variables do influence perception and preference for landscape, other psychological variables and processes--most notably environmental experience --enter the picture. Thus, cultural background may influence one's like--or dislike--of a new, unfamiliar landscape, but as one gains experience with that "foreign" environment, his perception of and preference for that environment will change.

4. Differences between experts and non-experts in appraising landscapes are not clear. Several researchers--especially those trying to support the validity, objectivity, and consistency of their methods, such as Craik (1972a), Zube et al. (1975), and Coughlin and Goldstein (1970)--have claimed "high agreement" among expert and non-expert panels in evaluating and describing landscapes. Others, such as Fines (1968), R. Kaplan (1973a) and even Zube (1974) have pointed out differences between expert and lay appraisals of landscape. These discrepancies appear to be more a matter of degree of difference with respect to the naturalness of the scene. Experts, such as landscape architects and planners, appear to place higher value on natural scenes than do lay persons. The latter seem to be more tolerant of, or favourably disposed to, the presence of man-made features in a landscape than are the "experts."

5. Related to the question of "expert" versus "lay" appraisals is that of "intended use" of the resource. Daniel and Boster (1976) found differences among landscape architects, foresters, forest economists and range managers in their appraisals of quality of forest stands--with landscape architects having stricter criteria for scenic value; others may have placed differing values in terms of what they had learned to value in the forest. Rabinowitz and Coughlin (1971:54) also found that subjects would differentially rate sites on the basis of intended use, i.e., as a place to live, to go for recreation, or to stop and view. They concluded, "a panoramic view . . . would be attractive in a picture, and nice to stop and gaze at for a few minutes; but for residential and recreational use, a secluded site might be preferred". Greenbie (1975:89) similarly concluded that "landscape is assessed not only in terms of the intrinsic responses its forms may involve . . . but also in terms of what one plans to do with it". Further consideration of such differences in preference as related to intended use will be undertaken in the subsequent discussion of outdoor recreation.

5.3 WILDERNESS RECREATION

As G. L. Peterson (1973:164) has observed, one of the most "fertile" areas of environmental perception research is outdoor recreation where "the 'recreator' is frequently involved in a direct transaction with the physical environment, and is profoundly influenced in his behaviour and satisfaction by the conditions of the environment and his perception of it". Over the past 20 or more years, as leisure and outdoor recreation activities have increased and as land available for such activities has become increasingly scarce, research interest in outdoor recreation has soared. Wilderness research and wilderness recreation represent a special case, or subset, within the broader context of outdoor recreation. Because of its particular relevance to northeastern Alberta, wilderness recreation deserves special attention.

5.3.1 Perceptions of Wilderness

The concept of wilderness illustrates one of the key tenets in environmental perception, that is, what one perceives a phenomenon to be defines that phenomenon. In a sense, then, "wilderness is in the eye of the beholder". This problem of defining "wilderness" has been recognized and dealt with by a number of researchers who have attempted to define wilderness from the perspective of users, or observers, of wilderness areas.

One of the earliest studies of perceptions of wilderness was conducted by two sociologists in the early 1960's. Bultena and Taves (1961) interviewed vacationers in the Quetico-Superior area along the Ontario-Minnesota border, and found five "images" of wilderness:

1. Wilderness as a locale for sport and play;
2. Wilderness as fascination ("summons to adventure," "an opportunity to struggle with the elements");
3. Wilderness as sanctuary;
4. Wilderness as heritage; and
5. Wilderness as personal gratification.

Subsequent studies similarly reflected differing perceptions of wilderness, often dependent upon the use being made of the area. Lucas (1964, 1966), for example, surveyed visitors to the Boundary Waters Canoe Area (BWCA) in northern Minnesota, a National Forest wilderness area. He found that there were two main types of visitors with two very different areal perceptions of wilderness. When asked to draw on a map the boundary between wilderness and non-wilderness, canoeists and other "purist" users indicated a much smaller area of wilderness than did other users such as motor-boaters and weekend campers. Those using motorboats were less bothered by the presence of roads, crowding, or noise than were the canoeists; but even for the "purists", the presence of light logging was not incompatible with wilderness, nor was remoteness necessary if use was light. Furthermore, neither group's "perceived wilderness" corresponded with the officially designated area nor with the area perceived by the resource managers.

Merriam and Ammons (1968) interviewed subjects in three wilderness areas in Montana, areas that differed in terms of isolation and access. They found two types of temporary users--one group consisting of roadside campers, and the other consisting of hikers and horseback riders. When asked to define wilderness, the campers indicated that wilderness began at the edge of the campground. The hikers and riders, in contrast, defined wilderness in terms of such criteria as underdeveloped natural country, difficulty of access, absence of people, and absence of man-made improvements. Hikers in Glacier National Park specifically indicated that a person had to be at least 5 km from the nearest road or guided nature tour to consider himself in the wilderness. One point to be learned from these findings is that the use being made of a resource influence one's perception of it, thus illustrating the transactional relationship between perception and behaviour.

Building upon this work, a number of researchers have endeavoured to identify types of wilderness users. Hendee et al. (1968) studied wilderness users in the Pacific Northwest and identified types of users ranging from "purists" to "urbanists". The purist wilderness users were characterized by such attitudes as spartanism, anti-artifactualism, primevalism and humility in relationship to the natural environment, outdoorsmanship, aversion to social interaction and a desire to escape from civilization. Stankey (1972) similarly examined the attitudes of wilderness users toward features of four wilderness areas (in Montana, Wyoming, Utah, and Minnesota). On the basis of responses, Stankey identified four groups of wilderness users: strong purists, moderate purists, neutralists, and non-purists. Among all the groups, solitude was considered an important feature of wilderness (82% of the total sample considered it important, while 96% of the purists considered it highly desirable). Other studies (Cicchetti and Smith 1973; Rossman and Ulehla 1977; Noe 1978) similarly have indicated the importance of solitude, primarily defined as lack of contact or encounter with other groups of users.

The above studies indicate differing perceptions of wilderness depending on the use made of the resource or on personality

factors. Relatively little attention has been paid to socio-economic or background experience factors that may contribute to wilderness perception. One study by Cicchetti (1972) addressed such questions. Using Stankey's purism scale, Cicchetti analyzed such factors as (1) age, sex, income, education, and (2) childhood residential and recreational experience. Heimstra and McFarling (1974:131) have summarized Cicchetti's findings as follows:

> Cicchetti found that the older a person was when he first visited a wilderness, the higher was his purist score. This direct relationship was also true for the variable of education; for each year of education beyond the eighth grade, the purism score increased by about .65 points. It would seem, then, that with greater age and education the individual needs a more pristine or remote wilderness experience. In some cases relationships between other variables were also found. For example, in the Bridger area male visitors tended to rank higher in purism than did women visitors.
>
> Childhood residence and recreational experiences were also found to affect purism scores. In general, visitors who grew up in a small town or in a rural area had lower purism scores than did users who grew up in urban areas. Cicchetti suggests that rural residence leads to the development of a utilitarian view of the wilderness--that is, the trees or other resources of a wilderness area are valuable and should be exploited. The users who said that they had hiked frequently as children scored higher on the purism scale than did the users who had not. Such other types of childhood experiences as camping also had a positive effect on the score.

