JAMES A. GRAASKAMP COLLECTION OF TEACHING MATERIALS

I. MANUSCRIPTS

E. Miscellaneous Monographs, Essays, and Articles

7. "Computerized Appraisal Analysis for the Appraisal of Large Acreage Wilderness Tracts: Two Innovative Case Applications", by James A. Graaskamp and Michael L. Robbins, School of Business, University of Wisconsin, (Circa 1985)

Index

COMPUTERIZED APPRAISAL ANALYSIS FOR THE APPRAISAL OF LARGE ACREAGE WILDERNESS TRACTS: TWO INNOVATIVE CASE APPLICATIONS

1. Establishing scenic quality as a significant component of highest and best use
2. Terrain analysis by air photos and computer mapping to define unique economic corridor for communication and transportation

Professor James A. Graaskamp, Ph.D., CRE, SREA
Chair, Real Estate & Urban Land Economics
Room 118, School of Business
University of Wisconsin
1155 Observatory Drive
Madison, WI 53706
(608) 262-6378

and

Professor Michael L. Robbins, Ph.D.
Assistant Professor of Real Estate
School of Business, University of Wisconsin
1155 Observatory Drive
Madison, WI 53706
(608) 262-7565

ABSTRACT

The pricing of large area roadless natural lands of great topographical and ecological diversity is a specialty within general appraisal practice which has received little theoretical or practical development.

Research has shown that the utilization of a fine grained computer mapping technique to record the physically ascertainable components of the subject and comparables, when available, can greatly advance the defensibility of value estimates. The two case studies will illustrate that the valuation process is simply the extension of general data techniques used for land use planning, and the use of a point system, to establish ordinal ranking and cutoff decisions, is well established in valuation theory. The innovative aspect of the case studies is the use of spatial data bases to systematically describe and evaluate the parcels being studied.

APPRAISAL PURPOSE AND ASSUMPTIONS

An appraisal report serves to communicate a defensible benchmark of value where value is determined by the context and assumptions inherent in the property, data base, or factors affecting buyers and sellers in the marketplace. Defining the value situation provides the basis for determination of the appropriate valuation methodology.

Appraisal Issue

The issue for which fair market value was required as a benchmark for both case example appraisals was fair compensation of a private land owner for a taking of acreage under eminent domain to advance a public project. In the first case, 25,000 acres of rugged mountain terrain was to be acquired by the U.S. Forest Service to protect and enhance a premier wilderness area in northwestern United States. The unique physical attributes suggested the highest and best use could be scenic quality conservation and that this traditional public use concept could also be identified as a private market phenomenon where there was an organized market acquiring land without right of eminent domain for the specific purpose of scenic and environmental conservation. In the second case, the acquisition of wilderness was, in fact, the acquisition of a unique set of physical attributes which determined its use as economic corridor 35 miles long; again it could be shown there was a private market for the purchase of such corridors that did not and could not operate under eminent domain. As a result, there were dramatic opportunities to link the Ratcliff tautology that most probable use suggests most probable buyer which leads to the appropriate search and selection of comparable sales with fair market value for eminent domain based on relevant application of the market approach to value.

Appraisal Principals and Definitions

Contained within the definition of market value, as provided by the American Institute of Real Estate Appraisers (AIREA) are several significant assumptions. [1] Critical to the understanding and application of the definition is that both buyers and sellers have alternative choices that are possible and of which all parties are knowledgeable so the price of a transaction presumably optimizes the self-interest of both at that particular point in time. The premise of a choice of alternative sites underlies the principal of substitution -- a cornerstone of appraisal pricing methods.

---

[1] American Institute of Real Estate Appraisers, The Appraisal of Real Estate, Eighth Edition, Chicago, IL, 1983, p. 33.

Real Estate Valuation Methodology

Contemporary appraisal process moves inductively from what is known about the property to be appraised toward identification of alternative uses that might be placed on the land. These alternative uses are then ranked in terms of economic benefit, physical suitability, political acceptability, effective demand, and economic viability at a particular point in time. This matrix of choice suggests scenarios of most probable use for the parcel which in turn suggests the nature of the most probable buyer. To estimate what the most probable buyer would pay in terms of market value, or most probable price, the appraiser must either find direct cash equivalent sales of comparable property between fully informed parties or, in the absence of current market information, the appraiser must simulate the economic logic and pricing calculus of the most probable buyer, given political constraints and available market alternatives.

Once a tentative value has been set, it must be reviewed in terms of exogenous factors such as changing interest rates, changing investor expectations about future economic scenarios, or other factors not explicitly considered in the basic pricing formula.

The following cases will illustrate these issues clearly. The appraisal of the Alpine Lakes Area will illustrate the application when direct comparables are available. The Ahtna corridor appraisal will illustrate the application economic logic and pricing calculus drawn from negotiation principles of comparable transaction representing Ratcliffian simulation.

CASE 1
THE ALPINE LAKES APPRAISAL

Introduction

The goal of the research was to develop a methodology for the valuation of mountain wilderness land. [2] The need for the methodology arose in part from an increased public and private awareness of the social value of natural landscapes, specifically, wilderness. This awareness is manifested in a variety of individual and community actions toward preservation, but none as important as the passage of the National Wilderness Preservation Act (NWPA).[3] This statement of public intent by the Congress established the legislative basis for the creation of wilderness areas. In general, areas designated as wilderness are to be created out of lands primarily owned by the U.S. government, but, to the extent that private ownership is included in those designated areas, ownership rights are to be acquired by the federal

---

[2] Michael L. Robbins, Methodology For Evaluating, Ranking, And Pricing Mountainous Wilderness Lands, (Madison, WI: Unpublished Ph.D. Thesis, University of Wisconsin, 1983), p. 3-7.

[3] Public Law 88-577, Wilderness Act, 88th Congress, September 3, 1964, (78 Stat. 890: 16 U.S.C. 1131-1136).

government. The form of these acquisitions can range from donation and trade to purchase of fee simple title. While the NWPA gives the government the right to acquire property under the government's power of eminent domain, the Act clearly suggests that condemnation is not to be the principal method of acquisition. [4] Emphasis is given to negotiation of value difference between private and public parties in settling differences between value estimates. In all instances a negotiated determination of just compensation is sought.

The research focused on a specific acquisition of approximately 23,000 acres of private lands, owned by 20 individuals, located in the Cascade Mountains, in the state of Washington. (See Figure 1).

These lands were to be acquired by the federal government for inclusion in the Alpine Lakes Wilderness Area, authorized by passage of the Alpine Lakes Management Act (ALMA), by the U.S. Congress on July 12, 1976.

The ALMA authorized acquisition by donation, trade or purchase, with the value basis being the "fair market value" of the private interests being acquired. Beginning with an initial primes of estimating fair market value, the research showed how the definition of fair market value leads to the need for determination of the land use policy most appropriate for the property being valued. In appraisal practice, this procedure is referred to as determination of "highest and best use".

An important component of the research was to recognize "wilderness" as the best use having economic capacity to compete with other land use policies, such as logging and recreational home development, and how the identification of wilderness as best use could become operationalized within appraisal methodology. The research further described how the best use definition lead to the identification of the valuation method utilized and how the valuation method was applied for pricing.

Significance of Research

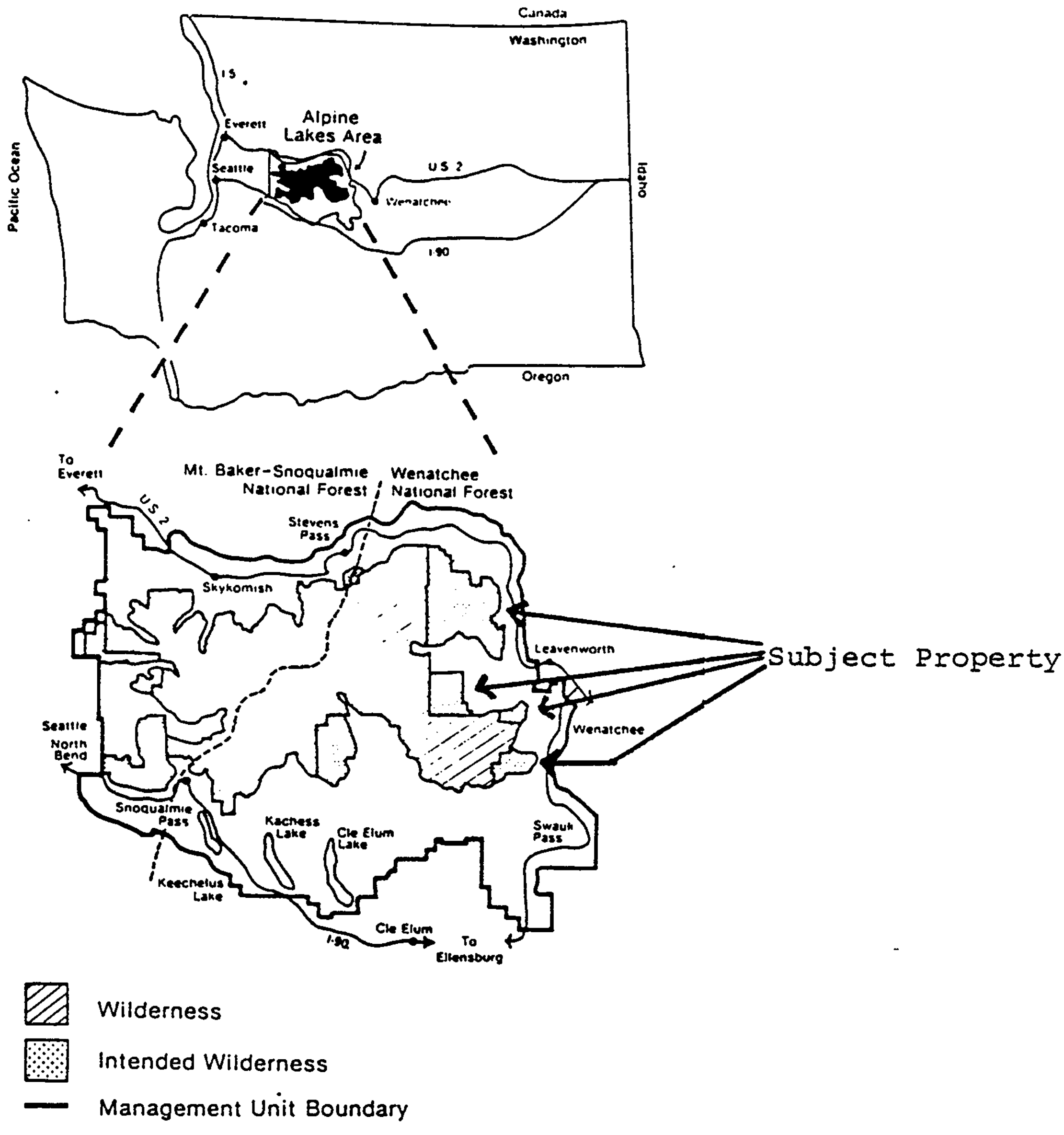
The research has shown that spatial data base concepts can be used to price individual appraisal units, explicitly recognizing the unique combinations of ascertainable facts present in each appraisal unit. Rather than assigning average values for only limited amounts of the total site (valuing the site for timber or recreational lot development by either the aggregate or multiple regression methods), the techniques utilized in this project provided for the pricing of each individual appraisal unit making up the subject property.

---

[4] Report of the Controller General of the United States, Federal Land Acquisitions By Condemnation -- Opportunities To Reduce Delays And Costs, (Washington, DC: General Accounting Office, May 14, 1980), p. i.

Figure 1

Subject Property - Vicinity Map



Data from Land Management Plan, Alpine Lakes Area, U.S. Department of Agriculture, Forest Service, Wenatchee and Mt. Baker Snoqualmie National Forests, 1980.

The development of the Wilderness Evaluation System (WES) provided for the use of physical attributes and user attitudes, based on ascertainable fact, in establishing proxies for recognized wilderness characteristics. Through the use of the WES, individual wilderness attribute scores were determined for appraisal units as small as 10 acres. The WES also allowed individual 10 acre cells to be combined into alternative appraisal units as large as 640 acres.

Having established the wilderness proxies, the wilderness scores were evaluated and priced using an attribute matching methodology which was not dependent upon inferential statistical reliability for accuracy. In addition, the attribute matching pricing methodology provided for testing of alternative pricing models allowing internal consistency and appraisal goals to be evaluated and maintained. Finally, the derived price estimates are provided in a format which is easy to follow and explain, thus, adding greatly to the defensibility of the price estimate.

Appraisal Methodology

Since land appraisal depends primarily on market comparison as opposed to income or a cost approach to valuation, the goal of the research was to establish a methodology to enable the market comparison valuation method to be applied to the pricing of the subject property. While this is a simple statement of intent, the implementation was very difficult, partly because of a complex land ownership pattern overlayed on the scale and diversity of a complex physical pattern.

It has been indicated that of the three most likely methods of appraisal, the most desirable is to estimate value from what buyers have done in prior transactions (inference). This preferred method of determining most probable price is to infer future market behavior from recently completed market transactions. This method implies that a prudent person will not pay more to buy a property than it will cost to buy a comparable substitute property.

The concept of comparable substitute states that buyers have personal values which they attach to combinations of specific attributes. Then, through a process of evaluation and elimination, buyers will match attributes from one property to another in deciding which property (if any) provides the greatest amount of satisfaction relative to its cost. Thus, it can be seen, that the application of the market comparison method of real estate valuation requires the collection and analysis of pertinent data which describe the attributes of both the comparable properties and the subject property. It is through these analyses that an indication of the transaction range for the subject property can be estimated.

The structure of the contemporary appraisal clearly indicates that in order to be properly sensitive to the attributes affecting economic value, it is important to analyze any economic unit of land, from residential lot to national wilderness, by collecting relevant data according to the five following categories: [5]

1. Physical attributes, such as size shape, soils, geology, slope, water, flora and fauna, etc.

2. Legal/political attributes affecting use and degree of decision making within the private sector, including federal, state, county, and private land use controls relevant to the parcel.

