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Economic Valuation of Waquoit Bay Natural Resources: An Investigation of Waterfront Property Values

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ECONOMIC VALUATION OF WAQUOIT BAY NATURAL RESOURCES: AN INVESTIGATION OF WATERFRONT PROPERTY VALUES

1. Abstract

This study investigates use of hedonic price analysis of waterfront property values around Waquoit Bay to test and to measure the economic value of local environmental attributes. Within the limits of the study, water frontage had a positive but decreasing influence on property value; adjacent open space increased property value; and a buffer of conservation land between a property and the bay (i.e., setback) did not affect property value. The implicit demand for water frontage was approximated. The capitalized net economic value of water frontage--which reflects, in part, the quality of water view and of access for recreation--was estimated at about $28 thousand for a property with 100 feet of water frontage and average amounts of other attributes. Extensions of this work are suggested.

2. Introduction

Throughout human history, food resources, commerce, and jobs have drawn people to the coastal zone. Currently in the United States, one-third of the GNP is currently produced in coastal counties (Colgan 1990) where roughly half of the nation's population resides (NOAA 1990). However, this concentration of business activity and human population within an area about one-tenth the size of the contiguous United States has exacted a toll on the coastal environment.

The history of Waquoit Bay in Falmouth and Mashpee, Massachusetts illustrates the more general struggle between traditional economic growth and conservation of natural resources, making Waquoit Bay a logical choice as one of NOAA's (National Oceanic and Atmospheric Administration) 21 National Estuarine Research Reserves (Figure 1). Initially valued for hunting, farming, and fishing, Waquoit Bay is now primarily sought for its aesthetic and recreational opportunities (WBNERR 1989). However, these seemingly innocuous demands generate residential development and business for local marine-dependent industries such as marinas. For example, across Cape Cod over 65 thousand single family housing permits were authorized during 1970-1989, particularly by Falmouth and Mashpee--enough to make Cape Cod the seventeenth fastest growing coastal county in the United States (Culliton et al. 1992). As a result of such development, Waquoit Bay confronts environmental problems similar to those being faced in other estuaries around the world, including eutrophication, habitat loss, and resource depletion (WBNERR 1989).