Cicchetti's findings thus reinforce previously discussed findings that background and cultural factors influence one's evaluation and use of wilderness resources.

A final study worthy of attention is that of Shafer and Mietz (1969), who asked hikers ("ardent wilderness users") in the Adirondacks and White Mountains in northeastern U.S. to identify the importance of five general qualities of the wilderness experience: physical, emotional, aesthetic, educational, and social qualities. The results indicated that aesthetic and emotional experiences were the most important wilderness-recreation values, with social aspects being the least important. Shafer and Mietz (1969:80) illustrate what the

hikers referred to as "aesthetic" and "emotional" experiences as follows:

> . . . the limited sample of hikers we interviewed felt strongly that trails should be designed to provide maximum scenic enjoyment. Hikers also suggested that trails should (a) include large rock outcrops where the hikers can observe the surrounding landscape; (b) go through natural openings in forest stands where there is variability in lighting, colour, temperature and the distance one can see through the forest; and (c) follow stream courses whenever possible so that waterfalls and rushing water are part of the natural beauty along the trail.
>
> Hikers noted that forest stands that have a mixture of pine and white birch often are more attractive than a pure stand of pine; at other times a pure stand of majestic old culls may be far more desirable. From an aesthetic viewpoint, trails should be located on grades that will prevent erosion from water and heavy use. Overall, the respondents wanted variation in trail scenery more than anything else . . . .
>
> Emotional experiences were almost as important as aesthetic experiences. Respondents included in emotional experiences the roaring flush of a ruffed grouse, the splash of a leaping trout, or a simple curve in the trail that promises something new or challenging beyond the bend.

Such conclusions, which are not inconsistent with the landscape values discussed previously, emphasize not only the importance of scenic beauty, but also the importance of the presence of wildlife to enjoyment of the outdoor wilderness experience.

5.3.2 Wilderness Recreation: Preferences and Satisfactions

"Outdoor recreation" is a major use of leisure time, encompassing a variety of specific activities. Table 5 indicates some of the more popular outdoor activities in which people engage: the 1962 U.S. sample lists the ten activities in which people most frequently participated when they visited a recreation area (Outdoor Recreation Review Commission 1962); the Peace River sample shows the ten most frequent types of outdoor activities in which Peace River regional residents participated (Peace River Regional Planning Commission, 1974). As can be seen from comparing the two columns in Table 5,

Table 5. "Top Ten" outdoor recreation activities engaged in by U.S. and Peace River residents.

U.S. 1962 Sample[a]		Peace River Sample[b]	
Activity	% Participating	Activity	% Participating
Relaxing	53.1	Picnicking	88.2
Picnicking	51.1	Sightseeing	77.7
Swimming	43.2	Recreational Diving	71.3
Sightseeing with Stops	41.3	Visiting Historic Areas	56.9
Walking to Scenic Points	39.9	Fishing	56.9
Photography	39.9	Swimming	55.3
Sunbathing	31.4	Hiking	49.0
Camping	29.3	Bicycling	48.1
Sightseeing from Car	26.2	Tobogganning	46.8
Trail Hiking	23.9	Tent Camping	42.5

[a]Source: Outdoor Recreation Review Commission (1962)

[b]Source: Peace River Regional Planning Commission (1974)

picnicking, driving for pleasure and sightseeing, swimming, hiking and camping are outdoor activities in which many people participate. Table 6 outlines findings from a more recent survey of 1000 U.S. residents who were asked to identify their favourite leisure time activity (Hawes 1978). While "home-based" activities such as crafts and gardening were cited most frequently as favourite activities, outdoor activities such as driving for pleasure and picnicking were also named. The activities selected by men and by women differed considerably, but three activities appeared among the top ten for both men and women: gardening and lawn care, swimming, and fishing and hunting. The Hawes study is of further interest because it looked not only at the favoured activities, but also at the satisfactions associated with the leisure pursuit. Overall, the most important satisfactions expected (or gained) from leisure pursuits were as follows:

For Women	For Men
Peace of mind	Peace of mind
Chance to learn new things	Chance to get the most out of life
Chance to get the most out of life	Adventure and achievement
Chance to escape home or family problems	Comfort of a familiar activity

The satisfactions associated specifically with fishing and hunting were:

For Women	For Men
Development of family ties	Enjoyment of wonders of nature
Peace of mind	Adventure and achievement
Enjoyment of wonders of nature	Peace of mind
Escape from pressures	Aloneness in a quiet spot

Leisure-time activities are undertaken in order to satisfy certain perceived needs or wants in an individual's daily living. The extent to which a particular activity or experience meets an individual's expectations will largely determine his satisfaction with that particular experience. For example, both men and women consider "enjoyment of the wonders of nature" to be a major ingredient in the hunting and fishing activity; if a certain setting provides the natural features

Table 6. Favourite leisure activities among U.S. adults.[a]

Women			Men		
Activity	No.	%	Activity	No.	%
Creative Crafts	257	42.6	Gardening	71	13.9
Reading Books	154	25.5	Fishing, Hiking	64	12.5
Visiting Friends	94	15.5	Listening to Music	60	11.7
Fishing/Hunting	77	12.7	Attending Sports	54	10.5
Bingo, Cards, Games	77	12.7	Home Workshop	50	9.7
Swimming	70	11.6	Bowling	49	9.5
Gardening	66	10.9	Swimming	49	9.5
Camping	65	10.7	Driving for Pleasure	49	9.5
Picnicking	62	10.3	Visiting Friends	48	9.3
Listening to Music	54	8.9	Reading Books	47	9.2

[a]Source: Adapted from Hawes (1978)

desired, the more satisfying is the experience and, presumably, the more satisfying is one's life. A number of researchers have endeavoured to specify what qualities or attributes of recreational sites or settings contribute to satisfaction in outdoor recreation. Two types of activities relevant to northeastern Alberta--hunting and fishing, and camping--illustrate how the perceived attributes of a wilderness site or experience can contribute to satisfaction from recreation.