3. Linkage attributes -- those relationships which tie the site to systems such as roads and sewer or to peripheral activities and establishments which may generate demand for the parcel.

4. Dynamic attributes which have to do with how people perceive a site -- such as prestigious, dangerous, attractive, enjoyable, beautiful, etc.

5. Environmental attributes have to do with off-site impacts of the subject property. Such as storm water runoff, or destruction of a view shed.

The contemporary appraisal process prefers to compare the subject property in terms of specific, physically ascertainable attributes to broadly similar properties which have sold to a class of buyers with similar motivation. Therefore, it is necessary to describe the physically ascertainable attributes of the subject property which may be significantly related to alternative uses for the selection of the most fitting use. In the case of the Alpine Lakes Wilderness, where the subject properties were owned in a checkerboard pattern adjoining both government and other privately owned positions, it was also necessary to place the subject properties in context to the regional pattern and sub-environmental systems. (See Figure 2). Comparison of scale, physical diversity, ruggedness, and quality of the properties in question creates a data problem of unusual proportions. Nevertheless, the distinctions between and among subject properties and comparables must be retained with sensitivity if pricing inferences are to be equitable.

Spatial Organization

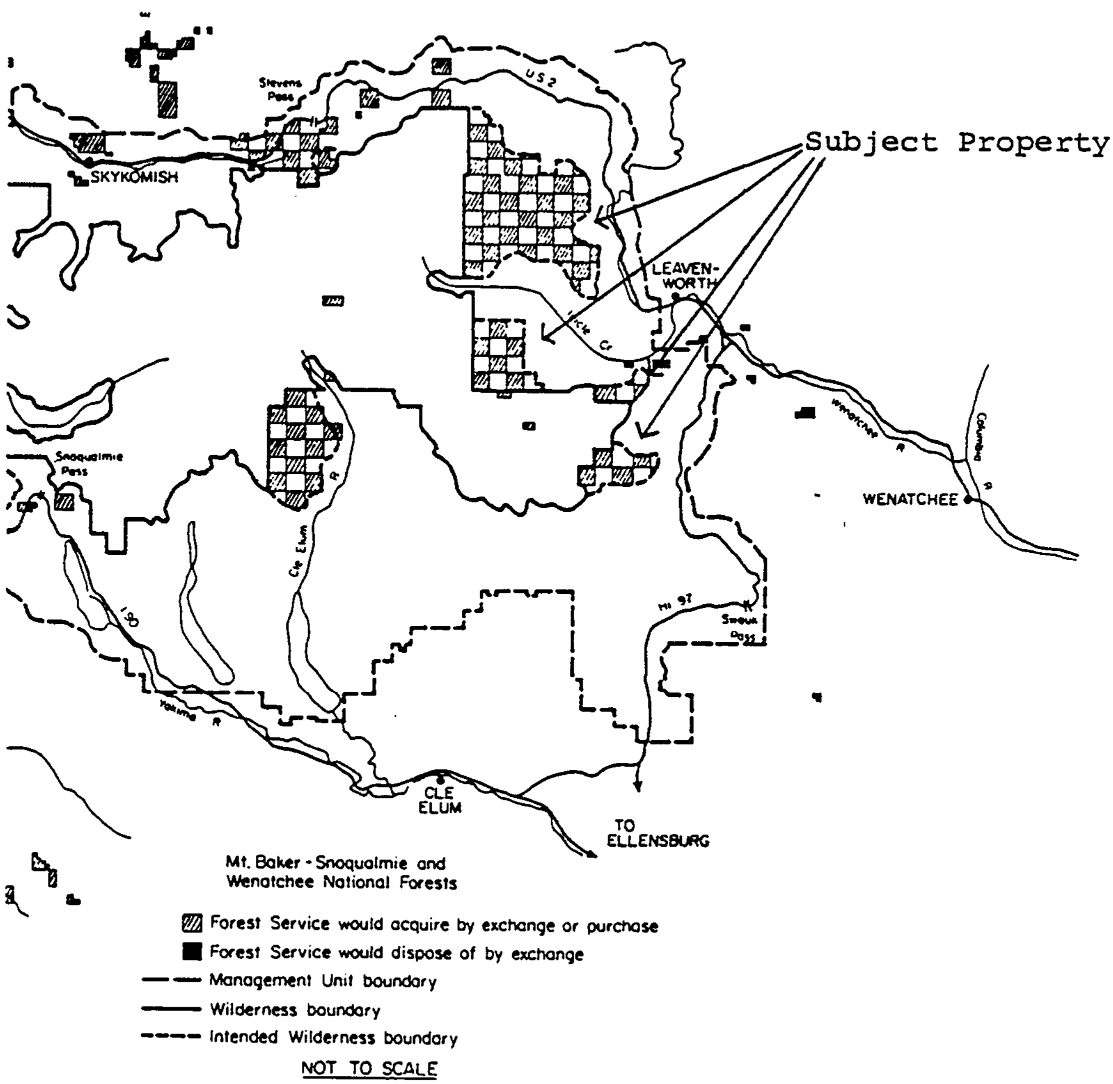
In order to describe the subject properties in a context of a regional pattern, a computerized spatial data base was constructed. The spatial data base covered an area roughly 13 miles wide by 23 miles long and includes an area of approximately 133,000 acres. (See Figure 3A & 3B).

---

[5] James A. Graaskamp, The Appraisal of 25 N. Pinckney: A Demonstration Case for Contemporary Appraisal Methods, (Madison, WI: Landmark Research Inc., 1977), p. 11-12.

Figure 2

Subject Property - Alternate Sections



Data from Draft Environmental Statement, Alpine Lakes Area Acquisitions, Wenatchee and Mt. Baker-Snoqualmie National Forests, Pacific Northwest Region Forest Service, U.S. Department of Agriculture, 1978.

Figure 3A

Subject Property Spatial Reference
(Township/Range Reference)

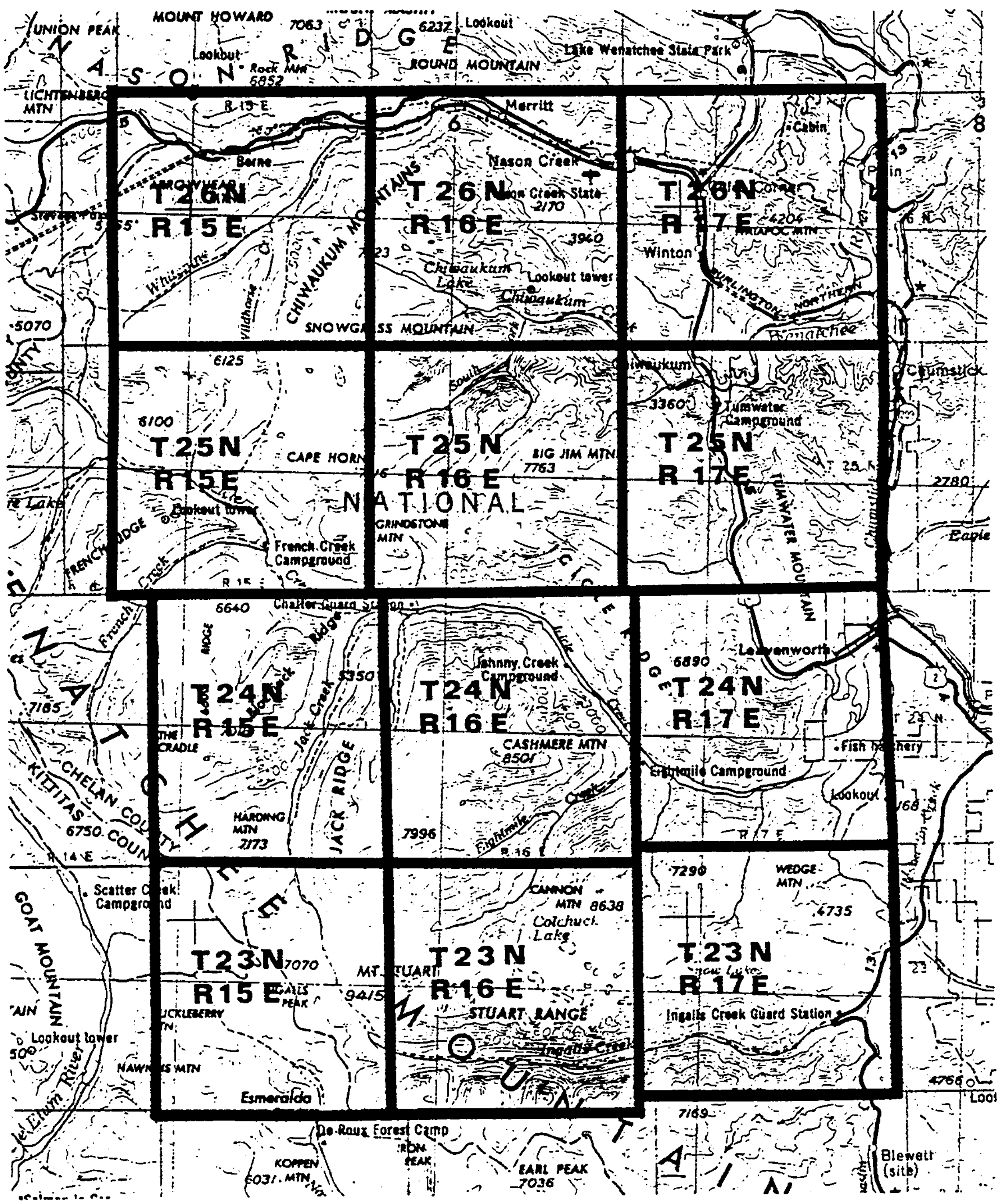
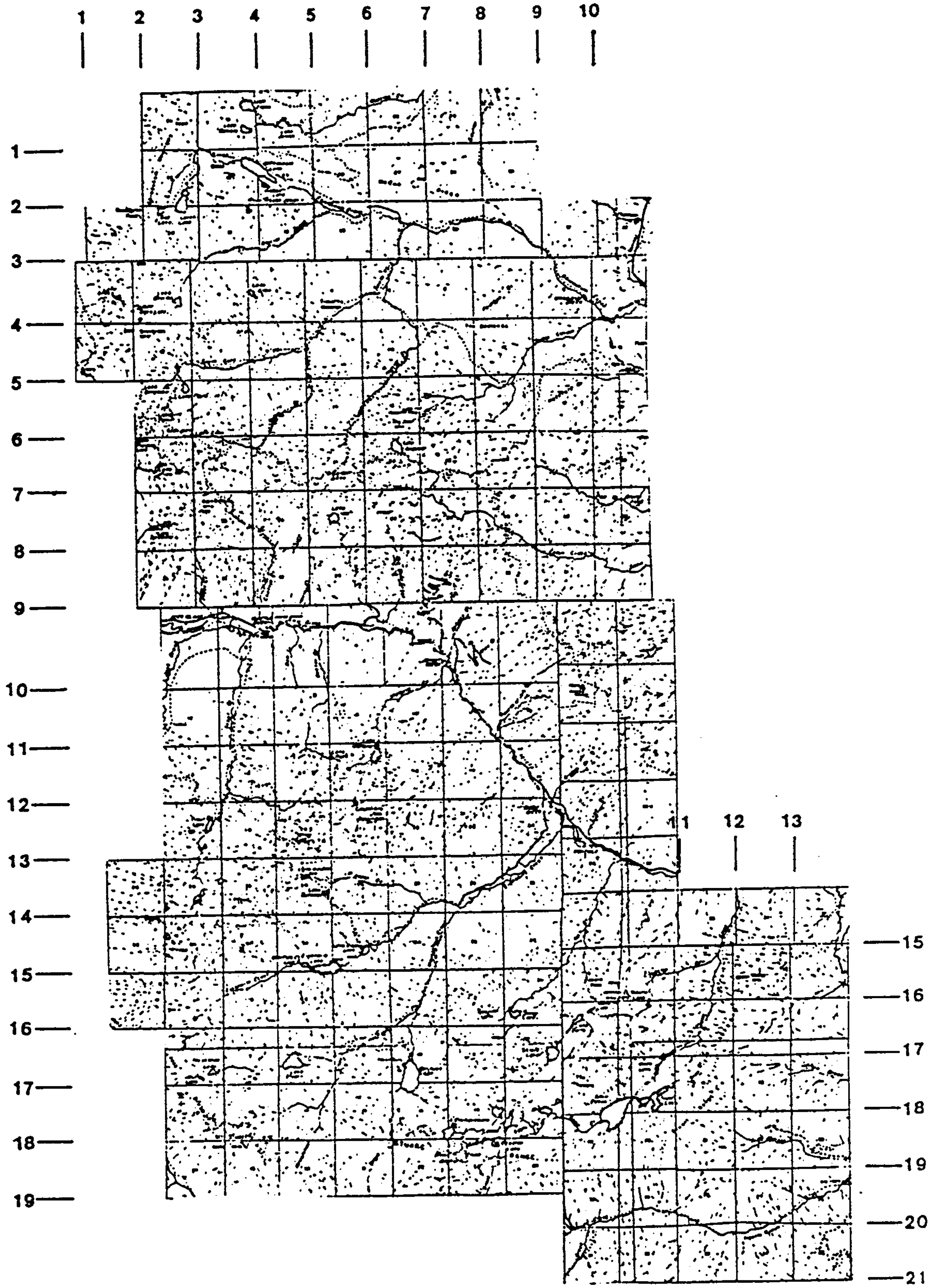


Figure 3B

General Spatial Reference Scheme



The recording of data for record keeping and storage in the spatial data base is based upon an arbitrary X-Y coordinate basis. Each pair of X-Y coordinates references a unique 640 acre section, based on the township and range mapping system. The X coordinates (columns) range in value from 1 through 13 and the Y coordinates (rows) range in value from 1 through 23. The starting X-Y coordinate (1,1) is located in the northwest corner of the data base beginning at Range 15E, Township 26N, Section 24. (See Figure 3A & 3B).