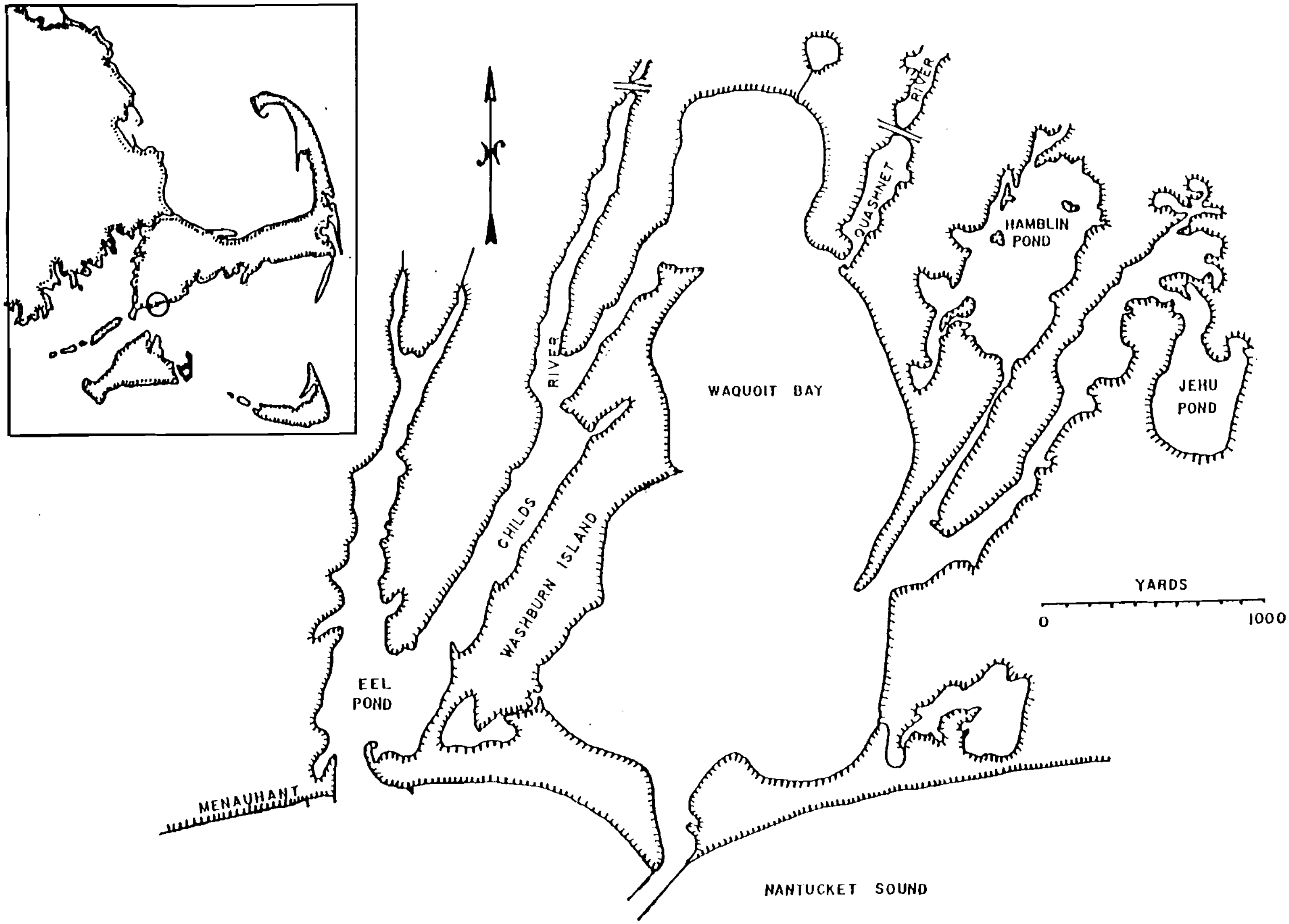

Figure 1. Waquoit Bay

Although NOAA's Waquoit Bay National Estuarine Research Reserve (WBNERR) program emphasizes an understanding of natural processes, management of Waquoit Bay and its watershed is very much an economics problem involving benefits and costs and their incidence. The natural resources of Waquoit Bay are scarce in the sense that they can not satiate all demands. In response, all levels of government have stepped in to allocate use of the public domain, including shellfish stocks and water quality. However, allocation results in both benefits and costs, or tradeoffs (even de facto allocation from inaction), making it important to ask to what extent do the potential economic benefits of conservation outweigh its costs.[1] That is, conservation must be understood in degrees; it is neither infinitely costly nor infinitely beneficial. Furthermore, every distribution of benefits and costs creates winners and losers. Consequently, knowing how a redistribution of benefits and costs might affect collective action is important, including the possibility of winners compensating losers such as when government purchases development rights to natural lands (McGilvray et al. 1985) or subsidizes waste treatment.

WBNERR's Research Committee recommended funding a resource economics internship to begin to examine these complex economics questions. Given the time and financial constraints of an internship and the central importance of residential development, we chose to study the influence of Waquoit Bay and surrounding ponds on residential waterfront property values in Falmouth and Mashpee. Our objectives were twofold: (1) to test the effects of water frontage, setback, adjacent open space, and wetlands on property values, and (2) to derive information on the demand for, and economic value of, Waquoit Bay from property values. These objectives are germane because conservation of Waquoit Bay and similar estuaries necessarily involves watershed management which creates both benefits and costs and winners and losers.

Our report is organized as follows. In section 2, the economic theory of natural resource valuation is presented and related to the analysis of property values. Next, the study data and methodology are described. Results are reported in section 4 and discussed in section 5.

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[1]We are specifically referring to opportunity costs, not financial costs, although the latter are also important. The labor, physical capital, and natural resources used to conserve Waquoit Bay are not being used to produce conservation elsewhere, public education, road and bridge repairs, or market goods and services--hence, opportunity costs.

3. The Economic Theory of Natural Resource Valuation[2]

Background: Economists maintain that natural resources--including entire ecosystems--are subjects of economic valuation even when markets are absent. To understand this point of view, one needs to understand how tastes and preferences affect demand. All else held constant, the "law" of demand states that consumption declines when something becomes more costly, and, conversely, consumption increases when something becomes less costly (Figure 2). But why the inverse relationship?

In a market, prices help to reveal people's tastes and preferences. That is, given income and other constraints on choice (e.g., leisure time), prices reveal what people are willing to spend on a good or service. Specifically, prices help to reveal the most that people are willing to spend on the final amount of the good or service rather than do without it. To see this, imagine a price-discriminating cable television monopoly which sells television by the hour each month. This monopoly might exact high payments from you for the first hour of viewing during each month, the exact amount depending on your income and tastes and preferences for television shows. However, as your appetite for television becomes satiated, other goods and services become relatively more valuable. For example, you might become more interested in reading a book, or gardening, or going to a movie than watching more and more television. Accordingly, the most you are willing to spend on additional cable service declines eventually to zero.

Having traced your demand curve--or what might be called your marginal willingness-to-pay curve (marginal because of the small, one-hour increments of television)--we want to interpret the area it encloses. Following the above discussion, the entire area behind demand (up to the actual quantity-consumed) is the total gross economic value of the good or service measured in terms of your maximum willingness-to-pay (Figure 3a). Total gross economic value can be divided into actual expenditures, given price, (after all, cable television companies are regulated by government, and it probably would be too costly for a monopoly to research each household's demand for television) and an area called consumer's surplus (Figure 3b). Consumer's surplus is, in a sense, your "profit" because it is the amount of gross benefits that you do not spend. Intuitively, when prices rise, consumers "lose", and when prices fall, consumers "win". Changes in consumer's surplus measure such economic losses or gains.

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[2]Freeman (1979a) and Anderson and Bishop (1986) are good general references to the material in this section. Edwards (1987) applies the concepts and methodologies to coastal resource management.