5.3.2.1 Hunting and fishing. A number of researchers have investigated the characteristics of hunting that are valued by hunters. Two aspects are most highly valued (as much as or more than bagging game): companionship and the aesthetics of nature. Hautaluoma and Brown (1979) examined the dimensions which deer hunters in the state of Washington perceived to contribute to satisfaction. The nature dimension, which was important to all kinds of hunters, was described as:

1. Being close to nature;
2. Being outdoors;
3. Getting away from civilization;
4. Getting away from everyday problems;
5. The smells and sounds of woods and fields;
6. Camping out; and
7. At least seeing some wildlife.

Hautaluoma and Brown further analyzed their data to determine if there were types of hunters whose hunting expectations varied in systematic ways. They found that there were types of hunters who would be satisfied, even gratified, by a nature-oriented experience which included seeing game, but not necessarily bagging it. Other types of hunters highly valued the harvest and skill component of hunting. The authors suggested that such variations in values associated with hunting can be used by wildlife managers, e.g., by giving special consideration to those hunting groups (perhaps, for example, native groups in northeastern Alberta) who highly value the harvest component of hunting, while emphasizing substitute activities or areas for those

who value the nature and companionship components of the hunting experience. A parallel in fishing would be the designation of "no-kill" stream segments where fly fishermen can be assured of a catch, but are expected to return the trout to the stream.

5.3.2.2 Camping. Camping is a complex leisure choice, involving many different activities. Because of its popularity and its complexity, a number of researchers have investigated the camping experience not only to determine its particular characteristics, but also to glean information that might be generalized to other leisure choice situations. Two approaches to the camping experience have been taken: (1) to examine the motives and personality factors influential in the choice of camping as a favoured leisure activity; and (2) to identify environmental factors that contribute to satisfaction from the camping experience.

1. Psychological motives in camping. Three studies exemplify the interest in identifying motives and expectations related to camping. Two hypotheses sometimes used to explain the choice of camping are (a) that such choices are convergent, or congruent, with other activities, or (b) that such choices are divergent, or escapist. Clark et al. (1974) asked 1850 campers to select explanations or reasons for their camping and found high percentages of endorsements for the following:

1. Awareness of unspoiled beauty (83%);
2. Teaching my children about the out-of-doors (71%); and
3. Getting emotional satisfaction from solitude and tranquility (65%).

A fourth alternative, "getting completely away from people other than my camping party", was endorsed by only 28% of the sample, thus suggesting that the choice of camping was not a divergent or escapist activity. Hollender (1977), in a series of follow-up studies, examined two aspects of camping: (a) the motives in going camping and (b) the choice of a campground. He identified seven factors or motives influential in the decision to camp at a particular campground (listed in order of importance):

1. Security of the campground;
2. Aesthetic outdoor experience;
3. Escape from urban stress;
4. Primitive lifestyle;
5. Escape from routine;
6. Nearby entertainment; and
7. Escape from the familiar.

Other factors such as liking to fish or read books, were low in importance. Hollender (1977:140) concluded that "divergent motivations are the most important motivations for camping".

Driver and Tocher (1974) have criticized the convergent-divergent hypotheses as being too simplistic and not sufficiently psychological. They have, alternatively, approached the matter from the point of view of identifying personality factors that influence choice of camping as a favoured leisure activity. In a recent study (Driver and Knopf 1977), personality information was collected about groups of recreationists participating in a variety of leisure activities (camping, swimming, tennis, hiking, nature walks, picnicking). Analysis of the personality profiles indicated that both male and female campers were higher than the norm on "sentience" (use of the senses) and "autonomy" and lower on "social recognition"; that male campers were higher than the norm on "endurance" and "understanding"; and that females were lower on "aggression". Driver and Knopf (1977:186) point out that "these patterns agree with one's intuition about the personality profile of outdoor recreationists".

2. Environmental factors in camping satisfaction. While such research as the above is useful to understanding why some people prefer camping, and has potential for predicting demand for and planning camping resources, other studies dealing with environmental factors contributing to satisfaction from camping appear to be more directly relevant to recreation planning and management. Three studies dealing with such aspects are deserving of attention. Shafer (1969), who asked campers in the Adirondacks to name the most important features of various campgrounds, identified five major responses:

1. Campsites near water;
2. Swimming and water sport facilities;
3. Landscape variability surrounding the campground; and
4. Campground design--campsite spacing, vegetative screening;
5. Tourist attractions nearby.

Lime (1972:202) found that the reasons for choosing a campground in northern Minnesota were the following:

1. Fishing opportunities nearby;
2. The "wilderness-uncrowdedness atmosphere" associated with the campground and its immediate surroundings;
3. Remoteness, well away from main roads and towns;
4. Individual campsites both within sight of the lake or stream and well-screened from neighbours; and
5. Small size of campgrounds (less than 15 sites).

When campers were asked to identify the "best" campsite within the campground, there was a strong preference for camping within sight of the nearby water body; furthermore, a large majority of those preferring a waterfront site did so because of the view. Lime (1972:204) commented:

> Although the need to preserve and protect the waterfront is real, it also seems possible that by judicious campsite placement, which takes full advantage of topography and vegetation thinning, many distant campsites can provide visitors with at least a distant view of water.

Findings from another study also illustrate the importance of water, view, and "nature" to outdoor recreationists. Peterson (1974), in a study of canoeists in the Boundary Waters Canoe Area in Minnesota, identified the following major sources of canoeists' satisfaction and dissatisfaction:

Satisfaction (in order of average desirability)

. Crystal clear lakes and streams
. Being able to drink water directly from the lake
. Campsites with a view of the sunset across the lake
. Natural noises: thunder, wind, waterfalls, etc.

. Mature virgin forests
. Campsites located in groves of big pines
. Beaver dams and lodges
. Portage signs giving name of lake and length of portage
. Canoe rests at convenient intervals on portages
. Permanent fire grates at campsites

Dissatisfaction

. Litter at campsites or portages
. Murky or discoloured water
. Trees damaged by cutting, chopping or bark peeling
. Birch trees damaged by cutting or peeling
. Initials or names painted on rocks or carved in trees
. Uses of motors or other mechanized equipment
. Poor fishing
. Insects that bite

Peterson's study is of additional interest because he developed a method (mathematical model) for assessing not only the desirability of certain features, but also the "perceived commonness" of such features in a given area. Satisfaction, he asserts, is a function of the two aspects, i.e., both what the user desires or wishes to have present and what he perceives to be available.