Data Representation

In most instances a predetermined numerical value, identifying a condition of the variable of interest, is coded into each cell of the coding form. For example, if the variable being coded is slope aspect the value coded into each of the cells identifies the predominant direction that the slope is facing within the cell. For this variable, the numerical identification value utilizes integer values between 0 and 9 to denote the direction of the slope aspect; the value 1 denotes a north facing slope, the value 9 denotes a multi-directional slope and the value 0 indicates the cell is mostly flat. The fact that the north facing slope has a value of 1 and the multi-directional slope has a value of 9 does not imply that the multi-directional slope is 9 times better or worse than the north facing slope. The numerical value is used for identification purposes only. The transformation from a numerical identification to a judgemental evaluation score is accomplished later. (See Figure 4).

The data for the subject and comparable properties was then collected, coded and stored into spatial data bases, one for the subject property and one for each comparable property, where the resolution and content was kept constant. With the data so configured it was then possible to implement systematic evaluation and analysis procedures.

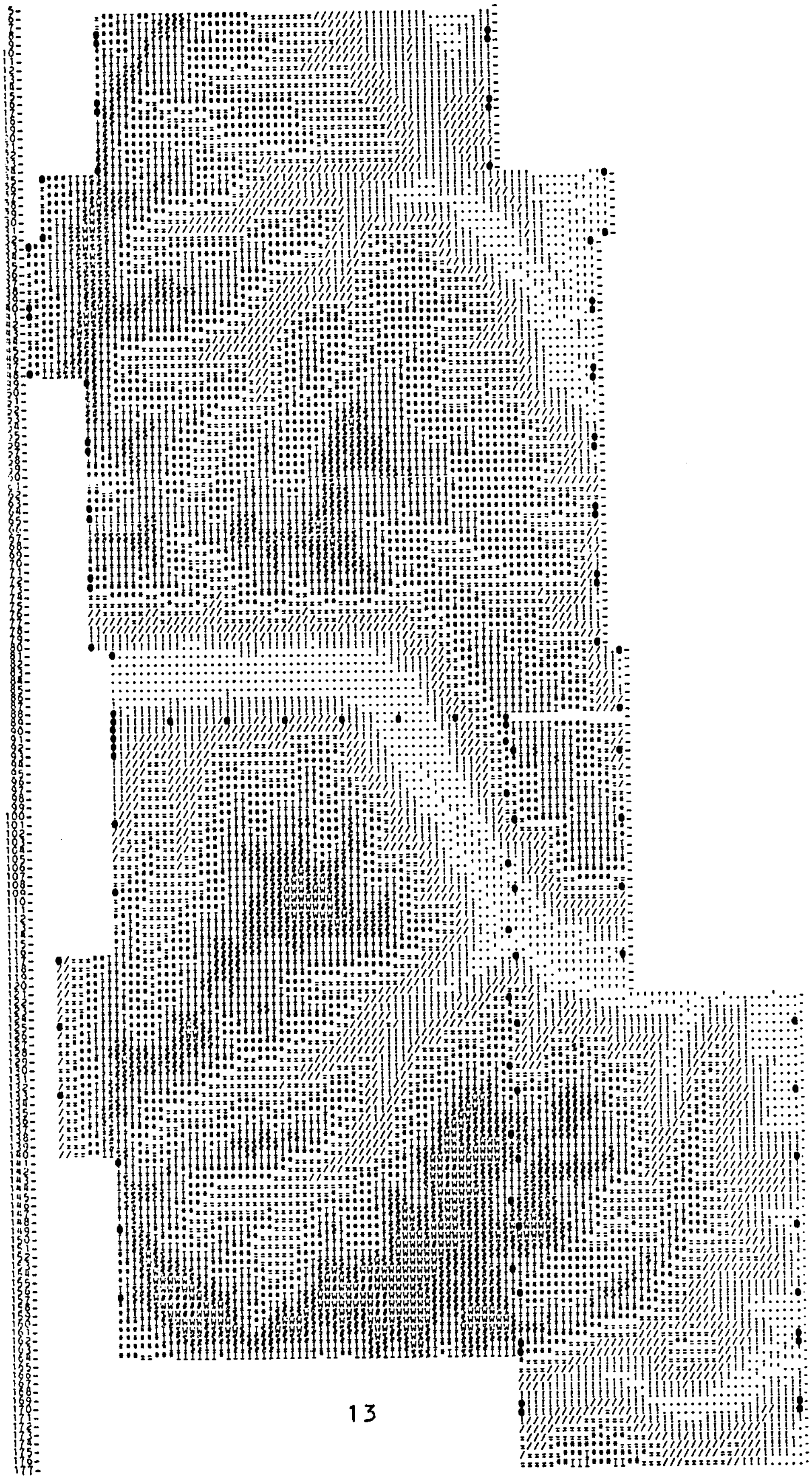
A systematic or automated data processing model leading to valuation of the subject property was also necessitated by the fact that there were a number of legal issues to be resolved relative to establishing the date of taking, the definition of the larger parcel for possible severance damage compensation, and related matters as to the unities of use, ownership, and contiguity. As these issues would be negotiated in the future or determined by court action, the appraisal process would have to be updated to be consistent with such determination in a very short period of time to continue the trial or counsel the property owner during negotiations. Given detailed data on the properties, the only feasible methodology for revaluation with changing directives on key parameters was to build an automated or semi-automated system.

Market Comparison Approach to Value

The basic concept of the market comparison valuation method is to search for properties which might have served the same uses as that indicated as best use for the subject property to be appraised on the principle that buyers will tend to pay as top price only as much as they would have had to pay for reasonable substitutes -- a presumption about behavior often referred to in the textbooks

Figure 4

Elevation in Rank Order



as the principle of substitution. For wilderness lands there are three major conditions for executing this task:

1. There is an orderly market for parcels of singular scenic quality and other wilderness attributes producing transactions at arms length without recourse to eminent domain.

2. There is adequate information to adjust sale prices of transactions meeting the first condition for external factors such as time of sale, financial terms and custom conditions short of a cash sale in fee simple, and that the appraiser can exercise judgment in the application of reasonable adjustments for differences in location or imbalances in the market to the degree that these differences are unique to only some of the comparables.

3. There is a common denominator for comparison of sales once adjusted for condition two above that will overcome differences in both size and quality or suitability for the use presumed.

Steps in the Market Comparison Approach

In selecting market transactions, comparability should consider location, physical attributes, and motivation of buyer and seller. These issues may be addressed through application in the following five steps:

1. Research the market to identify similar properties for which data are available; pertinent sales, listings, offerings, etc.

2. Qualify the prices as to terms, motivating forces, and bona fide nature.

3. Compare each of the comparable properties' important attributes to the corresponding ones of the property being appraised, under the general categories of time, location, physical characteristics, and conditions of sale.

4. Consider all dissimilarities and their probable effect on the price of each sale property to derive individual market value indication for the property being appraised.

5. From the pattern developed, formulate an opinion of market value for the property being appraised.

The determination of the comparability of individual sales leads to the most general and difficult problems in the application of the market comparison method. Each parcel of real estate is distinctive as to the land on which it is situated. Land may vary in its locational features, topography, views, soil conditions, etc. Consequently, the appraiser employing the market comparison method must take all of these factors into consideration in using market sales of differing parcels to estimate the value of the subject property.

Adjustment of Comparable Sales for Externalities

To equalize comparative sales for terms of sale, regional locale, improvements included with land, differences in development or market pressures, and price change over time due to dollar devaluation, it was necessary to set up rules for adjusting sales prices to a common date, a common bundle of rights, terms of sale, and market context.
The sales prices, adjusted for time and other externalities, became the basis with which to appraise the subject property. The adjusted sales represent prices paid for wilderness properties, generally purchased with the explicit buyer objective or implicit recognition that the property would largely remain wilderness, and meet the second condition of the market comparison approach.

Establishing Comparative Wilderness Scores

The key to the market comparison approach is selecting a relevant unit for comparison, a unit that measures the kinds of utility which the buyers think they may be purchasing. A Mercedes-Benz and a Ford pickup cannot be compared on price per pound, but corn land is rated in bushels per acre of production, and grazing land is compared on animal unit months of carrying capacity rather than just acres. Bushels and animal unit months are simple point systems which reflect complex combinations of soil, water, climate, and farming methods.
Farm appraisal provides another useful analogy. When comparing farm sales, it is necessary to reallocate the total purchase price to the different types of land, including tillable acres, meadowland, woodlot, bottom land and so on, in terms of their relative contribution to the farm as an economic enterprise.
The principal component of this research was the development of a wilderness evaluation procedure that would enable the identification of an appraisal unit that could be used for comparison, on both the comparables and the subject, and allow for the implementation of the market comparison valuation method.

THE WILDERNESS EVALUATION SYSTEM

The need to develop a systematic data analysis procedure resulted in establishing a data organization process defined as the Wilderness Evaluation System (WES). At the heart of the WES is a procedure of data organization and representation modeled after the Wilderness Attribute Rating System (WARS), which was developed as a component of the Roadless Area Review and Evaluation process (RARE-II), by the U.S. Forest Service, United States Department of Agriculture.

The WES was developed to specifically address the problem of representing the significant physical characteristics of the comparables and the subject property that wilderness buyers were most likely purchasing. The WES was designed to provide an inventory of ascertainable facts describing the physical characteristics of the land which are implied to be important to the buyers of wilderness land.

The WES is composed of the three requisite components included in the WARS process: Apparent Naturalness, Opportunity for Solitude, and Opportunity for Primitive Recreational Experience. In addition, the WES includes a supplemental component for the evaluation of View Quality. Each component contains several attributes related to recognized wilderness qualities.

For this project, the inventory of the wilderness attributes was compiled using a 10 acre cell as the basic unit for evaluation. The 10 acre cell was selected after diversity tests (tests designed to measure the frequency of change with individual attributes when measured at alternative resolutions) were done on 25 selected transacts of a mile in length each.

Attribute Weighting

The WES consists of ten attributes scored on an ordinal basis in which each attribute has a minimum possible score of 0 and a maximum possible score of 10. (See Table 1.) The ten attributes were grouped into four components of wilderness, modeled after the WARS section of the RARE-II procedure. It was determined that the most defensible weighting scheme, from a legal standpoint, would be to set up a weighting scheme in which each attribute would be weighted equally, relative to the component in which it was assigned, and that each component would be weighted equally to each other. (The Wilderness Act of 1964 identified the three primary wilderness components; Wilderness Quality, Solitude and Primitive Recreation Experience. The 1964 Act also permitted any of four supplemental attributes (including Scenic Quality), if present to a significant degree. Neither the Wilderness Act, the Alpine Lakes Act nor the RARE-II analysis suggest one component more important than another.) This type of weight distribution is consistent with contemporary appraisal theory in that the appraiser is attempting to remove any one-sidedness relative to one component compared to another.

Table 1
Attribute Weights

I.	Wilderness		.25
	Apparent Naturalness	.25	
II.	Solitude		.25
	Distance to Perimeter	.0625	
	View From - Rev.	.0625	
	View To - Rev.	.0625	
	Vegetation Screening	.0625	
III.	Primitive Recreational Experience		.25
	Challenge	.08334	
	Diversity - % Slope	.08333	
	Diversity - Terrain	.08333	
IV.	View Quality		.25
	Scenic Quality Est.	.20	
	View From	.05	
	Wilderness Attribute Score		1.00

The Wilderness Attribute Score (WAS) represents the composite score of all four wilderness components and is derived by summing the resultant weighted attributes comprising the Wilderness Evaluation System. The model was used to derive estimates for each of the attributes and components and combined to establish a measure of wilderness (WAS) for each 10 acre cell making up the subject property as well as the individual comparable properties.

Determine Average Price Paid Per WES Attribute

As appropriate for the market comparison approach a broad search for properties purchased for conservation purposes as unique resources was instituted across the northwest on the eastern side of th major mountain range in areas of similar climate, rainfall, and treeline levels so that vegetative growth rates were comparable. Comparables were ultimately found in the Cascades, Idaho primitive area, western Montana, and western Wyoming. Adjustments were made for payment terms, time of sale, and special background negotiations. Location had to recognize the density of tourism and proximity to urban centers using highway traffic data as a measure of recreational consumer recognition of the wilderness area. The adjusted purchase price then represented the value placed on the physical characteristics of the total parcel. Through the application of the WES to the comparable property, it was possible to estimate the total wilderness attributes present within the property's boundary. With this information, the average price paid per attribute could be estimated. For example, for the Phelps Creek comparable, the adjusted purchase price of the 357 acre property was $287,000. When the information was processed the analysis indicated that the total attribute points scored was 265.66. By dividing the adjusted purchase price of $287,000 by the total attribute score of 265.66, the resulting average attribute price per point of $1,080.31 was determined. This indicates that the buyer paid $1,080.31 for each wilderness attribute point inventoried in this comparable.

Distribution of Price Paid

Having determined the average price paid for each wilderness attribute, the next step was to use the information to indicate the price paid for individual 10 acre cells, making up the comparable. The indicated price for each cell in the comparable is determined by multiplying the number of attributes within the cell times the average price paid for each attribute. For Phelps Creek, the average attribute score per cell was 6.325, however, evaluation of detailed information shows that the attribute scores ranged from a high of 6.592 to a low of 2.946. By redistributing the adjusted purchase price, by the number of attributes present within the cell, indicates that the price paid for the maximum attribute cell is 6.592 times $1,080.31 or $7,121,40 and the lowest cell is 2.946 times $1,080.31 or $3,182.59. The sum of all the cells' assigned prices are equal to the adjusted purchase price for the entire comparable ($287,000). The important point is that the better quality cells (those with the greater number of attributes) receive a greater portion of the purchase price.