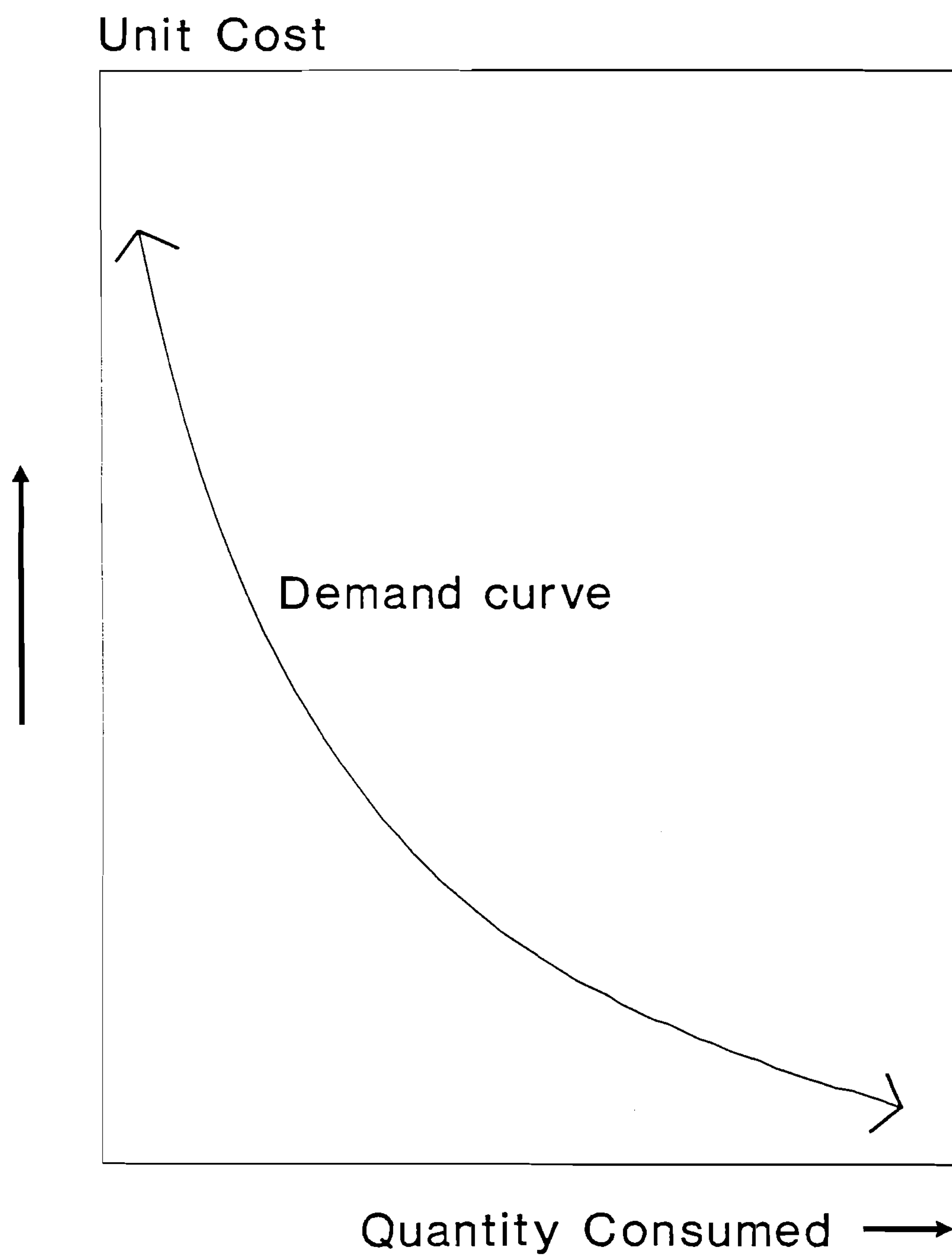

Figure 2. "Law" of demand

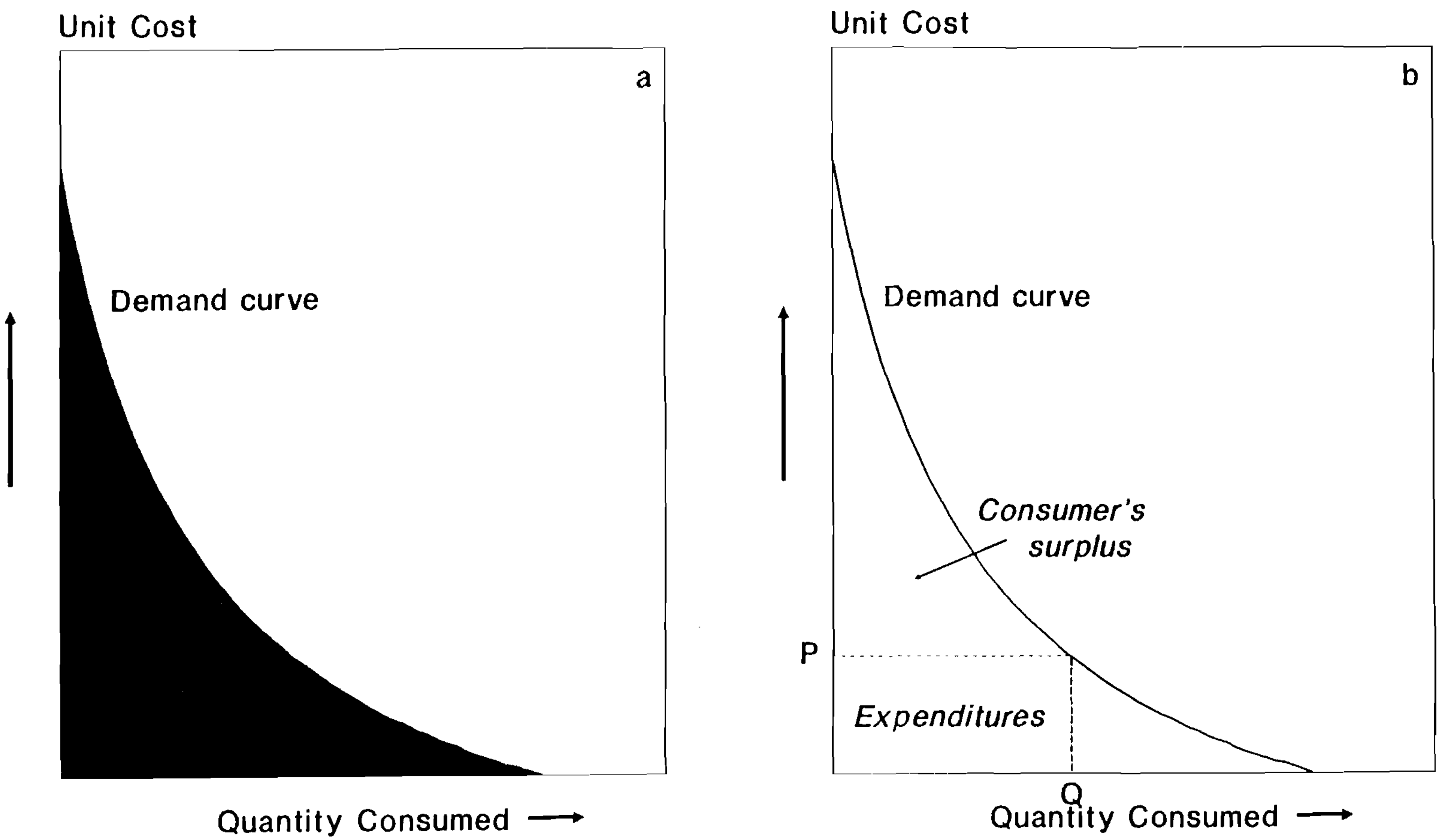

Figure 3. Interpretation of the area behind demand: (a) total gross economic value and (b) expenditures and consumer's surplus. P and Q denote a specific price-quantity pair on the demand curve.