5.4 CONCLUSIONS AND IMPLICATIONS

Two broad conclusions can be reached on the basis of research reviewed in this section, one being that, although individuals differ in their perceptions and preferences for landscape, such differences can be understood, grouped--and presumably predicted; and the second being that certain commonalities in human perception and preference for landscape and wilderness appear to exist. The import of these two conclusions for research and planning in northeastern Alberta will be discussed below.

5.4.1 Observer Characteristics

It seems clear that perceptions and preferences for landscape and wilderness are not directly related to, nor can be predicted by, traditional demographic or socioeconomic indicators such as age, sex, income, education, and occupation. The factors or variables that do appear to influence perception and evaluation of land resources would appear to be the following:

1. Cultural influences: exemplified by Sonnenfeld's (1966) work on differing perceptions among natives and non-natives in the Arctic and by Lowenthal's (1968) and Lowenthal and Prince's (1965) work on American and British landscape tastes. In the context of northeastern Alberta, this would suggest that one could anticipate differences in perception, evaluation and even use of land arising from the presence of different cultural groups, such as native people, "Prairie" Canadians, Quebecois, Eastern Canadians, and others if foreign immigration occurs.
2. Personality factors: exemplified by Driver's (Driver and Knopf 1977) work on personality profiles of recreationists, by Craik's (1972b, 1975) work on personality typologies among landscape observers, and by Stankey's (1972) work on personality characteristics of wilderness "purists". While it might be speculated that there exists a personality type that is attracted to resource development in the north, such has not been investigated in the specific context of northeastern Alberta. An investigation (R. Foster, personal communication) presently underway for AOSERP has found evidence that recreation preferences among Fort McMurray residents differ radically from those in the south. Further examination of this phenomenon, in terms of associated personality or experiential factors, would be an excellent contribution to the field of study.
3. Environmental experience: exemplified by Cicchetti's (1972) finding that childhood camping experiences and

rural upbringing influenced one's evaluation of wilderness resources, and by Sonnenfeld's (1966) Arctic research indicating that landscape preferences were different between short-term and long-term residents. Further understanding of such relationships, particularly in the context of northeastern Alberta, could be of value not only in understanding differences, even conflicts, among groups with differing levels of environmental experience, but also in planning programs to enhance the environmental experience of those not familiar with the regional environment.

4. Intended use of the resource: exemplified by the Daniel and Boster (1976) work on differing perceptions of forest stands among foresters, landscape architects, etc., and by Lucas's (1964) work on differences between canoeists and motorboaters regarding perceptions of wilderness. The relevance of this to northeastern Alberta is clear, insofar as one could anticipate differing perceptions among those groups who reside in the region and utilize the natural environment for recreational purposes; those who reside there and use the resource for sustenance (hunting for food, firewood, etc.); those who commute in and out for employment purposes; those who exploit the resource (land, timber, minerals) for economic gain.

All these factors have bearing for research in northeastern Alberta. AOSERP has a role to play in identifying the characteristics of the population of northeastern Alberta that might influence perception, evaluation, and use of the local environment. If it is found that resident characteristics (especially personality and environmental experience) are similar to those of populations studied elsewhere, then certain generalizations can be made from existing research to the northeastern Alberta situation. If, however, it is found that the northeastern Alberta population is atypical, then further research

into their environmental perceptions, attitudes, and values would be a logical and necessary next step.

5.4.2 Commonalities in Perception and Preference

Until such time as research findings are available regarding the perceptions and preferences of residents of northeastern Alberta, resource planners and managers can make use of common findings from the perception research reviewed herein. One illustrative example pertains to land reclamation. Clearly, one of the major problems facing resource managers in the region is not only how to reclaim the land stripped for oil sands extraction, but also the state or condition to which the land should be returned. Findings from the research on landscape preference may provide some ideas and clues as to what features in the landscape are valued by people, thereby being goals for reclamation. For example, the findings regarding the desirability of varied terrain might possibly be taken into account by trying to create hillocks in a reclamation area; the importance of spaciousness and varied vegetation could also have implications insofar as planners might try to create some areas of small open fields, bounded by tree belts and some areas of denser vegetation through which walking trails provide access to open areas. Indeed, one could imagine that a reclamation project itself could become a scenic and educational resource over the years, as older areas matured and as experiments with differing vegetation and silviculture techniques bore fruit. As further information becomes available regarding the perceptions and preferences of area residents for landscape and outdoor recreation, it should be brought to bear on land reclamation planning.

6. WATER QUALITY

6.1 INTRODUCTION

The research literature regarding human perception and evaluation of water quality is far less extensive than that regarding air or land quality. Robert Coughlin, in his 1976 review of perception and valuation of water quality, observed that he was aware of only six research projects (including his own) which addressed these subject areas. Since his review, only a few additions have been made to the literature. Reasons for this relative dearth of research are not completely clear, but would probably include the following:

1. Water is difficult to dimensionalize for purposes of perception research. This is because it is "multi-modal" (having dimensions relevant to several sensory modes, such as taste, smell, vision and even hearing); because it is dynamic (as streams ripple and flow); and because it is multi-functional (human life support, wildlife habitat, industrial and agricultural resource).
2. Concern about water resources is not singly a matter of water pollution or suitability for various uses. Water resource concern and attitude studies also address questions of water supply or availability for various--and sometimes competing--uses, as well as questions of flood control and watershed management.
3. The values attached to water vary or, put another way, cannot be reduced to a single value. D. Berry (cited in Coughlin 1976:223) has conceptualized four categories of values associated with water:

   Recreational values--among the most prominent, though not necessarily the most important. Swimming, wading, fishing, walking, picnicking are among the activities relevant here.

   Contemplative and aesthetic values--. . . that complex of memories and instincts which are awakened in the average man by the word 'beauty.' These may be enjoyed by simply knowing that an

environment exists, without even actually visiting it.

Functional values--in which the environment functions to promote human welfare, production, or consumption. For example, cleaner water may act to reduce disease, reduce economic loss downstream due to dirty water, reduce water treatment costs downstream.

Ecological values--in which plant and animal communities are felt to be valuable in themselves and therefore ought to be protected. The concern here is not for the well-being of people but for the well-being of other forms of life for their own sake.

In the subsequent sections, the following topics related to water quality will be addressed:

1. Dimensions of water that can be perceived and assessed as contributing to water pollution;
2. Attitudes and concerns regarding water problems, as these are related to observer characteristics, to information and education, to role, and to use; and
3. Effects of perceived water quality on behaviour, as exemplified by recreational use and "willingness to pay" for high water quality.

6.2 DIMENSIONS OF PERCEIVED WATER QUALITY

6.2.1 Dimensions of Water Quality

Coughlin (1976:205) has said, "Since there is no single accepted index of water pollution, it is often hard for the non-physical scientist to know just what is meant when pollution is being discussed". His statement would seem equally true if the words "water quality" were substituted for "water pollution".