This process of allocating price to the cells with the greater amount of attributes is modeled after the process frequently used in the appraisal of farm land. The procedure, usually referred to as the allocation method, requires the appraiser to identify the major types of land making up the parcel and then distribute a portion of the price to each of the landscape units. The appraiser would then have to evaluate the market of farm sales and develop an evaluation procedure for valuing each of the composite parts to derive an overall price estimate.

The wilderness evaluation system operates on the same primes, except the spatial unit is fixed at 10 acres and the attributes evaluated are fixed at 10.

ATTRIBUTE MATCHING - THE PRICING PROCESS

The implementation of the attribute matching process utilizes a data processing technique designed specifically for automated market comparison called MKTCOMP. [6] Over the years, MKTCOMP has been used intensively by such federal agencies as the National Park Service in the acquisition of the southwest Everglades in Florida, The National Wildlife Service in the evaluation of the border waters in Minnesota, and the Bureau of Indian Affairs for pricing agricultural land. Private appraisers have used it for ranch lands, single family homes, and rental comparisons as well as automated community tax assessment.

The MKTCOMP process permits definition of an initial subset of sales data using Euclidian distance in terms of the sum of the squared dollar adjustments to rank a preliminary subset of specified dimension. A second refinement of the subset is then processed to rank the available comparables in order of "closeness" to the subject parcel. It should be noted that the appraisers anticipated a court fight on every step of the methodology so that the techniques selected were those that had been used at some point by the National Park Service for land analysis or valuation. Indeed, some of the techniques had been highly touted in a seminar for wilderness analysis sponsored by the Park Service. However, the sequence of techniques as they were relevant to the real estate appraisal process had never been recognized before. The appraisers were in the fortunate position of having tutored various federal agencies in the use of MKTCOMP and having some statistical evidence of the frequency with which it had been applied in other federal compensation matters so that there was strong reason to believe that the automated models components could be upheld in the courtroom.

For the purpose of this project a special version of the MKTCOMP program was developed. The change provided for the identification and selection of the landscape unit (cell) from the comparable that is most similar to the landscape unit of the subject being priced. In this way, the most similar representative from each comparable property is chosen.

---

[6] MKTCOMP is an automated market comparison program specifically designed to implement the market comparison procedure. The system was developed at the University of Wisconsin by H. Robert Knitter with the cooperation of a joint project of the appraisal professional groups called EDUCARE, The Educational Foundation for Computer Applications to Real Estate.

In order to execute this process in a data processing mode without placing many constraints upon the manner in which the appraiser wishes to express judgment, experience and insight, the MKTCOMP system has the following components:

1. A subject file which provides the attributes' scores for the landscape units making up the subject property. This could be 10, 40, 160, or 640 acre cells.

2. A comparable sale file which consists of the landscape units, in the same sequence and scale as in the subject file, and an indication of the price paid to acquire the landscape unit.

3. A factor file which identifies each attributes adjustment amount, in dollars or percent of selling price, for a difference between the comparable's attributes and the subject's attributes.

4. A ranking procedure which displays the comparable landscape units in order of their similarity to the subject landscape unit being evaluated. The degree of similarity between the subject landscape unit and the comparable landscape unit is generated from the combined adjustments for differences in wilderness attributes, between the subject and comparables.

To illustrate how the pricing process works, two example cells will be processed; a subject cell and a comparable cell. Recall, the third step in the market comparison approach to value, to indicate the degree that the subject and comparable are similar. To the extent that the two property units are similar, no adjustment will be necessary. Table 2 identifies the attribute scores for the subject and comparable cells.

Table 2
Pricing Example Cells

	Attribute	Subject	Comparable
1.	Apparent Naturalness	10.00	8.30
2.	Distance	0.00	2.52
3.	View From - Rev.	2.52	1.89
4.	View To - Rev.	2.50	2.14
5.	Vegetation Screening	1.58	1.26
6.	Challenge	0.00	0.00
7.	Diversity - % Slope	0.50	3.32
8.	Diversity - Terrain	1.00	1.63
9.	View To - Normal	0.00	0.50
10.	Scenic Quality	3.20	3.20

In identifying the degree of difference between each wilderness attribute, by subtracting the attribute score of the comparable from the subject, two important steps have occurred. The first is the obvious, the indication of difference. The second step is the implicit indication of the degree of similarity. For example, the scores for Apparent Naturalness are 10.00 for the subject and 8.30 for the comparable. This indicates that the two parcels are different by 1.7 units, but also shows that they are similar by 8.3 units. This implicit recognition of the level of similarity is an important component of the attribute matching method of price estimating.

In the attribute matching method, an adjustment is applied only to the difference between attributes, thus, for the units of similarity between the subject and comparable, no adjustment is made. To account for the price difference between attribute scores, the difference is multiplied by an adjustment factor. (This factor is generally determined by the appraiser through analysis of the comparable file.) The adjustments are then combined and added to the selling price of the comparable. If the net adjustments are negative, the comparable's selling price is reduced, if the net adjustments are positive the selling price is increased. In this way the attributes of the comparable are adjusted to be similar to the subject and any difference is used to adjust the selling price of the comparable.

If this process, determining the degree of difference between each attribute, followed by converting the difference into dollar adjustments and adding the adjustments to the purchase price, is continued for all comparables in the comparable file, the result is that each comparable in the data file is priced as if it had the exact attributes as the subject.

Identifying Similarity - Selecting Comparables

The key to unlocking the attribute matching method is being able to identify similarity and in selecting comparables. Having developed a pricing method which can be consistently applied to all comparables, which is robust and meets the objectives of the buyer profile, the last step is to extend the process to be compatible with the requirements of the market comparison method. Recall, that the market comparison method requires a set of market transactions to be selected from the pool of all similar transactions. Also note that selection is based on those comparables most similar to the subject in physical characteristics.

The attribute matching method just described, gives the basis for selecting those properties most similar to the subject, from all the adjusted comparables. Note that the comparable properties most similar to the subject property (the 40 acre subject compared to the 40 acre comparables) will be the comparables with the least amount of adjustment made to their purchase prices. By identifying the 40 acre parcels that received the least amount of adjustment, it is possible to automatically find the best subset, from the total set, which are most similar to the subject.

The idea of similarity can be implemented in several ways. The first method would be to define similarity as being the net adjustment made to any comparable parcel. By searching through the data file of adjusted comparable properties, it would be possible to find the number of comparables that received the smallest net adjustment and call them most similar. However, the use of the net adjustment has some problems for selecting most similar parcels. For example, it may be possible to have two comparable parcels quite different in attribute scores but resulting in the same net adjustment. For example, if the first comparable parcel was exactly like the subject parcel, no adjustment would be necessary. If the second parcel had two negative adjustment of $-500 and a single positive adjustment of $1,000, the parcels net adjustment would be zero (0), exactly like the first parcel.

The method employed by the MKTCOMP program to measure similarity and thus choose comparable properties, and overcome several problems in attempting to use either net adjustments or the absolute value of the adjustments is Euclidean Distance. The Euclidean Distance model states that the total distance in multi-dimensional space is equal to the square root of the sum of the squares of the individual attributes. In appraisal this means that an index for selection can be determined for each comparable by summing the squares of the adjustments made for differences between the subject and the comparable and then taking the square root of the sum. The number (Euclidean Distance) is referred to as the selection index and is the basis for determining the level of similarity between the subject and comparable, measured in dollars.

MKTCOMP OUTPUT

When the MKTCOMP program is run, a property report is printed for each cell of the subject property and the report consists of the following six reports: (See Figure 5)

1. Selection Summary
2. Subject Parcel Identification
3. Adjustment Summary
4. Comparable Parcel Identification
5. Adjustment Detail
6. Selection Index Identification

Selection Summary

The Selection Summary summarizes the impact of the first three decision rules imposed by the appraiser. Decision Rule #1 directed the selection process to consider the best 28 comparable sub-sales for each 40 acre subject parcel. This resulted in the 28 most similar parcels (of the 265 alternatives) being selected for each subject parcel.

Following the completion of Decision Rule #1, Decision Rule #2 was activated. Decision Rule #2 addressed the problem that some of the 15 original comparables sales contributed more sub-sales to the most similar 28 than others. To avoid one comparable sale dominating any particular set, the appraiser directed the system to accept only the first and best sub-sale from any specific sale, up to a maximum of 10 sales. Thus, the maximum number of sub-sales (chosen one each per comparable sale) to be used in estimating the price of the subject parcel would be 10. Figure 1 shows that after the 28 most similar sub-sales are selected the number of sub-sales is reduced to 7 and the mean of the adjusted prices of these 7 is $66,821.23 with a standard deviation of $45,644.23.

At this point Decision Rule #3 evaluated the distribution of the remaining 7 sub-sales' adjusted prices. Decision Rule #3 discarded (from the sub-sales surviving Decision Rule #2) any sub-sales having an adjusted price of more than plus or minus two standard deviations from the mean of the cluster of Rule #2. This prevented outliers from having a major impact on the price estimate. Figure 1 indicates that Rule #3 reduced the

Figure 5

MKTCOMP Property Report

Selection Summary (1)

7	NCMPS					
28	NCMPS	66821.23437	AVE ADJ PR	45644.22656	STD DEV	
7	NCMPS	66821.23437	AVE ADJ PR	45644.22656	STD DEV	
6	NCMPS	56652.95703	AVE ADJ PR	40392.65234	STD DEV	

Subject Identification (2)

1 4 49 2 10 4.

Adjustment Summary (3)

ADJUSTMENT ==

FACTOR	TYP	RATE	AVE.	S-DEV.
SALEID	1.	0.00	0.	0.
PRICE	0.	1.00	64041.	44146.
APPNTL	1.	2427.00	3242.	3545.
DISTANCE	1.	607.00	-759.	759.
VIEWFRMR	1.	607.00	736.	354.
VIEWTOR	1.	607.00	512.	288.
VEGSCRN	1.	607.00	139.	219.
CHALLENG	1.	809.00	178.	359.
DIVSLOPE	1.	809.00	-1020.	685.
DIVTERRA	1.	810.00	84.	157.
VIEWTON	1.	485.00	-462.	226.
SCENICQL	1.	1942.00	130.	827.
AVE ADJUSTED AMT			56653.	40393.
WEIGHTED AVE.		61500.		

Comparable Identification (4)

59:C30	1	35.	4.
50:C22	1	2.	3.
174:C40	1	53.	4.
85:C35	6	23.	4.
27:C16	2	19.	4.
109:C36	2	33.	4.

Adjustment Detail (5)

FACTOR	SUBJECT	59-AMT	ADJ	50-AMT	ADJ	174-AMT	ADJ	85-AMT	ADJ	27-AMT	ADJ	109-AMT	ADJ
SALEID	0.00	30.00	0.	22.00	0.	40.00	0.	35.00	0.	16.00	0.	36.00	0.
PRICE	0.00	69250.00	69250.	84785.00	84785.	29649.00	29649.	19148.00	19148.	104219.00	104219.	14331.00	14331.
APPNTL	10.00	9.15	2063.	8.30	4126.	10.00	0.	10.00	0.	5.75	10315.	8.30	4126.
DISTANCE	0.00	0.00	0.	2.50	-1518.	0.00	0.	0.00	0.	2.50	-1518.	1.25	-759.
VIEWFRMR	2.46	0.55	1159.	1.00	886.	1.50	583.	1.00	886.	2.18	170.	0.75	1038.
VIEWTOR	2.31	0.55	1068.	1.50	492.	1.75	340.	1.42	540.	1.92	237.	1.88	261.
VEGSCRN	1.58	1.88	-182.	0.83	455.	1.25	200.	1.06	316.	1.63	-30.	1.56	12.
CHALLENG	1.25	1.25	0.	0.55	566.	0.83	340.	1.25	0.	0.42	671.	1.66	-332.
DIVSLOPE	0.75	1.74	-801.	2.21	-1181.	3.07	-1877.	0.50	202.	2.08	-1076.	1.66	-736.
DIVTERRA	1.66	1.33	267.	1.77	-89.	1.74	-65.	1.74	-65.	1.49	138.	1.49	138.
VIEWTON	0.05	1.56	-732.	1.20	-558.	0.80	-364.	1.20	-558.	0.26	-102.	1.40	-655.
SCENICQL	3.20	2.80	777.	3.73	-1029.	3.60	-777.	3.20	0.	2.60	1165.	3.20	0.
ADJUSTED AMOUNT			72869.		86936.		28029.		20470.		114189.		17424.
SELECTION INDEX			500. (2)		1155. (6)		667. (4)		520. (3)		1025. (5)		410 (1)

Selection Index (6)

number of sub-sales from 7 to 6, which in turn changed the mean price from $66,821 to $56,653 and reduced the standard deviation by $5,200 to $40,393.

Subject Parcel Identification

The subject parcel identification report (Figure 1) displays the spatial information data of the subject parcel being priced. This information is processed and is used to develop the summary reports by ownership.

Adjustment Summary

The adjustment summary report (Figure 1) summarizes the adjustments by wilderness attribute, which were applied to the chosen sub-sales (those remaining after Decision Rule #3). The last line of the report shows the third price estimate derived by the MKTCOMP process; i.e. WEIGHTED AVE. This estimate is determined by applying the sum of digits weighting formula ((N*(N+1)/2)) to the rank order adjusted prices. Note that this is consistent with contemporary appraisal methods which indicate that the comparables most similar to the subject property should be given the greatest amount of weight.

Comparable Identification

The comparable identification report (Figure 1) displays the selected comparables in rank order according to their similarity to the subject parcel. The basis for determining similarity is the Euclidean Distance measure derived when the comparable sub-sales are matched to the subject and adjusted using the price adjustment rates from the factor file.

Adjustment Detail Report

The adjustment detail report (Figure 1) displays the adjustments made to each attribute. The sub-sales are listed beginning with the most similar and moving to the least similar.

CONCLUSION

Contemporary appraisal theory recognizes that an appraisal is an opinion of value for an adequately described property, as of a specified date, supported by the analysis of relevant data. Furthermore, contemporary appraisal theory recognizes that the appraisal opinion is a conviction founded on acceptable evidence but with less than perfect knowledge, thus the determined value estimate will be subject to variance, leading to the determination of most probable price.