How does this discussion relate to economic valuation of natural resources such as Waquoit Bay, though? First, it should be understood that prices and markets emerge from peoples' tastes and preferences only when the good or service is valued and property rights and production costs facilitate supply. Thus, prices reveal economic value; they are not, themselves, economic value. Second, economic value has monetary units because people are willing to spend their income on goods and services, not because there are prices. Thus, one can imagine--although it might be empirically difficult to measure--economic value expressed in units of time because time, like income, is a constraint on most people's choices. In a bartering economy, other units of exchange would be necessary, perhaps crops or game. Finally, the goods and services valued by people are not confined to what an economy produces. The natural environment also "produces" both renewable (e.g., oxygen and bay scallops) and non-renewable (e.g., petroleum and gold) goods and services valued by people. It is here that consumer's surplus is vital. Although Waquoit Bay water quality, shellfish resources, visual amenities, and most other resources are not produced by an economy or even privately-owned, many people suffer feelings of personal loss when Waquoit Bay resources are damaged. Economists measure such damage, in part, by the amount that consumer's surplus shrinks.

To measure this perceived damage, economists been looking outside of markets during the past 40 years for information which reveals peoples' valuations of the natural environment. One of three methodologies--the travel cost technique--uses information on the cash and time costs of traveling to a recreation site and the number of visits (among other things) to estimate demand, similar to the way market prices and quantities are used. The travel cost technique could not be applied in this study, however, because the range of travel costs in a local setting is too small to identify demand.

Another common approach involves developing an experimental market in a survey to directly elicit valuations of a natural resource from people. However, the contingent valuation method was too costly to apply in an internship project.

Finally, unlike travel cost or contingent valuation which focus on an individual environmental good or service, the third methodology recognizes that property values are determined, in part, by many attributes of the local social and natural environments as well as lot and building attributes. The challenge, then, is to isolate the contribution of a particular environmental attribute to total property value and then to correctly interpret the result in light of demand theory. The name given to this technique is hedonic price analysis.[3] Hedonic price analysis has been used to estimate the economic value or damage of a wide range of environmental attributes, including air pollution (Harrison and Rubinfeld 1978; Nelson 1978), noise from airports or traffic (Abelson 1979; Linneman 1980), water pollution (David 1968), lake shoreline (Brown and Pollakowski 1977), and a number of marine coastal environmental attributes, including beach pollution (Wilman 1984) and water view and water frontage (Anderson and Edwards 1986; Milon et al. 1984; Parsons and Wu 1991). In some cases, analyses were also applied to assess the economic benefits and costs of land use policy, including establishing setback for public use and access (Brown and Pollakowski 1977) and using downzoning, transferable development rights, or preservation to conserve land and water resources in the coastal zone (Anderson and Edwards 1986; McGilvray et al. 1985; Parsons 1987).

Hedonic price analysis: Hedonic price analysis involves three steps. First, one estimates a statistical relationship between property values and important attributes of properties, such as lot size, size of house, number of bathrooms, and the local environment. To illustrate, a hypothetical relationship between property value and water frontage is drawn on Figure 4a.[4] Second, one calculates how marginal changes in an attribute might affect property value. In our illustration, this would be like measuring the "height" of each step along the property value curve after incrementing water frontage by one foot and then plotting the results against water frontage (Figure 4b). The values corresponding to these heights are known as marginal implicit prices.

Finally, marginal implicit prices are calculated for each property in a data set and, when combined with other data (e.g., household income), are used to estimate demand (Figure 4c). As above, the area behind an implicit demand curve is an estimate of a household's total economic valuation of its purchase of the attribute. The product of a household's water frontage and marginal implicit price is expenditure on water frontage, leaving consumer's surplus as the area above the marginal implicit price line. In this particular case, consumer's surplus measures a household's enjoyment of the things that water frontage provides,

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[3]The word, hedonic, refers to psychological, not ethical, hedonism. Note, also, that hedonic price analysis can be, and has been, applied to the analysis of any commodity that is differentiated by attributes, including crops, automobiles, and electronic equipment.

[4]Of course, this illustration holds the contribution of all other attributes to total property value constant as evidenced by the intercept.