A number of researchers have attempted to dimensionalize water quality from various perspectives. Richerson and McEvoy (1973:126), for example, listed twenty-six "environmental quality measures" related to water quality:

Physical temperature
Transparency
Sediment load
Settable solids
Flow rates
Chemical
    Dissolved oxygen content (DO)
    Total dissolved solids (TDS)
    Toxic substances
    Organic matter
    Various inorganic ions
Biological
    Biological oxygen demand (BOD)
    Coliform count
    Primary productivity (PPR)
    Diversity
    Biomass
    Toxicity
    Biomass composition, fish biota
    Indicator organisms
    Bioassays
Social
    Scenic indices
    Attitude surveys and opinion polls
    Taste and odour
Economic

Although these authors recognized the need to include scenic or aesthetic measures in the evaluation of water quality, they did not specify or clarify what such measures involve. R. B. Litton et al. (1974), on the other hand, outlined a set of "universally valued water qualities" that "contribute to a positive aesthetic experience" (Litton et al. 1974, Appendix D):

Non-visible Qualities

Sound
Smell
Touch (heat, cool, fluid)
Balance (buoyancy)
Taste-thirst
Known Potential for a Recreational Pleasure:

    Fishing, swimming, boating, sailing, scuba, canoeing, water skiing, rowing, contemplation, photography, painting, wildlife watching, collecting, etc.

Visible Qualities

Movement (gravity movement, wind movement, mechanical, fountain)
Placidity
Transparency
Reflection--mirror sparkling light--water as a modifier of light
Colour
Space-Openness-Distance-Space in enclosed areas
Enclosure-Boundary-Limit-Containment
Plain Surface-Horizontal Sheet
Inclined and Vertical Surface
Unity of Element-Continuity of Direction, Linking Element-Orientation
Landscape Focus (lowest point in landscape) - Orientation
Water Landscapes have Balance - Symmetry to Shore Definitions
Contrast to Land (less seen than land)--Relative rarity Scarcity
(edge configuration)
(setting for landforms or features-islands, outcrop rocks, floating objects)
(contrast in texture)
Environment for Pleasing Life Forms
Vegetation--Riparian Associations--(Willows, cattails, lilypads, fish amphibians, butterflies, etc.)
Geological sculpturing and weathering (cutting, smoothing, polishing, staining)
Ice
Vapor-mist

Litton et al. caution that this list, which is based on their "common-sense", is neither complete nor empirically validated. However, the list does illustrate the complexity of water dimensionalization, even when restricted to "aesthetic" considerations of water bodies.

6.2.2 Characteristics of Perceived Water Pollution

Litton et al. (1974, Appendix D) also listed a number of factors which detract from or decrease aesthetic satisfaction from water bodies:

Floatable man-introduced debris-garbage, paper, suds, oil

Increased turbidity - decrease of natural clarity. Silt.

Presence of unnatural colors

Drawdown of water level from usual or natural levels - exposure of bottom or shoreline sides

Decrease usual or natural flow to stagnant conditions - fish kills, smell, pests

Attraction of annoying pests - insects, snakes, rodents, trash fish

Algal blooms, proliferation of weed plants

Evidence of dead or sickly wildlife, or fish

Unpleasant smells

Activity eroding banks, vegetative debris across banks and into water body

Noise from human activity

Crowding of area users

Flood flows of a destructive or threatening magnitude

Vandalism, overuse and deterioration of facilities, vegetation, ground cover

Hazards and barriers

The authors pointed out that the list is only "suggestive" and required further research to identify the relative contribution of each factor to aesthetic satisfaction. (It is also recognized that this listing does not consider other non-visible qualities associated with water pollution, such as bacteria and toxic chemicals.)

Several researchers have carried out surveys to determine how laymen identify water pollution. Barker (1971) surveyed beach users and lakeside cottage residents from the Toronto area and found that the majority of respondents evaluated water quality on the basis of appearance or odour (see Table 7). Similarly, Willeke (1968), in his study of San Francisco Bay, found that appearance or visual evidence was cited frequently as evidence of water pollution; respondents made reference to debris and garbage, dead fish, oil, foam, murky or scummy water, discoloration. David (1971) in a household survey in Wisconsin found that green scum and algae, and murky, dark water were frequently mentioned characteristics of water pollution; when asked what would most deter swimming, respondents identified algae and scum, cans and glass, weeds, debris, murky water, and suds or foam (in that order of importance). Nicolson and Mace (1975) similarly found that 90% of campers interviewed defined water pollution in terms of visible qualities.

Table 7. Toronto survey: criteria used to identify water pollution.

Criterion	Beach Users %	Cottage Users %
Appearance (algae, floating material)	55.8	47.4
Odour	14.7	11.3
Taste	0.8	1.3
Scientific tests, signs posted	4.1	15.0
Don't know, can't tell	24.6	25.0
	100.0	100.0

Source: Barker (1971)

These studies, in addition to illustrating that visual appearance is a common criterion used to identify water pollution, also indicate to some extent the difference that intended use of the water body has on perception of pollution. The Barker data presented above indicate some differences between users, with beach users relying more on perceived conditions of appearance and odour, and cottage users relying more on cognitive measures such as signs or tests. Ditton and Goodale (1973) also found that outdoor recreation participants have a perception of water quality that is significantly different from that of non-participants, with participants being less tolerant of bad water quality (among participants, swimmers were less tolerant than boaters). Kooyoomjian and Clesceri (1974) similarly found that different types of users complained about different aspects of pollution: "recreationists" complained more than other groups about unclear and muddy water, strange colours, and floating objects (elements that would probably not only be more apparent to them in the water, but also would interfere more with swimming); fishermen complained more about films and oils and dead fish on the surface; and cottage owners were more concerned about strange odours, algae, and irritation caused to eyes or skin.

6.2.3 Perceived vs. Objectively Measured Pollution

Willeke's (1968) study in San Francisco Bay found that citizens and public health officials differed in opinion regarding whether the Bay was polluted: public health officials, who based their assessment on scientific criteria such as coliform bacteria count, considered the quality of the water to be fine; the citizens, who based their evaluations on perceived conditions such as floating garbage and dead fish, considered the Bay to be polluted.

Barker (1971) in her Toronto study found considerable variation in evaluation of water quality at the various sites. The worst site (as classified by the interviewers) was judged to be "somewhat dirty" or "very dirty" by 90% of the respondents, whereas the best lakes were more likely to be evaluated as clean. Similarly, Parkes (no date), in a 1970 survey of users of four lakes in

Saskatchewan, found that the lakes with the worst quality (based on water samples) were more frequently identified as having an algae problem than the lake with the best quality.