This project did not attempt to remove any decision making or rule setting control from the appraiser. The goal of this project was to address the issue of adequately describing the subject and comparable properties and providing the property descriptions to the appraiser in a usable and easily understood format. A usable and easy to understand format is important so that the appraiser can readily simulate the reactions of real-life users in the market in response to particular combinations of attributes and to the net benefits which these attributes are capable of generating.

The need to adequately describe a sample of competitive properties is to suggest that if the comparable properties were offered for sale at the same time as the subject property, buyers would consider then as reasonable alternatives. Clearly, the comparables need not be identical to the subject property, for buyers will consider different combinations or packages of attributes as substitutable. The degree of attribute variation tolerable for a buyer group will depend upon the weights which they, the buyers, attach to the various attribute groups.

The implementation of a market comparison pricing model, driven by procedures for selecting similar comparable sub-sales was an explicit recognition that buyers and sellers weigh similar attributes differently, even when the intended use is the same. By selecting the single most similar sub-sale from individual comparable properties, the price/weight difference within individual comparable properties is recognized and utilized in ascertaining the price estimate of individual subject sub-units.

This project has demonstrated that through the use of spatial data base concepts, the descriptions of the subject and comparable properties are improved because the spatial data base can be sensitive to variation over short distances. With the improved property description, in combination with the attribute matching pricing method, a more reliable and acceptable appraisal model has been developed.

The appraisers always anticipated a courtroom battle as federal attitudes reflected an early era of $50 an acre for snow and rock plus timber values for commercial timberlands only, suggesting a value of $8 to $12 million for this subject property, depending where the date of taking was set relative to stumpage price cycles in northwestern United States. On the other hand, scenic quality suggested values in the neighborhood of $30 to $34 million for the acreage in question. A preliminary presentation was made to an assistant U.S. Attorney General and a number of knowledgeable land specialists with federal agencies, but the Park Service continued to postpone making a jurisdictional offer long after the time for acquisition had expired as defined by the Wilderness Act. The property owners went into court requesting an effort at negotiation and purchase or condemnation as required under law. A summer was spent defining legal positions and preparing a visual series of 4 feet x 8 feet display boards with which to teach a jury the appraisal process. Suddenly, there was a settlement on the steps of the courthouse in the fall of 1983 providing approximately $28 million for the taking, to the satisfaction of the property owners and the disappointment of researchers hoping for a court review of the process. The size of the federal agency move from its own initial appraised values to the actual settlement may represent tacit recognition of the methodology and the concept that scenic quality, which can be a public good, is also, in fact, a commodity in the private land market.

CASE 2
WILLOW-HEALY INTERTIE APPRAISAL

Introduction

In December 1971, Congress passed and President Nixon signed the Alaska Native Claims Settlement Act Pub. L. No. 92-203, 85 Stat. 688 (hereafter ANSCA). This significant piece of Indian legislation settled the land claims of the Alaska Native people by providing for a grant of 43 million acres of land and $965 million in cash. The settlement is administered by 12 Regional Native Corporations and 200 or so village corporations. Seventy thousand Alaska Natives hold shares in these corporations.

AHTNA Inc. is the smallest of the 12 Regional corporations with slightly more than 1,000 Alaska Native shareholders. The Ahtna region, the section of the state in which Ahtna and its eight villages select their lands, is in eastern South Central Alaska. Within this area AHTNA, Inc. and its villages selected 1,750,000 acres of land. The Ahtna land selection pattern encompasses, among other things, village sites, subsistence areas, wilderness, and commercially developable acreage. The land selection pattern also takes advantage of a unique attribute of the Ahtna region: traditional Native lands and certain Ahtna villages lie across the only two routes from Fairbanks in the interior to tidewater, either through Windy Pass, Cantwell, and Broad Pass to Anchorage, or through Gakona, Gulkana, Tazlina, and Copper Center to Valdez.

The Native land settlement in 1971 was the second of three major pieces of legislation which were to determine land tenure in Alaska in the post-statehood era. The first was the Statehood Act of 1958, Pub. L. No. 85-508, 72 Stat. 339 with its grant of 104 million acres of federal land. The third was the Alaska National Interest Conservation Act of 1980, Pub. L. 96-487, 94 Stat. 2371 which set aside over 80 million acres of federal land for parks, wilderness and related purposes. The balance of the land is held by the federal government; a small amount of Alaska land, about 1 percent, is in private ownership.

By 1983, in many respects, Alaska had the appearance of the western United States though, to be sure, on a greatly enlarged scale. Its vast public holdings were interrupted by large blocks of Indian lands or impressively sized parks, all of which were punctuated by relatively small cities, towns, or villages wherein lay the limited private residential and/or commercial lands. At points throughout this subcontinental land mass, energy and other great resources were to be found. Development of these resources, movement of energy, transportation of resources, or travel of Alaskans between resources, markets, and/or population centers was of course influenced by the three legislative land developments.

In that regard, the location of Native or Indian lands in Alaska compares with the locational properties of Indian land in the lower 48 states. Both in Alaska and outside the state, blocks of Indian lands either contain significant resources or lie athwart routs used to transport energy or resources. In the latter instance, those wishing to use such routes must confront the fact of Indian ownership or find alternative land to cross. While Alaskan Indians have, in the past ANSCA years, moved to receive their land entitlement, the Indians of the lower 48 states, particularly those in the Western United States -- with federal and state agencies and/or private users, through the courts or by arm's length negation -- have developed a meaningful way of addressing the question of valuing these special attributes.

Appraisal Issue

The issue for which the appraisal was sought as a benchmark was fair and reasonable compensation of AHTNA Inc. for granting fee title to the benefit of the Alaska Power Authority for an electrical transmission right-of-way 35 miles long, and 170 feet wide, access roads, two-year leases for two staging areas, and land deemed necessary for construction of the Cantwell Substation and substation transmission line stud -- a project generally identified as the Willow-to-Healy Intertie (Anchorage/Fairbanks). The initial impetus for the valuation was a right-of-way agreement dated April 1983 between the Alaska Power Authority (APA) and AHTNA Inc. The appraisers advised the clients that there was reason to believe that legal precedents in northwestern United States required the Ahtnas to sell only a ten-year, limited use easement, limited to an intertie. There was reason to suspect that use as an intertie was a way of avoiding federal envirnomental impact regulations that are applicable if the installation is a regular transmission line, regulations which may have imposed significant costs and a less visible route on the Power Authority. Suspicion was fostered by acquisition of the right-of-way twice as wide for the balance of the required corridor and construction of a 345 KV line to operate at 138 KV for ten years. There were rumors that engineers were exploring the development of gas-powered turbine generators to be floated ashore at Prudoe Bay to manufacture power from unused natural gas reserves at a price less than the controversial Susitna Dam, a future generating project which would also need the same transmission corridor if it were built. The appraisers argued that a taking in fee was excess condemnation and should be resisted by the Ahtnas. For the appraisal, the appraiser chose to follow precedent for similar easement rentals of land held in trust for Indian tribal groups in the western United States.

As to duration, the law limits the initial duration to a maximum of 50 years or the terms of the specific permit granted by those regulating the power company relative to the specific capital improvements requiring the easement.[7] In this case, APA requested a permit to construct a 345 kV line and to initiate operations at 138 kV for ten years. If matters ran parallel to Federal Regulation Code (FRC) 25, 169.14, [8] any change in this format would require a new permit and a review of rental rates for the easement. The standard of

----

[7] Details on the early history of ANSCA and other significant Alaskan land developments have been supplied by Walt Parker and Associates. Parker is uniquely qualified to comment on significant Alaskan land development in light of his professional career which includes service on the Alaskan Federal Field Committee, as Commissioner of Highways, and State Co-Chairman of the ANSCA mandated Federal-State Land Use Planning Commission. See also FELIX S. COHEN'S HANDBOOK at FEDERAL INDIAN LAW (1982 ed.), pp. 739-741.

[8] Opinion 529, Federal Power Commission, The Montana Power Company, Project No. 5, Opinion and Order Readjusting Annual Charges, Issued October 4, 1967.

reasonableness that govern Federal Energy Regulatory Commission (FERC) pricing of land interests recognize the need to readjust annual charges for right-of-way easements from time to time on a de novo basis as the context and larger purpose of right-of-way easements change in terms of function, throughput, and the relative value added to the system by specific land routs. [9]

Definition of Property Interests Valued

General components of real estate interests that were valued include specific corridors necessary for construction of a transmission line route 170 feet wide and approximately 34.68 miles long, certain permanent access road right-of-ways, two-year leases for two construction staging areas, and lands necessary for construction of the Cantwell Substation and Cantwell Transmission line stub as a connector to the Power Authority.

Future options, all of which tied the line into FERC-licensed energy generation projects, might also include transmitting gas-generated power from Anchorage to Fairbanks, coal-generated power from Healy to Anchorage or Fairbanks, or hydroelectric power from Susitna to Fairbanks. As a result, values for the corridor occupied by the Intertie were set only for the initial capacity of about 100 MVA at the 138 KV level, a limit dictated by the size of the transformers.

Discussion of a perpetual easement seemed inappropriate. Since pricing of a power line right-of-way easement rental should be related to its economic benefits, depending on function and intensity of electrical transmissions, the appraiser choose to define the duration of the easement as an easement of 10 years with some sort of reevaluation option, either on a decade-by-decade basis or when the power generation driven boost to 345 kV takes place. Rental payments will be reestablished de novo at each exercise of that option or at the time of the 345 kV boost, including lands occupied by the Cantwell Substation and supporting lines. The appraiser further assumed the limited uses, with the exception of the Cantwell Substation and related support systems, to be those of a 138 kV Intertie line operated so as not to exceed 100 MVA of output. These clarifications and assumptions were necessary to operationalize the valuation provisions of the right-of-entry agreement of April 1983.

---

[9] Right-of-Way width and length are from the November 26, 1982, appraisal of the subject by Alan G. Olson.
Total property taken:
714.55 acres, or 31,125,798 square feet
31,125,798 square feet/170 feet = 183,092.93 linear feet
183,092.93 linear feet/5,280 feet = 34.68 linear miles

Limitations on Use

Since in comparable instances the FERC has tied compensation for lands involved in electric power generation and transmission to the net present value of the program in place and would permit periodic review of the compensation on a de novo basis, limitations were tied directly to time periods of specified uses in the permits granted by regulatory authorities in the process of regulating various components of the total system. In addition, the intensity of current passing through the lines determined not only their economic productivity, but also influences the degree of interference that occurs between the electric system and adjacent uses, people, and environment. In short, until permits are modified, use of the line as constructed is limited to 138 kV-100 MW and activities necessary to maintain these lines. Even the modification of transformers off-site which control the capacity of the initially overbuilt Intertie line on the subject parcel should trigger a review of compensation for use of the corridor.

Other Interests Affected

Installation of the Intertie line entirely within the easement borders prescribed may still encroach on property interests of AHTNA Inc. on their remainder lands within the approximately 80,000 acre total parcel. The sight, sound, and field forces generated will adversely impact other elements of potential economic development including construction of a natural gas pipeline, possible recreational development for tourism, the quality of subsistence hunting, or enjoyment of aesthetic, cultural, and historical attributes in the affected area. While subjective values are unknown, opportunity costs of avoiding all of these consequences was known and provided an objective basis for measuring degradation of interests in the remainder land.

Appraisal Methodology

The agreement between AHTNA Inc. and APA was unspecific about appropriate methods of valuation for pricing the easement and so the appraiser first looked to comparable situations in recent federal-state relationships, significant court decisions, regulatory agency precedents and actual market behavior of those negotiating right-of-way easements in the absence of eminent domain powers. There was also the basic economic logic of appraisal precepts, reflecting the contribution value of land to commercial enterprises.

FERC and Court Precedent

The governing law and regulatory precedent for valuation methodology was believed by the appraiser to be clearly delineated in an opinion and order issued June 3, 1981, by the U.S. (FERC) relative to the Portland General Electric Company for its project number 2030. The case established the need to adjust rates for rental of land as changing conditions warranted on a de novo basis. Further, it stated reasonable charges would be fixed "upon the commercial value of the tribal land involved, for the most profitable purpose for which suitable, including power development." The case had many parallels to the subject property including the determination by the court to ignore special values attributable to the narrow gorge controlled by the Natives in allocating values to the land. It is useful to quote a portion of the court direction in the Portland General Electric case in order to structure this case report:

> The judge determined, upon considering the statute and applicable case law, that the standard against which a determination should be measured is simply the requirement that the annual charge must be reasonable. (I.D. 4-6) The judge decided that in determining reasonableness the Commission was required to strike a balance between two competing interests. On the one hand, the Act is designed to achieve a comprehensive development of the Nation's water power resources for the benefit of the general public. On the other hand, the Indians are entitled to receive "fair treatment" through the charge for the use of their land.
>
> Moving beyond these general guidelines, the judge noted three more specific bases for determination of a reasonable annual charge. These were:
>
> (1) The charge should be based on the commercial value of the tribal lands for the most profitable purposes for which they are suitable, including power development.
>
> (2) The charge should reflect the relative value of the various parcels of land which were contributed to the project by various parties.
>
> (3) A reasonable charge must be determined <u>de novo</u> at each readjustment proceeding.
>
> The judge then examined the evidence in light of the foregoing criteria. (I.D. 6-16) The evidence consisted of the testimony of various experts as to appropriate means of determining a reasonable annual charge, and the results obtained by such means.
>
> The judge first rejected an approach proposed by the Company which relied on the annual charge set for 1957. The judge called this an indexing approach. This method adjusted the 1957 charge to reflect the change in power costs from 1957 to 1977.
>
> The judge then addressed the remaining approaches. He found that these fell into four categories. He denominated these approaches as: (1) land value appraisal; (2) earnings on equity; (3) profitability; and, (4) net benefits.
>
> He determined that the record in this proceeding recommends the net benefits approach as "the most reliable and least speculative means of determining a reasonable annual charge for the use of tribal lands." (I.D. 20) On the basis of his application of the approach, the judge found the annual net benefits of the project to be \$5,525,125. (I.D. 32)

The final step that the judge used in determining reasonable annual charges for the tribe involved allocation of the net benefits among the various owners of project lands and the project developer.