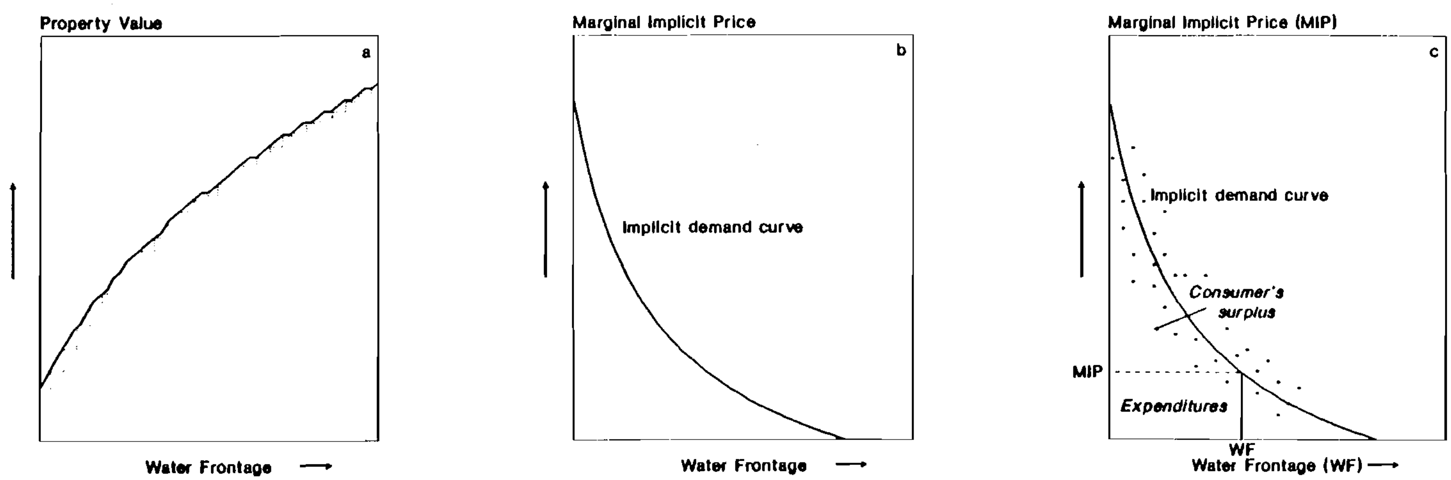

Figure 4.. The hedonic price technique: (a) hedonic price curve, (b) marginal implicit prices, and (c) implicit demand. The dots on graph (c) denote data.

such as a water view and easy access for recreation.[5]

A complete hedonic price analysis of all properties within the Waquoit Bay watershed was beyond the scope of the internship. Instead, this study investigated application of the first two steps of hedonic price analysis to residential waterfront properties around Waquoit Bay. Property values models were estimated, and marginal implicit prices for water frontage were derived.

4. Data and Methodology

The study area encompassed waterfront properties along Waquoit Bay and its adjoining ponds in Falmouth and Mashpee (Figure 5). In order to control for different uses and types of development (e.g., residential versus commercial, houses versus condominiums), the analysis was restricted to 630 individual residentially zoned properties which had access to a throughway, were smaller than 400 thousand square feet, and were already developed or graded by the state and town as either developable or potentially developable.

Data on property values and other attributes of waterfront properties were provided by each town's assessment department. Although hedonic price analysis is best performed with sales price data, there were too few arms-length transactions in the study area even after going back to 1982.[6] Consequently, the 1992 assessed values of only the land component of each property were chosen for analysis. Assessed property values have been used in other hedonic price analyses (e.g., Harrison and Rubinfeld 1978).

Property attributes included location, lot size, whether the property was already developed or only potentially developed, and the presence of wetlands (Table 1).[7] The presence of setback

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[5]See Freeman (1979b) for an early discussion of the first two steps of hedonic price analysis. The theory of the third step was developed only recently; see Diamond and Smith (1985), Mendelsohn (1984), Parsons 1986, and Ohsfeldt and Smith (1985).

[6]However, had there been sufficient price data the 1982-1992 time-period would require controlling for the effects of a complete economic cycle of growth and recession on property values. Furthermore, using price data also requires specification of important building attributes in the hedonic price model. Whereas these sources of price variation might be controlled, not having to do so simplified the analysis.

[7]The complete data base is described in Appendix A.