Scherer and Coughlin (1971) undertook one of the few studies to attempt to directly relate observers' ratings of stream quality to objective measures of stream quality. Although their sample group of observers was small (twelve observers), they found significant correlations between ratings of streams and chemical variables. In their words:

> Such attributes as "transparent," "clean," "inviting colour," "polluted" and "healthy" related in a consistent and significant way to certain chemical variables. . . . The best visual cues (e.g., transparency, clean) apparently are related to the presence or absence of a high degree of chemical oxygen demand, fecal streptococci, total and ortho phosphates, nitrates, and total dissolved solids (Scherer and Coughlin 1971:40).
>
> . . . "polluted" was correlated with the largest number of chemical characteristics. It was strongly correlated (.01 level of significance) with chemical oxygen demand, nitrates, and total dissolved solids (179°). It was correlated significantly but less strongly (.05 level of significance) with fecal strep, total phosphate, orthophosphate, nitrogen dioxide, chlorine, total dissolved solids (103°), water temperature, dissolved oxygen, and the Water Quality Index . . . (Coughlin 1976:216).

A subsequent investigation by Coughlin et al. (1972), using a larger sample of respondents (312), supported these findings that non-experts' perception of water pollution is consistent with many, if not all, chemical characteristics of a water body.

In summary, then, the research literature would appear to suggest that human perceptions of water quality (pollution) are based primarily upon such observable features as appearance and odour; that the feature that is most salient (or objectionable) to the observer is related to the use being made of the water resource; and the quality, as perceived by untrained observers, does bear a consistent relationship with some objective measures or criteria.

6.3 EVALUATION AND CONCERN REGARDING WATER PROBLEMS

6.3.1 Introduction

As suggested earlier, attitudes and concerns about water quality are not simply a matter of water pollution alone. Some researchers have addressed questions strictly directed to concern about water pollution (e.g., Jacoby 1972; McEvoy 1973; O'Riordan 1971). Others have looked at such issues as attitudes toward watershed development (Dasgupta 1967) and perception of priorities among water problems such as flood control, water supply, pollution and recreation (Mitchell 1971; Borton and Warner 1971; Ibsen and Ballweg 1969). In general, what these studies have in common, and what is relevant to industrial development concerns of northeastern Alberta are not the specific and various attitudes toward water, but rather the factors which seem to be associated with evaluation.

By and large, it would seem that, when presented a list of environmental problems, most people rank water pollution lower than air pollution (Swan 1970; Saarinen and Cooke 1971; Erskine 1972; Jacoby 1972; McEvoy 1973; Stehr and Pong 1975). As many writers have pointed out, when such generalized data are stratified into groups, variations on the theme occur. Attitudes and concern about water pollution (and other resource problems) may be influenced, for example, by demographic and personal characteristics of respondents; by cognitive factors such as degree of knowledge about water problems and solutions; and by behavioural factors such as intended use of the resource. Although the body of literature is not large, some findings from the research are deserving of attention.

6.3.2 Concern about Water Problems Related to Observer Characteristics

As with the research reported earlier about air and land quality, findings about the influence of socioeconomic and demographic characteristics on concern about water resource problems are mixed. On the one hand, McEvoy (1973), in his analysis of a 1969 Gallup poll of a U.S. cross-section of 1500 adults, found little difference in

level of concern about water pollution among different age groups, income groups, or educational-level groups. Barker (1971:45), in her Toronto beach user study, found that "the relationships between the evaluations and the socio-economic characteristics of the respondents were weak, particularly between the opinion of water quality and the occupation, education, ethnic origin and sex of the people interviewed". Jacoby (1972:235-236) similarly found that "none of the socioeconomic characteristics were of great importance in predicting concern although younger adults seem(ed) to be more concerned about water pollution". This latter finding suggesting that the younger the person the more likely he/she is to be concerned about water resource problems has received support from one other source (Ibsen and Ballweg 1969). Another variable which the literature indicates is correlated with concern about water is level of education, i.e., the more highly educated, the more concerned about water pollution (Ibsen and Ballweg 1969) or more favourably disposed to watershed development (Dasgupta 1967).

Several researchers have suggested that place of residence (urban vs. rural) may have some bearing on concern, but the evidence conflicts: McEvoy (1973:147) found that those living in small communities were more concerned about water pollution than those in large cities (over 1 million population); he concluded that "rural residents' greater relative concern with water pollution is found in their relative freedom from air pollution and in their greater exposure to polluted rivers, lakes, and streams". In contrast, Mitchell (1971), in a study of differences between professional water managers and lay public and among urban, urban-rural, and rural residents regarding the relative priority of water problems in Waterloo County, Ontario, found no significant differences among the urban or rural groups. He did find, however, that differences between professionals and lay public were significant--with the public placing higher priority on water pollution and professionals ranking water supply higher in importance.

While the above evidence is not resoundingly clear, it does imply three possibilities which other researchers have explored and

which will be discussed below: one, the role of education and knowledge in attitude formation; two, the individual's role or self-interest in the decision-making process; and three, the use to which the resource is being put.

6.3.3 Information and Education

It is obvious that the amount of information that people have about environmental matters will influence their attitudes and concerns about those matters. Dasgupta (1967), for example, found that landowners who were knowledgeable about watershed planning and programs were more likely to have a favourable attitude toward watershed development than those who lacked information about the program. This factor, knowledge of the program, superceded any other factors such as socioeconomic level or organizational involvement.

A study carried out by Borton and Warner (1971) illustrates the role that information can play in water management. The Susquehanna Study Coordinating Committee was charged with responsibility for a comprehensive water resources planning effort for a rather large river basin encompassing a number of counties and municipalities in Pennsylvania. As part of a communication-participation study intended to achieve two-way communication between technical planners and the affected publics, the authors interviewed two groups of respondents regarding their rankings of priority water problems. The coordinating committee members (the technical planners) were asked to identify and rank the most serious problems, as they saw them and as they thought the local leaders would rank them; a sample of the local leaders were also asked to rank the problems. As Table 8 shows, the perceptions among the groups differed substantially. After a public information program, the authors again asked the coordinating committee and local leaders to identify and rank the priority water problems. These follow-up rankings, shown in Table 9, revealed some changes, presumably arising from the public information program. As the authors (Borton and Warner 1971:297) point out:

> The second series of comparative problem rankings appears to represent a heightened awareness of local opinions and attitudes on the part of the interagency

Table 8. Differences in perceptions of priority water problems in initial questionnaires.[a]