The judge first affirmed the applicability of what he described as the traditional formula of dividing the net benefits equally between the project developer and the landowner.

The judge turned then to a determination of the proper allocation of the value of the Tribes' share of the total project lands. He noted that the Tribes own 36.34 percent of the project lands. He concluded that the Tribes would be entitled to 18.17 percent of the net benefits. That is, the Tribes receive 36.34 percent of the 50 percent which was allocated to the landowners.

In this case, the net benefit value for the Intertie line, as constructed and limited to 138 kV, was determined by consulting engineers for the Alaska Power Authority and was available as a basis of determining rent for the subject easement. [10]

Actual Market Negotiation Precedents

A series of right-of-way settlements on tribal lands and reservations involving both petroleum and electric transmission lines are predicated on the well-established rent concept that land is a factor

of production and can be valued according to the marginal value added after accounting for labor, capital, and management. [11] Value added is a clearly quantifiable factor that can be derived and measured from the amount of profit it creates or the savings it provides relative to the next best opportunity available to the entrepreneur. Value added is not price, since a land-owner could raise rents to a point where it was cheaper for the tenant to take a less productive, less convenient piece of land when the supply of alternatives made that possible. Market price for land rises toward the economic value added only as the supply of alternative land is reduced or the cost of using alternative supplies of land are greater than the rental differential.

---

[10] See the Commonwealth Associates, "Anchorage-Fairbanks Transmission Intertie Route Selection Report, dated January 1982 and referenced specifically into valuation analysis by Professor F. L. Alvarado in Appendix D, paragraphs 7-12. of The Appraisal of The AHTNA Inc. Corridor For The Willow-Healy Intertie, (Madison, WI: Landmark Research Inc., Unpublished Appraisal Report)

[11] For a discussion and comparison of the classical view of rent to contemporary land economics by Dr. R. U. Ratcliff in his classic text, Urban Land Economics, (New York: McGraw-Hill Book Co., 1949) Chapter 12, "Land Income and Value" specifically Substitution and Price, pp. 366-367.

Thus, the opportunity cost doctrine for pricing right-of-way indicates that rental values are a function of the cost of an alternative route. Value added equals market price when the landowner has a monopoly on routes. These fundamental economic principles have been applied in at least eleven settlements for right-of-way by The Council of Energy Resource Tribes, represented by Dr. Ahmed Kooros and Dr. Ted Smith. These land economists have reported their work [12] in both The Appraisal Journal (specifically a note in Volume L1 #2, 1983, pp. 294-298) and the Right of Way Journal (specifically Application of the Opportunity Cost Doctrine to Right-of-Way Valuation). Pipeline settlements became the prototype for later transmission line agreements. Pipeline values were also shown to be relevant to the subject case in terms of severance damages that may have been caused by the positioning of the Intertie line as it was built. Because the power companies had alternative route options available at extra cost and because settlements were reached without benefit of the power of eminent domain, which is unavailable relative to reservation lands, application of the principle to transmission lines for electric power was clearly applicable as evidence of market behavior. Thus, these were arm's length agreements reviewed by government agencies, such as the Bureau of Indian Affairs, and considered to be in the best interest of the Indians and by FERC for best interests of consumers. In short, knowledgeable buyers and sellers were dealing from positions of relative parity in terms of skills, economic insight, and choice--fundamental assumptions of fair market value.

Transactions negotiated to reflect the land contribution to net present value of benefits include: [13]

(1) First, a settlement of a four-year dispute between the Navajo tribe and the Four Corners Pipeline Company, an Arco subsidiary. Arco, of course, dominates energy production in Alaska. In this case, the Bureau of Indian Affairs had already accepted $400,000 to issue a right-of-way grant for a 20-year

---

[12] Theodore Reynolds Smith and Ahmed Kooros, "Application of the Opportunity Cost Doctrine to Right-of-Way Valuation," The Appraisal Journal, 51:2 (1983), 294-298. "Application of the Opportunity Cost Doctrine to Right-of-Way Valuation," Right of Way (October 1984) 22-26, as reprinted from "The Opportunity Cost Doctrine: An Application to the Valuation of Tribal Land," The Real Estate Appraiser and Analyst (Spring 1984) 15-20, published by the International Society of Real Estate Appraisers.

[13] Details on transactions have been summarized as reported by Ahmed Kooros, Ph.D., who negotiated the settlements. The parties regard the details as confidential and privileged industrial secrets. Although details are sketchy, the numbers are irrelevant since each case is unique relative to opportunity cost savings or net present value benefits of the specific project. The significance is definition of net present value by the utility as a basis for computing rents, a 50/50 split of the producers surplus between the utility and the landowner for its proportional contribution of Indian land to the total route, and a discounting of benefits to the present after adjustment for inflation and for quantity of throughput.

period for a for a 12-inch pipeline, 262 miles long with a 75-foot easement. Based on opportunity costs, the negotiated settlement has approximately $9,000,000 present value for a 20-year stream of income of $92,000,000 in 1981. The line now carries Alaskan heavy crude, which is shipped to the Port of Long Beach, California and then on to Texas. The settlement, which called for a $0.03 per barrel of throughput in December 1980, adjusted annually according to the Consumer Price Index (CPI), was 50 percent of the net beneficial interest to the company of crossing the Navajo land as compared with detouring around the reservation. The reservation terrain is relatively flat, but optimal from a pipeline engineering point of view. This case established a precedent for all rights-of-way easement grants across Indian reservations. It has displaced the traditional real estate appraisal method of a price per rod of right-of-way and has advanced the self-determination goal of Indian tribes.

This latter objective is significant in light of the Alaskan Native corporation situation where the lands were selected for their potential to participate in economic development. If AHTNA Inc. is to become a viable, taxable enterprise by 1991 because of direct participation in the economic development of Alaska, it must be from compensation for the economic contribution of the highest and best use of Native lands to long term economic development of the state.

(2) In the wake of the Navajo settlement, the Pueblo of Laguna settled with Texas Eastern Gas Company (Transwestern Gas Pipeline Company) for $1.5 million for a 20-year term of a 32 inch, 35 mile gas pipeline on a 50 foot easement. The tribe received $1.5 million up front for the present value of a $17 million income stream, representing 50 percent of the net present value of the benefits.

(3) Additional lump sum settlements representing 50 percent or more of the opportunity costs as measured by 50 percent share of the proportional contribution of Indian land for:

a. El Paso-Laguna pumping station site.
b. The New Mexico Gas Company-Laguna 8-inch, 9 mile gas pipeline.
c. CENEX-Ft. Berthold 8-inch, 6.7 mile product line.
d. PureTransportation-Navajo gathering line.
e. Texas New Mexico-Navajo 16 inch, 68 mile crude pipeline.

(4) The Winnebago-Nebraska public power district 345 kV transmission line was disputed in court for four years until finally settled in 1983 out of court. The 345 kV line was surveyed to cross 31 tracts of tribal and allotted lands, 104 acres in total, of which 2 acres were tribally owned. The utility companies had been granted the right to condemn the allotted parcels, but not the tribal ones. Nebraska Public Power District (NPPD) had

planned to deviate the center line to avoid tribal sections but later expressed the willingness to negotiate. NPPD figures indicated a savings of $1.2 million by crossing the Indian lands and accepted the offer to settle for an easement rental of 50 percent of the savings, or $600,000. The final settlement came to $629,000 for a 50-year easement across 2 acres of flat and optimal land. The easement is for 100 feet on each side of the center line and includes recognition of the corona noise and adverse field force effects which may appear from time to time as a result of climate conditions. The final settlement included $20,000 for engineering scholarships for Winnebagos and fees for the Council of Energy Tribes representing the Winnebagos, based on like provisions in the Arco-Navajo case.

These settlements are consistent with the growing theory of the economics of property rights and the ways in which society assigns and entitles property rights. Social benefits and social costs of utility rights-of-way and the valuation of real estate related thereto, including severance damages, are greatly affected by the Coase Theorem. [14]

The ultimate objective of contemporary appraisal is to locate sales of similar properties where buyer and seller are of similar motivation in order to simulate and anticipate the transaction price most likely to result relative to the subject property. The cases above demonstrate the principle of arm's length bargaining and the acceptability of opportunity cost based rental values to rational, profit-minded utilities who have the opportunity to weigh other alternatives and choose the best solution in terms of equity to the landowner, timely economic development that is environmentally sound, and FERC's concern for cost-effective solutions in the rate payer's interest.

Appraisal Principles and Definitions

Recall the definition of market value provided by the American Institute of Real Estate Appraisers (AIREA). Critical to understanding an application of the definition is that both buyers and sellers have alternative choices that are possible and of which all parties are knowledgeable so the price of a transaction presumably optimizes the self-interest of both at that particular point in time.

The market approach assumes value will reflect prices paid for comparable interests; the cost approach assumes value will not exceed the cost to create an alternative facility; and the income approach assumes that income streams are purchased on some parity of risk and return among alternative investments.

---

[14] See R.H. Coase, "The Problem of Social Cost," Journal of Law and Economics, 3 (October 1960), 1-44; Harold Demsetz, "The Exchange and Enforcement of Property Rights," Journal of Law and Economics, 7 (October 1964), 11-26; Harold Demsetz, "Some Aspects of Property Rights," Journal of Law and Economics, 9 (October 1966), 61-70; Harold Demsetz, "Toward a Theory of Property Rights," American Economic Review, 57 (May 1967), 347-59; and George Stigler, "The Economics of Information," Journal of Political Economy, 69 (June 1961), 213-25.

Land such as the subject property of this example case is in part an economic commodity, and therefore the pricing of land in terms of fair market value presumes certain economic principles are operational in the pricing model. Often taken for granted, it is nevertheless useful to bring these economic principles to the foreground, at least in summary fashion, for the complexities of the subject's case: [15]

1. The principle of supply and demand is that price varies directly, but not necessarily proportionately, with demand, and inversely, but not necessarily proportionately, with supply.

2. The principle of substitution states that when several similar or commensurate commodities, goods, or services are available, the one with the lowest price attracts the greatest demand and widest distribution.

3. Related to the principle of substitution is the concept of opportunity cost, the sacrifice of opportunities not chosen or the cost of options foregone. Fair market value considers that the land owner receives economic rent reflecting the surplus productivity contribution by the real estate interest; if the contract rent is less than economic rent, the landowner suffers an opportunity cost while the tenant receives an economic surplus from the landlord's bad bargain. This principle will be shown to be a significant factor in negotiating prices for right of way.

4. The principle of balance is that value is created and sustained when contrasting, opposing, or interacting elements are in a state of balance. Balance thus affirms that a proper economic mix of types and locations of land uses in an area creates and sustains value. The relationships between the entire property and its environment, and those among the various property components, constitute applications of the principle of balance. Concepts related to balance are (1) conformity, (2) contribution, and (3) surplus productivity.

5. A property's external conformity refers to the relationship between the property and its surroundings. Land uses may be nonconforming and thus damage surrounding property values due to adverse impacts including noise, dust, unattractive views, physical danger or other sources of friction.

---

[15] For the full text from which this is abstracted, see pp. 22-27, Chapter 2, "Foundations of Appraisal," The Appraisal of Real Estate (Chicago, IL: The American Institute of Real Estate Appraisers, 1983).

6. A property's internal conformity occurs when the four agents in production--labor, capital, coordination, and land--are appropriately combined in the property. Fertilization of farmland provides a simple example of internal conformity. Applying fertilizer increases crop yield only up to a point. The optimum amount of fertilization is achieved when the value of the land's crops does not increase with any additional expenditures for fertilizer--the point of balance. For example, expenditures for conservation of scenic quality or environmental integrity would be out of balance if they exceeded the net surplus value of the product.

7. Contribution states that the value of a particular component is measured in terms of its contribution to the value of the whole property or by how much that part's absence detracts from the value of the whole. For example, the unavailability of a specific route for a transmission line might require a more expensive installation on an alternative route and this increase in cost over the preferred route is the opportunity cost of the optimal route; the opportunity cost to the user is the economic surplus to the landowner. The sharing of this contribution is the subject for setting fair market rent for the use of the land.

8. Surplus productivity is the net income that remains after the proper costs of labor, capital, and coordination have been paid. As market price moves toward surplus productivity assigned to the land depending on supply and cost of alternative sites.

9. The principle of externalities is that external economies or diseconomies result from goods, products, or conditions that have a positive or negative effect on people other than those who produce or own the goods or products, or who create the conditions.

10. Real estate is affected by externalities more than any other type of economic good, service, or commodity. Its physical immobility subjects it to many types of external influences. Such influences emanate from all levels--international, national, regional, community, and neighborhood. Influences may be as broad as international currency or national policies "on the use of wilderness land or as narrow as a the corona of a high tension line on a neighboring property." An appraiser should be knowledgeable about, and analyze the impacts of, all such influences on a parcel of real estate.

The logic of the appraisal process depends on analysis of alternative uses for the property--prior to a conclusion by the appraisers as to that use--from among reasonable, probable, and legal alternative uses. FERC and the courts indicate that power line placement should be one of the uses to be considered. Highest and best use must be determined to be physically possible, appropriately supported by effective demand under prevailing market conditions, and financially viable given the level of demand and cost that supports the highest present value of economic surplus. But, note that any hint of laissez-faire economics is tempered by the need to recognize uses that are consistent with community goals and land use planning--i.e., sensitivity to social and environmental concerns as well as profit maximization. The definition may be applied to land as though vacant or property as improved. In the subject case the land was essentially vacant prior to construction of the existing Intertie line. Quoting the AIREA text again: [16]

> ...land has no value unless there is a present or anticipated use for it, and the amount of value depends on the nature of the anticipated use (according to the concept of surplus productivity). Among all reasonable, alternative uses, the use found to yield the highest present land value, after allowing for payments to labor, capital, and coordination, is generally regarded as the highest and best use of land as though vacant.