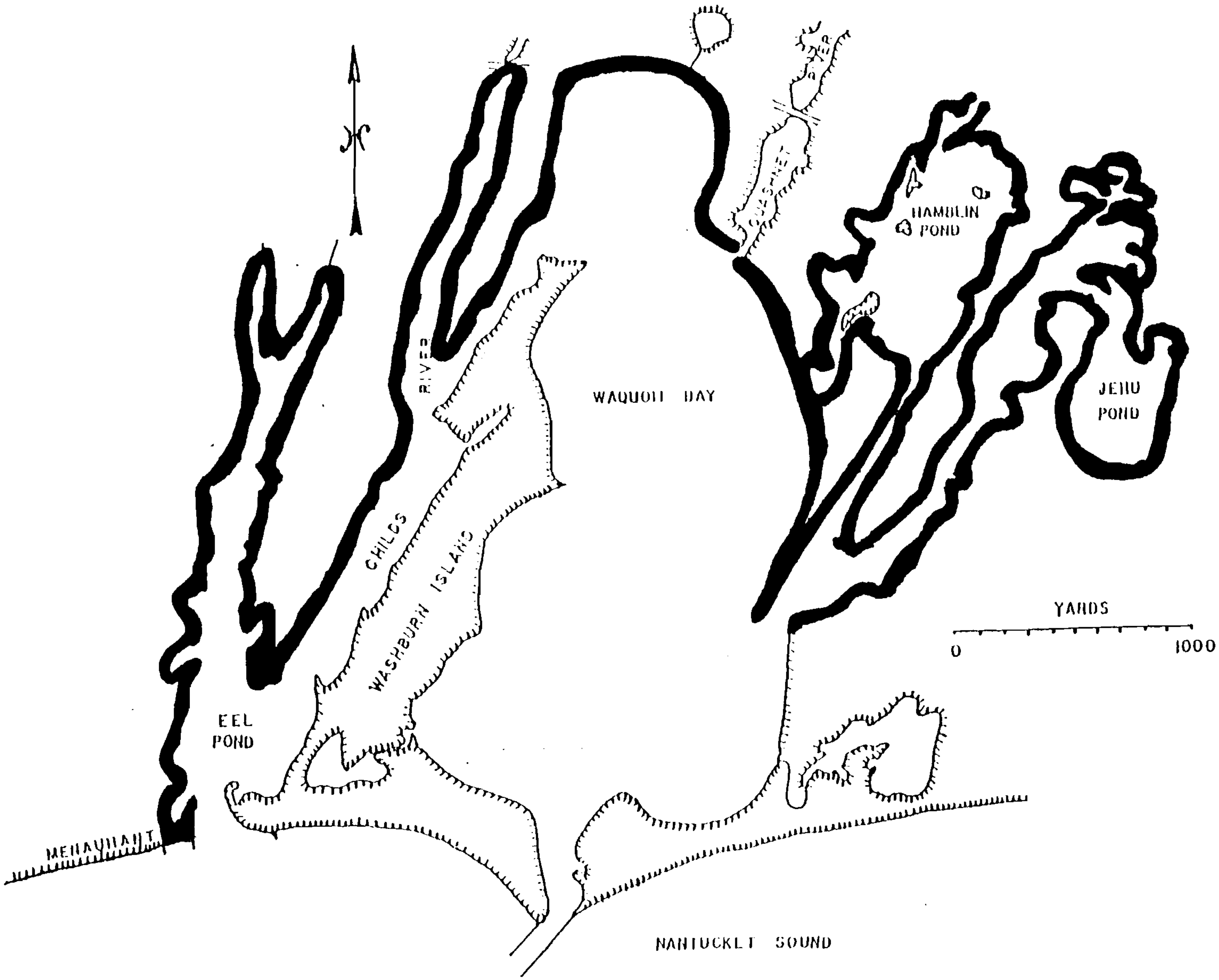

Figure 5. Waquoit Bay study site

Table 1--Attributes of individual residential waterfront properties around Waquoit Bay in Falmouth and Mashpee, Massachusetts.			
Attribute	Definition	Mean or Percentage	Range
Property value	1992 assessed value of land ($'00)	1781	504-4927
Lotsize	Square feet	26036	3485-302,306
Developed	Presence of house	90%	0-1
Potentially	Undeveloped site is considered buildable	1%	0-1
Water frontage	Frontage (feet) on Waquoit Bay or adjoining ponds	93	5-1250
Setback	Presence of public, undeveloped land between property and bay	10%	0-1
Wetland	Presence of wetlands on property	48%	0-1
Open space	Presence of conservation, public, or unbuildable land next door	10%	0-1
Town water	Town water available	60%	0-1
Other services	Count of the presence of paved road, private road, and/or natural gas line	1.6	0-3

(i.e., a strip of conservation or undevelopable land between the property and Waquoit Bay) or adjacent open space was determined from assessor maps and state property codes. Water frontage was measured from assessor maps; rather than the exact contour of properties, though, 1-3 straight lines which were consistent with a "field of view" were measured. The presence of town water or other services--i.e., paved road, private road, natural gas--was determined from site visits, records kept by Falmouth's Engineering Department and Mashpee's Department of Public Works, and maps provided by the Colonial Gas Company, respectively.

The hedonic price model of assessed land values was specified as follows:

$$\text{VALUE} = \alpha_0 1 + \alpha_1\text{LOTSIZE} + \alpha_2\text{FALLOT} + \alpha_3\text{DEVELOPED} + \alpha_4\text{POTDEVEL} + \alpha_5\text{FRONTAGE} + \alpha_6\text{BAYFRONT} + \alpha_7\text{SETBACK} + \alpha_8\text{WETLAND} + \alpha_9\text{ADJOPEN} + \alpha_{10}\text{WATER} + \alpha_{11}\text{SERVICES} + \epsilon$$

where

1	=	the intercept;
VALUE	=	natural log of the 1992 assessed value ($'00);
LOTSIZE	=	natural log of lotsize (square feet + 1);
FALLOT	=	LOTSIZE when the property is in Falmouth and 0 when in Mashpee;
DEVELOPED	=	1 for properties which are developed and 0 otherwise;
POTDEVEL	=	1 for undeveloped lots that require modification before development and 0 otherwise;
FRONTAGE	=	frontage on Waquoit Bay (feet + 1);
BAYFRONT	=	FRONTAGE when on the open part of Waquoit Bay or across from Washburn Island and 0 otherwise;
SETBACK	=	FRONTAGE when there is setback and 0 otherwise;
WETLAND	=	1 when the property has wetland and 0 otherwise;
ADJOPEN	=	1 when adjacent property is open space (e.g., unbuildable land or woodland, wetland, or field which is designated by town as conservation land) and zero otherwise;
WATER	=	1 when town water is available and 0 otherwise; and
SERVICES	=	0, 1, 2, or 3 depending on the presence of a paved road, private road, and/or natural gas.

The α_i's are parameters which weigh the influence of the property attributes on VALUE, and ϵ is the residual process. The parameter on the intercept is the value associated with attributes which are common to all properties (e.g., water view and minimum amount of water frontage). DEVELOPED, POTDEV, WETLAND, ADJOPEN, and WATER are intercept dummy variables which mark the presence or absence of an attribute and, therefore, can be added to the intercept. In contrast, FALLOT is a slope dummy variable which is specified to control for town. A slope dummy variable affects the coefficient on the regressor--in this case LOTSIZE. BAYFRONT and SETBACK also are slope dummy variables; they contribute to the net effect of water frontage on assessed value. BAYFRONT is specified to test whether proximity to the open bay or Washburn Island differentially affects property values. SETBACK is specified to test whether having a strip of conservation land between one's property and Waquoit Bay further affects property values.[8]

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[8]One can imagine a large number of attributes which describe properties and, therefore, might be specified in a property value model. However, studies show that consumers evaluate only a

The above property value model was estimated using the ordinary least squares (OLS) regression procedure in SAS (1989). Applying the OLS estimator assumes that residuals--i.e., estimates of ϵ--are normally distributed with zero mean and constant variance across observations--i.e., $\epsilon \sim N(0,\sigma^2)$. Marginal implicit prices of water frontage were calculated by taking the first partial derivative of the estimated hedonic price model with respect to water frontage and evaluating the result for each property in the data set. In contrast, the results for WETLAND and ADJOPEN can not be used to estimate marginal implicit prices because they involve dummy variables.

5. Results

Property value model: Estimates of the property value model are reported in Table 2. The regression model was significant ($F>F_{11,630-11,0.05(2)}$) and explained over 40% of the variation in VALUE. The mean value of the estimated residuals was zero, and the residual process appears homoskedastic from visual inspection of plots of estimated residuals against regressors. The D'Agostino D test rejected the null hypothesis that residuals were normally distributed, however. This test result could be influenced by the several highly negative residuals.