Source and Basis of Rankings	First Priority	Second Priority	Third Priority
Coordinating Committee (own evaluation)	Flood control	Water supply	Pollution
Coordinating Committee (what local leaders would think)	Water supply	Flood Control	Pollution
Local respondents in Sub-basin 1	Pollution	Recreation	Flood control

[a] Source: Borton and Warner (1971:297)

Table 9. Differences in perceptions of priority water problems on follow-up questionnaire.[a]

Coordinating Committee (own evaluation)	Flood control	Pollution	Water supply
Coordinating Committee (what local leaders would think)	Pollution	Water supply	Recreation
Local respondents in Sub-basin 1	Pollution	Water supply	Recreation

[a] Source: Borton and Warner (1971:297)

> planning group along with a corresponding adjustment of local leaders' problem perceptions based upon information presented during the program. The authors believe this added sensitivity on the Coordinating Committee's part to local problem perceptions was due, to a significant degree, to the opportunities for more extensive local contact provided through the various public information program activities--i.e., workshops and forums held during the intervening period.

Alone, this "before-after" public information study is not highly convincing, since clearly the local leaders were still not as convinced of the seriousness of flood control as were the coordinating committee members; the local leaders continued to feel that water pollution was the first priority. The authors go on to report that, during the course of the study, one county experienced a major flood. Comparison of responses to the questionnaires before and after the flood revealed that the local leaders in the affected county rated flood control as an extremely serious problem more frequently after the experience than before (17% before; 47% after). Thus, a "crisis" or personal experience with a problem (information in a direct sense) was influential in problem perception.

6.3.4 Self-interest or Role in Decision Making

The Borton and Warner (1971) study reported above is illustrative of another factor influential in evaluation, i.e., one's role or self-interest in decision making. As shown in Tables 8 and 9, after the public information sessions, the coordinating committee members (the technical planners) could more accurately tell what was important to the public; yet they still held their own different views of the priority of problems. Several other authors have addressed this issue. Willeke's (1968) finding regarding differences between lay citizens and public health officials in the assessment of pollution in San Francisco Bay is one such example. Another is a study carried out by Sewell (1971) in British Columbia among two groups of professionals who have major roles in water quality management: water resource engineers and public health officials. Through interviews, three types of information were solicited: the ways in

which these professionals perceived problems facing society and specifically those relating to environmental quality; their perceptions of solutions to problems with which they deal; and their attitudes toward their own role and the role of others in dealing with problems of environmental quality.

With respect to perception of problems, most of the public health officials identified environmental quality problems as the major issue facing the province, followed by other social problems such as poverty, unemployment, and education. On the other hand, the engineers identified social and urban problems as the major issues, with environmental quality far down the list. Another difference between the two groups was that most health officials viewed the water quality problem as a health hazard, whereas most engineers viewed it as a production cost problem.

With respect to potential solutions, differences were also found, with health officials identifying litigation against offenders as the preferred strategy and engineers identifying construction of facilities. Such approaches reflected not only the conventional practice of the profession, but also the perceived nature of the problem.

With respect to their perceived roles and responsibilities, some differences and some similarities were found. Each group felt that their training and experience enabled them to deal with water quality problems better than any other. The engineers tended to see themselves as primarily technical advisers (with politicians being the decision-makers), whereas public health officials tended to see themselves as both advisers and decision-makers. Both groups were "jealous" of their roles insofar as they were reluctant to consult with other agencies regarding problems; even more so were they reluctant to establish links with the public, although the public health officials were somewhat more amenable to public consultation (in the form of public information programs) than were the engineers. He also found that much of the variance within and between the two groups could be explained by such variables as length of time in the profession,

seniority in the agency, and attitude toward the relationship between man and nature.

What is revealing from Sewell's study is not only the marked difference in problem perception between the two groups of experts, but also how their perceptions differ from those of the public. Whereas the public commonly perceives the water quality problem to be manifested in visible features, public health officials see it manifested in potential health effects, and water engineers in economic costs. As long as experts continue to operate in what Sewell (1971:40) characterized as "closed systems", their understanding of public awareness and concern about water problems will be limited and their efforts perhaps stymied.

The professional environmental quality managers studied by Sewell (1971) demonstrated a certain degree of self-interest, e.g., in considering themselves to hold a major responsibility for identifying and solving environmental problems. The role of self-interest has been identified by several analysts to be an important factor in awareness of and concern about environmental problems. Burby and Weiss (1971), for example, in a survey of perceptions of community problems by property owners, found that those persons acquiring property for their primary residence perceived more problems than those acquiring property for recreational use; while such a finding might be attributed to the part-time nature of the recreationist's residence, it also suggests that the permanent residents would have greater, or more intense, concerns about community problems affecting their lives.

Pierce (1979) very recently examined the question of the relationship of personal values, including self-interest, to support for preservation of water resources. Pierce found that individuals who give a high value to a world of beauty gave a higher priority to the preservation of water resources, whereas those who placed a higher value on material well-being and the comfortable life were less supportive of preservation policies. Moreover, his hypothesis that "the relationship of values to the support for water resource preservation will be stronger among people with an identifiable self-interest in water resource policy" was confirmed. The measures he used to

identify self-interest were ownership of waterfront property and the level of water resource use. The strength of the relationship of beauty and preservation among property owners was about twice the size as for non-owners. Although it cannot be concluded from this study that property owners were more likely to support preservation, it is supportive of the importance of self-interest in value formation and policy support.

6.3.5 Evaluation of Water Quality Related to Use

Just as one's personal experience with flood hazard can influence one's perception and concern about that problem, so does experience and use of a water resource influence one's perception of pollution. Jacoby (1972), for example, found a significant positive correlation between concern about water pollution and whether respondents used the waterways for recreation. Similarly, O'Riordan (1971:201) found a high degree of concern among local residents about the quality of water in Shuswap Lake, B.C., not only because the lake "was a tourist attraction, and therefore a valuable component of the local economy, but also because it was extensively used by local residents for recreational purposes". Data reported above regarding complaints by swimmers, fishermen and others about types of pollution would also support this notion of use influencing evaluation.

6.4 WATER QUALITY AND BEHAVIOUR

A few researchers have also examined the extent to which perceived water quality affects behaviour or action. By and large, these studies have examined two areas: the effect of perceived pollution on use of a water body, and willingness to pay for clean water.