The AIREA further states that, "the relationship between the supply of, and demand for, land adaptable to a particular use is significant in determining highest and best use". [17] The supply of land in Alaska would seem to be inexhaustible, but in fact the subject property has unique topographical and political suitability to be adaptable to a utility corridor. Virtually no other points of passage were within cost limits imposed by total benefit or the lineal distance limitations of Intertie electrical transmission efficiency to the hinterland of Alaska like Windy Pass or Broad Pass. [18] Ahtna ownership benefits from a monopoly on alternative corridors through Windy Pass with the possible exception of an underground line in the right-of-way of the state owned highway or parklands.

Market value can approach opportunity costs only when the land has monopoly characteristics and the cost of alternatives exceed any net present value from the final project. Thus, the appraiser must catalog and analyze potential alternatives with the assistance of technical consultants in order to confirm the necessary monopoly conditions for market price to approach economic value of the land route. Availability of alternative routes for a power line within the perimeter of Ahtna lands at costs that might be acceptable within the benefit values of the finished project also becomes significant in evaluating the possibility of severance damage in placing the Intertie line to achieve lowest costs rather than lower environmental impact or minimum interference with future uses. To the degree that the first use in place forces opportunity costs on existing residents or those commercial uses that might follow as prospective tenants, thus reducing the net present value in which the Ahtnas might share, measurable severance damage accrues to the remainder interests.

---

[16] The Appraisal of Real Estate, p.28.

[17] Ibid, p.29.

[18] See memorandum from Professor F. L. Alvarado, Appendix D, paragraph 4. (Landmark Appraisal).

Appraisal Conclusion

At this point, it must be reported that the Alaskan Power Authority, when confronted with the completed appraisal, was both indignant and quick to alter its jurisdictional offer from approximately $200,000 and a power supply for the Village of Cantwell to $1.4 million and a power supply for Cantwell, a package reported to be worth about $1.9 million for acquisition of an easement in perpetuity or fee and subject to an unprecedented gag provision that would not allow the parties or their counsel to discuss the settlement! Certainly counsel for the Ahtna had reason to blanket this decision in secrecy. Presumably the appraisal justifying this expenditure of public funds is off limits to public review.

However, the net economic benefit of the proposed intertie for the first ten years was reported to be $132.5 million for the first ten years of operation according to Table 9 in the public report prepared by Commonwealth Associates in January of 1982, entitled Anchorage-Fairbanks Transmission Intertie Route Selection Report and an update of same with actual cost figures made available in a report dated November 14, 1984. The Intertie line was built on the basis of a negotiated right of access between the power company and the Ahtnas and granted essentially a floating easement to the power company to be valued after the fact when the actual costs were known. These reports indicated the total benefit of the intertie for the first ten years would be $143.8 million for the and that the actual costs, not including land rights already purchased, would be $120.86 million. When the actual revised costs are allocated between a ten-year useful life and a 35-year useful life of the 138 KV line, these engineering planners forecast an economic surplus at $76.4 million in Table 9 of the Commonwealth Associates report for configuration 1B, line route option 19, the line actually constructed. The Portland General Electric case, the Montana State Power case, and the 11 comparable transactions of corridors purchased across Indian reservations all indicated that 50 percent or more of net economic surplus should be attributed to the contribution of land in an arm's length negotiation. Therefore, the Commonwealth report leads to the implication that the project corridor had a value of no less than $38.23 million for the Intertie project, of which the Ahtnas owned approximately 20 percent, for an economic value contributed by Ahtna land of approximately $7.5 million.

If it could be shown from the computer data that the only feasible route had to cross Ahtna land, then the economic contribution of the land to the project also becomes a fair market rent of a ten-year easement limited to use as a 138 KV including temporary access, staging areas, and other peripheral matters because of a complete monopoly within the opportunity costs doctrine.

The appraisers also believe that severance damages occurred to a degree beyond acceptable social costs and that the condemnor has not met the standard in the statement for a declaration of taking under Section 09.55.430 of the Alaskan Code of Civil Procedure, specifically:

7. A statement that the property is taken by necessity for a project located in a manner which is most compatible with the greatest public good and the least private injury. (State Statute 132.0 ch 101 SLA 1962; am State Statue 1 ch 149 SLA 1976)

Traditionally, it is difficult to set dollar values on visual damages to the landscape, no matter how apparent, or to anticipate present dollar values of progressive deterioration of subsistence food gathering due to disturbance of the environmental integrity. There is also the problem that any conflicts of transmission lines with other future uses presently have unknown costs to cure.

The previously mentioned report by Commonwealth Associates examines no less than 19 alternative routes for the Intertie line, many of which require less Ahtna land, or intrusion into the federal wilderness area surrounding Mt. Denali, or selected underground installations in certain sensitive areas. The selected route 1B19 was apparently the least expensive route in terms of original cost and operation but the most visible and perhaps environmentally degrading of the alternatives. Negotiation of a specific payment to the Ahtna to accept a conflicting land use such as the Intertie was clearly a reasonable and expedient solution to the business problems of the Power Authority. One option priced out by the engineers as an alternative to the cheapest benchmark case 1B19 was to bury an underground line for six miles on George Park Highway and seven miles along the base of Reindeer Hills, Panorama Mountain, and the narrowest portion of the Windy Pass to avoid the unknowns of dealing with the Park Service. It would accomplish significant reductions of both visual and envirnomental damage to highly sensitive areas, but might still involve certain conflicts with the future pipeline. Such a solution would have provided an indicated Ahtna land value of $4 million at an additional cost to APA of $16.25 million. The appraisers' estimated compensation for Ahtna land taken would have dropped to about $4 million but the Power Company would have incurred an increase of costs in excess of $16 million to reduce significant environmental degradation.

Here seemed to be a classic application of the Coase Theorem [19] where 50 percent of the cost of avoidance might have gone to the property owner who had to incur this unfortunate encroachment for the public good, suggesting severance damages to the Ahtnas of $8 million, more or less. For purposes of illustration, the payment of land of $4 million and the share of avoided cost of $8 million would be the total amount the Power Company would be willing to pay for the corridor if each party would take a 50/50 split of avoided cost and known benefits. Therefore, it was concluded that a negotiated settlement under the Coase settlement of severance damages of soft envirnomental conflicts would total $12 million so that if there were a direct payment for land of $7 million, it would logically follow that severance damages would be in the neighborhood of $5 million to purchase the acceptance by the Ahtnas of all deleterious effects of the Intertie on the physical environment and quality of life on adjoining Ahtna lands for the ten years of the initial 138 KV Intertie.

The overhead power line and the swath cut through the vegetation and ground cover has been an immediate visual encroachment on the naturalness of the area. There will be an irreversible and progressive impact on plant and animal life and the subsistence lifestyle of some native residents. Progressive deterioration will be accelerated with the noise and magnetic fields if and

---

[19] Real Estate Investment Decision Making, Austin J. Jaffe, and C.F. Sirmans, Introduction to the Economics of Property Rights, pp. 140-146.

when the line is converted to 345 KV and 200 to 600 megawatts (MW) transmission. There will be incremental costs incurred by other tenants of the corridor, such as a natural gas pipeline, that will reduce rents collected by AHTNA, Inc. These observable and predictable losses must fit the Alaskan Code of Civil Procedure on damages to remainder, specifically:

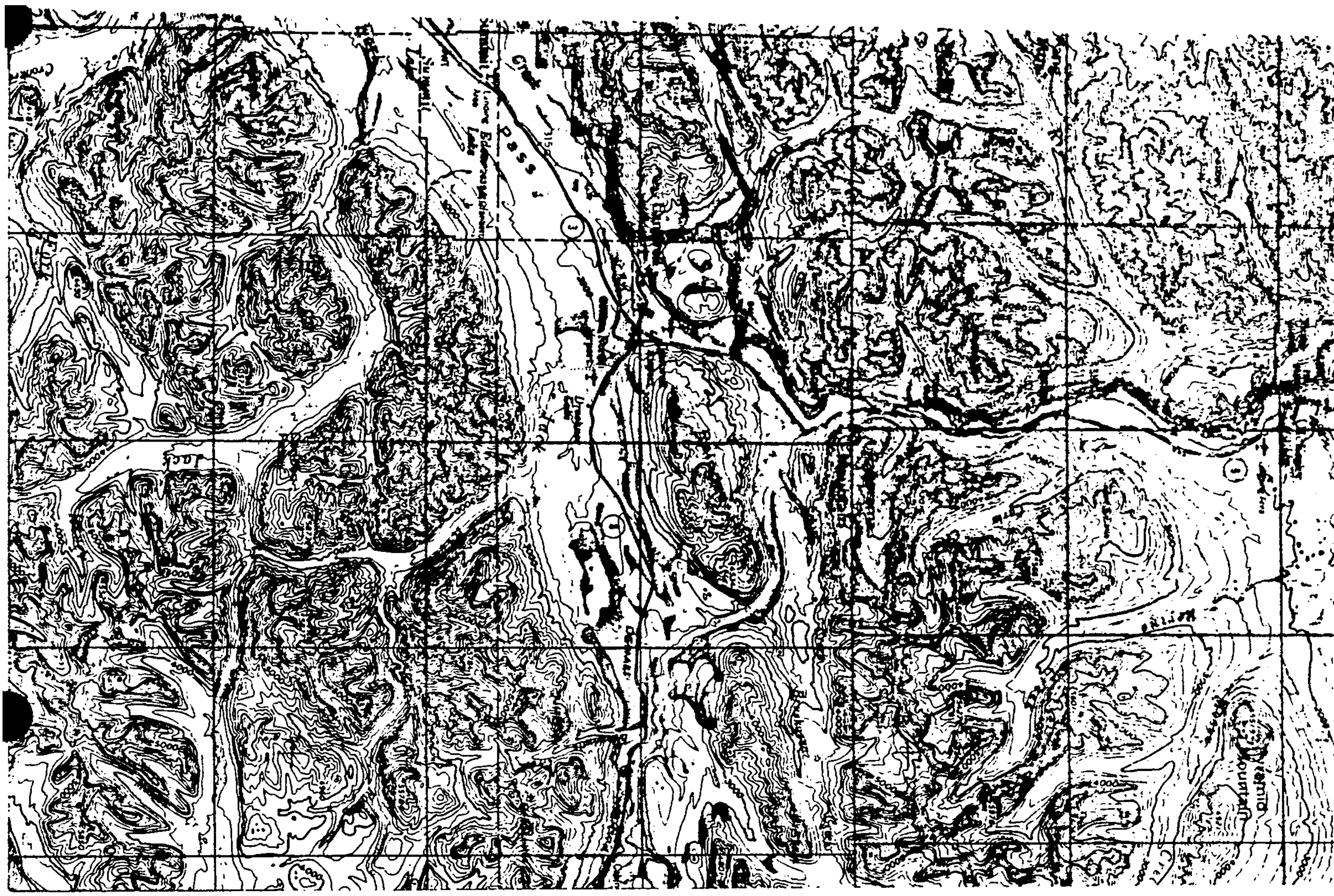
> Recoverable damages must be the natural and proximate consequence of the action taken; they must be direct and certain, actual and reasonable, readily ascertainable, and not remote speculative or contingent. Lewis and Clark County vs. Nett, 263 P. 418 (Mont. 1928); State vs. Bradshaw Land and Livestock Co., P. 2d 674 (Mont. 1935).
>
> Not every possible element of depreciation is compensable.--It is not every possible element of depreciation in value for which compensation must be awarded in an eminent domain proceeding. Lewis and Clark County v. Nett, 263 P. 418 (Mont. 1928).
>
> An attempt to enumerate elements of depreciation is futile.--Any attempt to enumerate the various circumstances which may enter into depreciation of the market value of a tract of land would be futile. Lewis and Clark county vs. Nett, 263 P. 418 (Mont. 1928).

<u>It is not necessary to measure loss of benefits to the remainder to establish severance damage</u>. The opportunity cost doctrine can redefine the issue to how much would the Alaskan Power Authority be willing to pay AHTNA, Inc., for the collective willingness of the Ahtnas to endure the envirnomental and economic damages to the remaining lands. If both parties were knowledgeable and informed as to the alternative opportunity cost of substantially avoiding aesthetic damage to the environment, disturbance of ecological systems, or interference with future economic development (such as a pipeline), in the free market of the fair market value concept, the Power Authority and the Ahtnas could negotiate for a payment that would settle on the damages at something less than the cost to cure or to avoid. The extension of the opportunity cost theory from a determination of rental value to a settlement of liability for land use conflicts is well developed in land law economics in a logical process known as the Coase Theorem.

The appraisers are unable to agree on the implications of the agreement relative to Ahtna's power to withhold approval because the Ahtnas have filed letters of nonobjection "for all land described". The land described specifically is the strip taken, which might be construed as leaving the remainder lands offended outside the terms of agreement. Power of approval is the fundamental premise for application of the Coase Theorem and on the acceptability of cost to cure as a proxy for minimum damage incurred.

At this time there is no way of knowing the legal potential or lost values to the Ahtnas and all the other native corporations that might have resulted from a legal test of these valuation principles. All of the Alaskan natives had a significant vested interested in establishing legal precedent for valuation of their lands and strategic positioning for playing an economic role in Alaskan development. An early determination of valuation principles prior to the necessity of recording land asset values by the native corporations in 1991 was critical. The attorneys for both sides defaulted on the role of legal advocacy and courtroom confrontation for establishing critical issues of social policy where there are clearly definable courses of action and measurable consequences. It remains to be seen if the ambush of the Ahtnas at Summit Pass will be the definitive battle on the valuation of economic development rights of native lands in Alaska. There was no honor for the legal warriors on both sides who cut and ran from the issue. Civil rights take many forms and one of those rights is the intelligent use of independent appraisal to achieve fair compensation of the individual suffering a taking of property.