Given the non-normality result, the t-tests of parameter estimates (and the F-test of the regression) are considered preliminary. Bearing this in mind, most of the regressors may be significant determinants of VALUE. Concerning the environmental attributes, water frontage increased assessed value at a decreasing rate, and its affect was augmented by being on the open bay or across from Washburn Island. Having conservation land next door also increased property value. In contrast, neither the presence of wetlands on a property nor setback had a significant influence on assessed value.

Although difficult to clearly illustrate due to the multiplicative form of the hedonic price model, the contribution of water frontage and adjacent open space to total assessed value is worth illustrating (Table 3). In this case, adjacent open space contributes 17% to land value, 100 feet of water frontage contributes 50%, and the combination of these environmental attributes contributes 58%. However, this calculation probably underestimates the total contribution of these attributes to property value because the intercept parameter is difficult to interpret. That is, the fraction of the intercept which weighs the influence of equal qualities or amounts of water view, water

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handful of factors when making purchases. Furthermore, our results are not biased by the omission of other possible attributes unless they are correlated with the important environmental regressors.

Table 2--Regression analysis results			
Regressor	Parameter Estimate	Standard Error	t-ratio
Intercept	4.986	0.211	23.67[a]
LOTSIZE	0.174	0.022	7.82[a]
FALLOT	-0.043	0.004	-10.42[a]
DEVELOPED	0.108	0.039	2.73[a]
POTDEVEL	-0.300	0.156	-1.91[b]
FRONTAGE	0.098	0.028	3.50[a]
BAYFRONT	0.051	0.008	6.77[a]
SETBACK	0.018	0.012	1.58
WETLAND	0.023	0.030	0.77
ADJOPEN	0.193	0.051	3.82[a]
WATER	0.262	0.038	6.80[a]
SERVICES	0.114	0.024	4.69[a]

630 observations
F=41.9 significantly different from zero, 99% level (F=2.47)
adjusted R^2=0.42
[a]Estimate significantly different from zero, 99% level (t=2.58)
[b]Estimate significantly different from zero, 90% level (t=1.65)

frontage, and adjacent open space across all properties would be added to these estimates.

<u>Marginal implicit price of water frontage</u>: Estimates of the marginal implicit price of water frontage for each property ranged from $22 to $3404 per foot and averaged $365. The highest estimates of marginal implicit price were for relatively small amounts of water frontage and for properties on the open bay or across from Washburn Island.

Although proper estimation was beyond the scope of this internship project,[9] household consumer's surplus for water frontage was roughly calculated by fitting straight lines through the marginal implicit prices of properties with between 50 and 200 feet of water frontage (see Figure 4a for an image). This

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[9]See references to stage 3 of hedonic price analysis in footnote 5.

restriction on the range of water frontage requires extrapolation to the marginal implicit price axis, but the lines were integrable and were not susceptible to the extremes in prices resulting from the logarithmic functional form of the hedonic price model.

Consumer's surplus from a property with 100 feet of water frontage (roughly the average in the data set) on the open bay or across from Washburn Island (i.e., BAYFRONT=1) was calculated to be $28 thousand, and expenditures on water frontage were $35 thousand. Both figures can be thought of as capitalized values of constant annual streams of benefits or costs over an infinite time horizon. Assuming that 7% is a representative household discount rate, the annualized consumer's surplus is $2 thousand in this example.[10] In contrast, household consumer's surplus of a property with 100 feet of water frontage on Waquoit Bay's adjoining ponds and rivers (i.e., BAYFRONT=0) was $14 thousand, or $1 thousand annually.

Table 3--Contribution of Waquoit Bay natural resources to the economic value of waterfront land. The baseline value was calculated from the estimated hedonic price model and the following values of regressors: LOTSIZE=10.165 (i.e., natural log of 26,001), DEVELOPED=0, POTDEVEL=0, WETLAND=0, SETBACK=0, TOWNWATER=1, and SERVICES=1. Values in $'000. Percent contribution of the environmental attribute(s) to total assessed value is reported in parentheses.

Attribute	Location			
	Open bay or across from Washburn Island		Adjoining ponds or rivers	
	Falmouth	Mashpee	Falmouth	Mashpee
Baseline (see legend)	$81	$125	$81	$125
Baseline plus adjacent open space	$98 (17%)	$152 (17%)	$98 (17%)	$152 (17%)
Baseline plus 100 feet of water frontage	$161 (50%)	$249 (50%)	$127 (36%)	$196 (35%)
Baseline plus adjacent open space and 100 feet of water frontage	$195 (58%)	$302 (58%)	$154 (47%)	$238 (47%)

[10] A personal discount rate is the return required for a household to delay present consumption until the future.

6. Discussion

Although the results are preliminary and must not be overstated, this investigation of residential waterfront property values around Waquoit Bay raises several interesting issues. First, it might be possible to estimate the demand for water frontage and, in so doing, part of the net economic value people enjoy from visual amenities and recreational use of Waquoit Bay. Future work would require in-depth specification and residual tests of the hedonic price equation, simultaneous equations estimation of household demand, and an inquiry into whether the intercept of the hedonic price model conceals further information on the value of Waquoit Bay that is not picked up by a water frontage regressor.

Another interesting issue involves some of the tradeoffs between conservation and land values. In particular, conservation land might enhance the value of adjacent residential properties. Although this qualitative result would not be surprising, the opportunity to quantify this additional benefit of conservation is important for policy analysis. In addition, it appears that a buffer of land required to protect wetlands or to improve water quality of Waquoit Bay may not diminish property values--a win-win situation, if it withstands closer scrutiny. Analysis beyond the use of dummy variables may be necessary to properly quantify these effects of conservation.

A third issue raised by this study involves the influence of wetlands on property values and inferences that might be drawn from a hedonic price analysis. Although lost in the regression analysis, the towns of Falmouth and Mashpee actually reduce the taxable value of residential land if wetlands are present because of the costs owners incur either in making such land buildable or in not being able to "use" the area designated as wetland. However, what it costs to prepare, or forgo, a site for building has little if any bearing on households' valuations of wetlands. A true test would require sales data on waterfront properties both with and without wetlands (Allen and Stevens 1983).