6.4.1 Effect of Perceived Pollution on Recreation Use

As Swan (1973:106) has said, "There is no question that water strongly affects a person's choice of recreational site". Studies by Shafer (1969), Lime (1972), and Peterson (1974) verify the importance of water quality in camping satisfaction and campsite

selection. What is not so clear is the extent to which differing levels or types of water pollution may affect particular uses of a waterbody. Scherer and Coughlin (1971) found, for example, that more pollution was associated with less desire to undertake water-related activities at the site; however, perceived or actual pollution levels were not correlated with non-water-based activities, such as relaxing, meditating, enjoying the scenery, or picnicking. A separate study conducted by Coughlin et al. (1972) further investigated this question and found:

> The probability of using a stream site falls with increase in water pollution . . . for nearly all activities: wading and fishing, for which the relevance of water quality is direct; but also walking, sitting, bird watching, and picnicking, for which water pollution is relevant through its effects on aesthetics. Ice skating and ball playing do not appear to be affected by differences in water quality (Coughlin 1976:221).

Other studies would similarly suggest that various types of water pollution would deter certain types of activities, as for example, Barker (1971) found to be the case with some beach users. The majority of non-swimmers (who were the most critical about the water quality) expressed their desire to swim, but stated that the main factor preventing them was the poor water quality. She also found that some users who were critical of water at certain sites (e.g., Lake Ontario) would travel further distances to lakes which they judged to be clean.

6.4.2 "Willingness to Pay" for Clean Water

Several researchers have addressed the question of willingness to pay for clean water from different perspectives. O'Riordan (1971:201), in his Shuswap Lake study, examined not only the local residents' concerns about the quality of the lake, but also how ready they were to pay to preserve its quality. His findings were that "a large number of respondents felt prepared to pay substantial amounts for sewage treatment; 56% . . . willing to pay at least $60 a year (a 12% increase in local taxes); and 20%, $120 per year (a 25% increase in local taxes)".

Parkes (no date), in his study of four Saskatchewan lakes, found that, as the quality of the lake deteriorated, the willingness of users to pay for improvement increased (48% at the best lake and 98% at the worst), as did the amounts they were willing to pay. In addition, Parkes found that the variables which positively affected willingness to pay were income levels, time of the season, and amount of participation in water-oriented activities.

Erickson (1978), in a survey of visitors to Rocky Mountain National Park in Colorado, found that "Park visitors were willing to pay an average of $5.42 more in entrance fees, 165% more for water-front recreation property and devote 89% more travel time to gain natural water quality". Erickson's study (which itself is an interesting application of consumer surplus/demand curve methods to environmental quality) further identified incremental values associated with degrees of water quality (e.g., willingness to pay six cents per day in recreation fees to avoid a one-unit decrease, on a 100-point scale, in water quality), and demonstrated how these could be used in park planning and water quality planning.

Several researchers have examined the influence of water quality on residential property values. Al-Ani (1977), in a study of Pennsylvania streams, found that a one-unit increase in pH level (acidity measured by pH was the main pollutant in the selected streams) would increase the adjacent property value by $630, and that a "representative property value" could increase by $1012 when pH was 5.5 or higher. Coughlin et al. (1972:54-55) similarly found that "Houses near streams with good water are perceived as being worth between 'a little more' and 'much more' because of their closeness to the stream" and concluded that "higher water quality is perceived as having a positive effect on house value".

Obviously, the implications of these studies are not the various dollar values associated with water quality, since the studies have been carried out at different times, in different places, in differing economies, etc. The message is clear that many people value water quality sufficiently to pay for it. That Albertans share this view is demonstrated by the Peace River survey showing that more than

90% of respondents were unwilling to accept increases in water pollution even if it meant increases of more than $5000 annually to their household income (Peace River Regional Planning Committee 1972).

6.5 CONCLUSIONS AND IMPLICATIONS

The research reported in this section points up two conclusions: one being the importance of directly observable characteristics in human awareness and evaluation of water quality; and the second being the importance of use of the resource (or behaviour in relation to the resource) in human evaluation and attitude toward the resource. In the context of northeastern Alberta, two implications are clear.

The first is that water managers should be aware of the role that sensory perception and cognition play in human evaluation of water quality. People primarily perceive water quality on the basis of what they can see or smell, and secondarily on cognitive factors such as signs, scientific reports, and media exposure. Water resource managers have a special responsibility when appearance belies reality. For example, if a tailings pond appears to be clean and clear, but in reality is toxic or otherwise potentially harmful, people must be warned of the danger through cognitive measures such as posted signs or fences. The converse may also occur occasionally, i.e., when the water appears to be polluted, but in reality is a fine habitat. One author recalls such a situation at a metropolitan public aquarium, where managers felt obliged to post a sign telling visitors that the water was not dirty, but rather that the more aerated and cloudy it appeared, the better it was for the fish.

Secondly, water managers should be aware of the role that one's use of the resource plays in evaluation. Public health officials can be expected to be primarily concerned about coliform counts and toxic discharges, with lesser concern about other manifestations of pollution such as algae and floating objects. Engineers and industrial planners may be more concerned about matters of supply and treatment, with lesser interest in aesthetic conditions. Ecologists

(and some sportsmen) may be more aware of and concerned about matters of habitat and eutrophication.

Laymen, or non-experts, will be more aware of and concerned about those aspects which interfere with their sense of quality of life. Persons who place a high value on water-contact sports, e.g., swimmers, will define water quality in terms of (and will complain about and object to) algae, floating objects, oil slicks, and junk on the bottom. People who rely on the water for economic reasons (e.g., residents of Fort Chipewyan who rely on commercial or individual fishing for income or food or trappers who work beaver or muskrat lines) will be concerned about potential disruption of wildlife habitats. People (e.g., residents of Anzac) who rely upon a water body for drinking water will be aware of and complain about offensive odours or tastes of the water, even if the water is chemically acceptable.

In fact, the situation at Gregoire Lake is illustrative of the conflict-in-use problem, where Anzac residents are concerned about not only their drinking water, but also changes in trapping habitats arising from the installation of the weir to raise water levels in the lake. Users of the Provincial Park, on the other hand, can be expected to be concerned about changes in the lake that would interfere with their recreational activities, such as swimming and boating. Homeowners in the cottage subdivision can be expected to be concerned about recreational and aesthetic qualities of the lake. Whether such conflicts can be resolved at this time is debatable. However, water and environmental managers should take note of the predictability of such conflicts when multi-use or over-use of a particular water resource is allowed to occur.

AOSERP could play a research and information-dissemination role in this regard. For example, AOSERP could carry out a study of perception and evaluation of Gregoire Lake water quality, as related to individual or group use of the resource. Such a study would not only clarify the problem as it exists at the local level, but also contribute to the environmental perception literature at large.

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8. AOSERP RESEARCH REPORTS

1.		AOSERP First Annual Report, 1975
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