AHTNA STUDY AREA

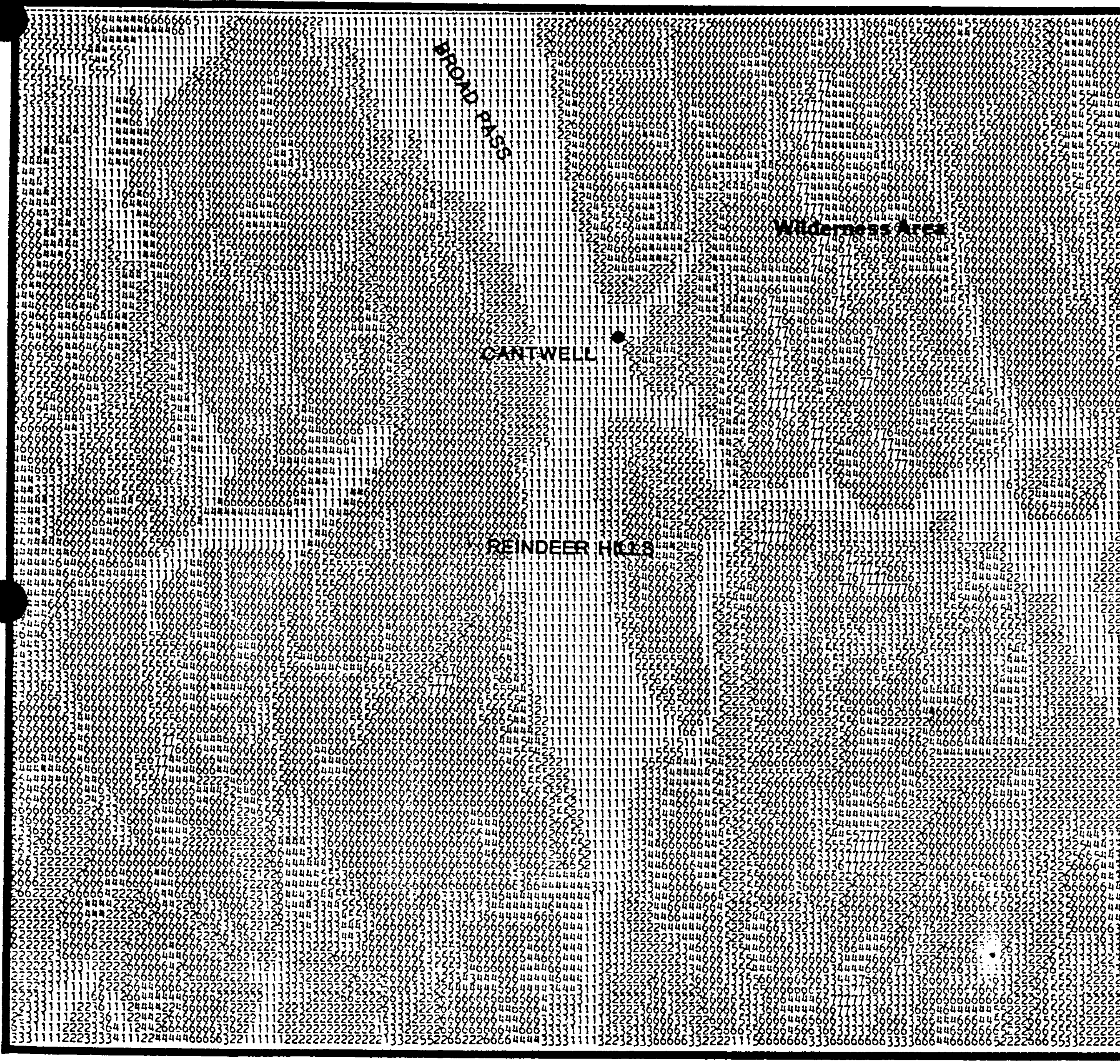


Site Characteristics

AHTNA STUDY AREA

PERCENT SLOPE - ALASKA DNR DATA

DATA SET = SLOPE.BLT



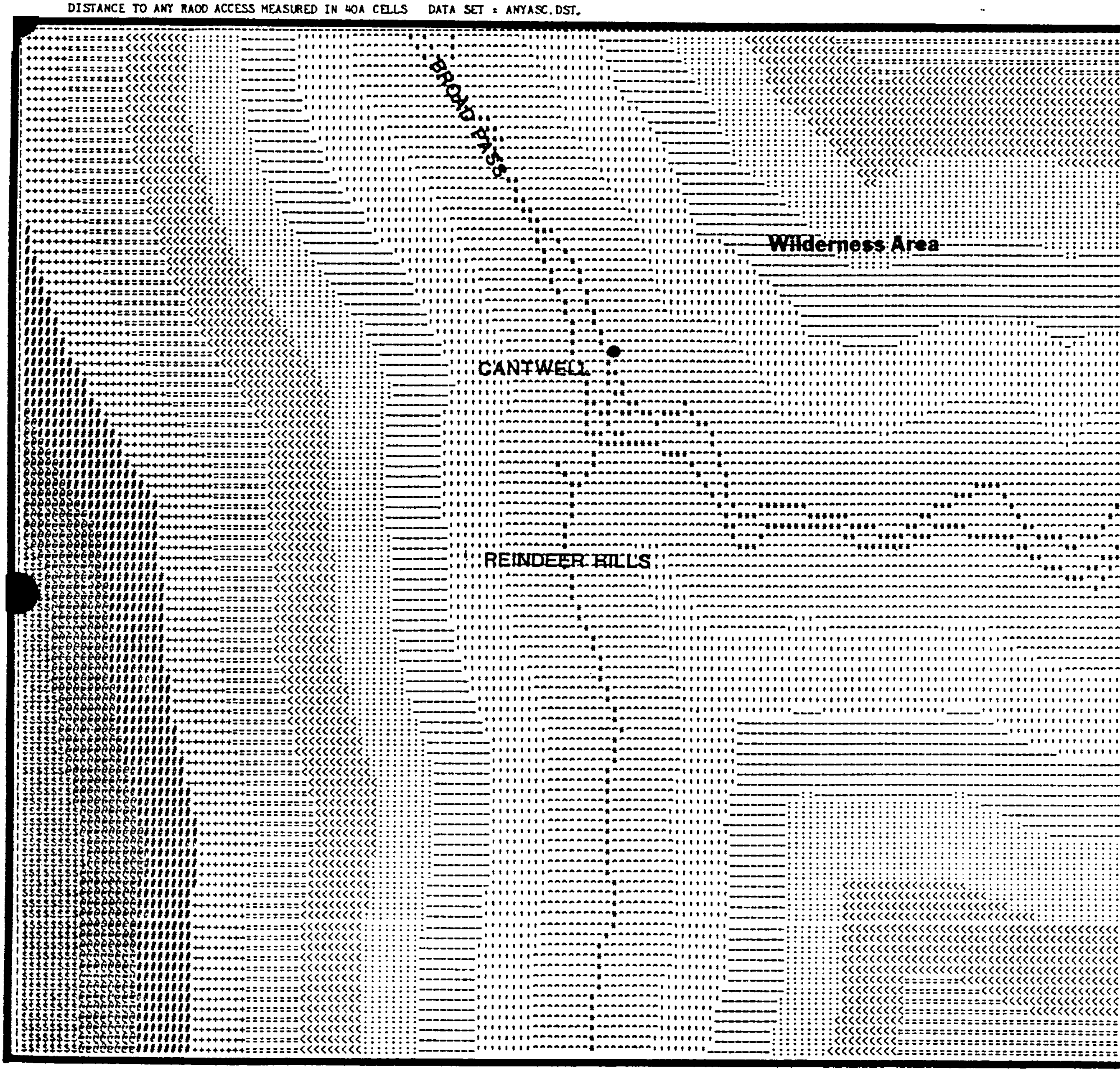
PERCENT SLOPE - ALASKA DNR DATA

DATA SET = SLOPE.BLT

LEVEL NUMBER	LOWER BOUND	UPPER BOUND	SYMBOL	FREQUENCY	% OF TOTAL	CLASS NAME
1	1	1	1	2175	.1359375	0 - 5%
2	2	2	2	1984	.124	6 - 10%
3	3	3	3	1816	.1135	11 - 15%
4	4	4	4	1732	.10825	16 - 20%
5	5	5	5	1261	.0788125	21 - 30%
6	6	6	6	6867	.4291875	31 - 50%
7	7	7	7	165	.0103125	51 - 75%

AHTNA STUDY AREA

DISTANCE TO ANY RAOD ACCESS MEASURED IN 40A CELLS   DATA SET : ANYASC.DST.



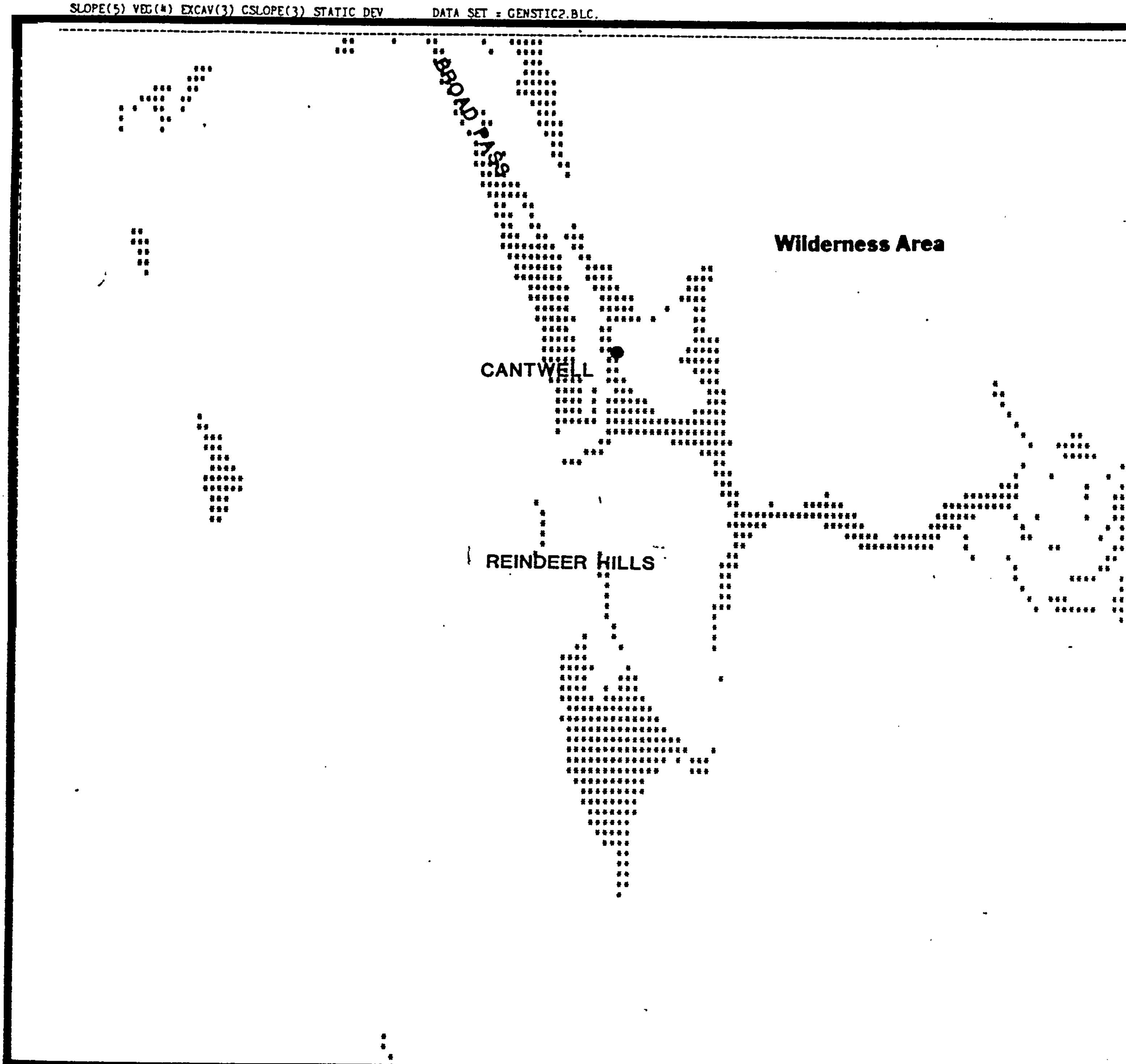
DISTANCE TO ANY RAOD ACCESS MEASURED IN 40A CELLS   DATA SET = ANYASC.DST.

LEVEL NUMBER	LOWER BOUND	UPPER BOUND	SYMBOL	FREQUENCY	$ OF TOTAL	CLASS NAME
1	0	0	▪	321	.0200625	CELL WITH ROAD ACCESS
2	1	8	^	3454	.215875	1 TO 8 CELLS AWAY
3	9	16	'	2564	.16025	9 TO 16 CELLS AWAY
4	17	24	-	2248	.1405	17 TO 24 CELLS AWAY
5	25	32	:	2010	.125625	25 TO 32 CELLS AWAY
6	33	41	<	1944	.1215	33 TO 41 CELLS AWAY
7	42	49	=	1197	.0748125	42 TO 49 CELLS AWAY
8	50	57	+	842	.052625	50 TO 57 CELLS AWAY
9	58	65	#	626	.039125	58 TO 65 CELLS AWAY

Site Characteristics

AHTNA STUDY AREA

SLOPE(5) VEG(4) EXCAV(3) CSLOPE(3) STATIC DEV DATA SET = GENSTIC2.BLC.



SLOPE(5) VEG(4) EXCAV(3) CSLOPE(3) STATIC DEV DATA SET = GENSTIC2.BLC.

LEVEL NUMBER	LOWER BOUND	UPPER BOUND	SYMBOL	FREQUENCY	% OF TOTAL	CLASS NAME
1	60	69	*	942	.058875	TOP 20% OF VALUE RANGE

Site Characteristics