Although it raises several interesting issues, this study only begins to address the economic value of Waquoit Bay resources and related policy questions. Households other than waterfront property owners, including tourists, probably value conservation of the Waquoit Bay watershed and aquatic resources. Part of this value might be revealed in an analysis of properties throughout the watershed using the effect of distance on property value (Edwards 1989; Parsons 1991; Parsons and Wu 1991). In addition, households in Falmouth and Mashpee and/or users of Waquoit Bay might be surveyed for their valuation of conservation using the contingent valuation method mentioned above. Finally, the contribution of Waquoit Bay to income and employment in the local economy requires economic-impact analysis.

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Appendix A: The Property Value Data Base

After preliminary meetings to ascertain availability and type of data, the assessment department's of Falmouth and Mashpee computer-searched their records for Waquoit Bay residential waterfront properties and printed the required information (see tables that follow). Assessor and planning maps were further used to measure water frontage with an engineering scale and to determine presence of adjacent conservation land.

Data on services were collected from the towns' water and public works departments and the Colonial Gas Company. For the purpose of this study the important factor was whether or not a property lot had town water available, not whether it was connected to the town water supply. Falmouth's Water Department and Mashpee's Water District provided overlay maps of water main positionings. It should be noted that the Mashpee Water District is aggressively extending their water mains; thus, lots that previously were too small for wells and septic systems may become buildable by virtue of only needing enough land for septic systems, under current regulations.

Falmouth's Engineering Department provided information about whether a road was private or town-owned, as did the Mashpee Department of Public Works. However, it was necessary to travel the study site to determine which roads were paved.

The Colonial Gas Company allowed access to its mapping department where locations of natural gas mains were learned.

The following tables describe the property value data bases on file at WBNERR.

Table A.1--Land attributes of residential Waquoit Bay waterfront properties in Falmouth.

Factor	Columns	Definition
Observation	1-4	Unique record identification
Town	6	Falmouth=F
Location:		Unique location in town
Map	8-10	
Section	12-13	
Parcel	15-17	
Lot	19-22	
Land value	24-27	1992 assessed land value ($'00)
Total value	29-32	1992 assessed total value, including structures ($'00)
Market sale:		
Price	34-37	Market price
Month	39-40	Month of sale
Year	42-43	Year of sale
Arms length code	45-46	State code for type of sale (contact assessment department)
Water frontage	48-51	Length along Waquoit Bay or adjoining ponds
Lines	53-54	Number of straight lines used to approximate water frontage
State code	55-57	State land use codes (contact assessment department)
Condition code	59	Town codes which describe special features of property (contact assessment department)
Lotsize	61-67	Size of land (square feet)
Services	69-70	Presence of town water, paved road, private road, and/or natural gas
Adjacent open space	72-73	Presence of conservation land or space unbuildable land next door (contact assessment department)
Wetland	75	Presence of wetland on property

Table A.2--Attributes of buildings on residential Waquoit Bay waterfront properties in Falmouth.

Factor	Columns	Definition
Observation	1-4	Unique record identification
House size	6-9	Finished living area (square feet), excluding garage, porches and decks
Year	16-19	Year built
Dock	21-24	Size (square feet), if present
Pier	26-29	Size of second dock (square feet), if present
Garage	31-34	Size (square feet), if present
Deck	36-39	Size (square feet), if present; A=stoop
Porch	41-45	Size of porch or patio (square feet), if present; A=unfinished,enclosed; B=unfinished, open; C=patio; D=finished, enclosed porch
Shed	47-50	Size (square feet), if present; A=barn; B=unfinished, utility shed
Features	52-53	Presence of other valuable attributes: 1=fireplace; 2=fireplace and dormer

Table A.3--Land attributes of residential Waquoit Bay waterfront properties in Mashpee.

Factor	Columns	Definition
Observation	1-4	Unique record identification
Town	6	Mashpee=M
Location:		Unique location in town
Map	8-10	
Block	12-15	
Land value	17-20	1992 assessed land value ($'00)
Total value	22-26	1992 assessed total value, including structures ($'00)
Market sale:		
Price	28-32	Market price
Month	34-35	Month of sale
Year	37-38	Year of sale
Arms length code	40-41	State code for type of sale (contact assessment department)
Water frontage	43-46	Length along Waquoit Bay or adjoining ponds
Lines	48-49	Number of straight lines used to approximate water frontage
State code	51-53	State land use codes (contact assessment department)
Influence code	55-56	Town codes which describe special features of property (contact assessment department)
Lotsize	58-65	Size of land (square feet)
Services	67-68	Presence of town water, paved road, private road, and/or natural gas
Adjacent open space	70-71	Presence of conservation land or space unbuildable land next door (contact assessment department)
Wetland	73	Presence of wetland on property

Table A.4--Attributes of buildings on residential Waquoit Bay waterfront properties in Mashpee.

Factor	Columns	Definition
Observation	1-4	Unique record identification
House size	6-9	Finished living area (square feet), excluding garage, porches and decks
Year	16-19	Year built
Dock	21-24	Size (square feet), if present
Pier	26-29	Size of second dock (square feet), if present
Garage	31-34	Size (square feet), if present
Deck	36-39	Size (square feet), if present; A=stoop
Porch	41-45	Size of porch or patio (square feet), if present; A=unfinished,enclosed; B=unfinished, open; C=patio
Shed	47-50	Size (square feet), if present; A=barn; B=unfinished, utility shed
Features	52-53	Presence of other valuable attributes: 1=hot tub; 2=whirlpool, 3=swimming pool; 4=greenhouse; 5=3 sheds; 6=2 porches; 7=patio; 8=pool and hot tub; 9=porch and patio; 10=greenhouse; 11=pool, whirlpool, porch, and patio