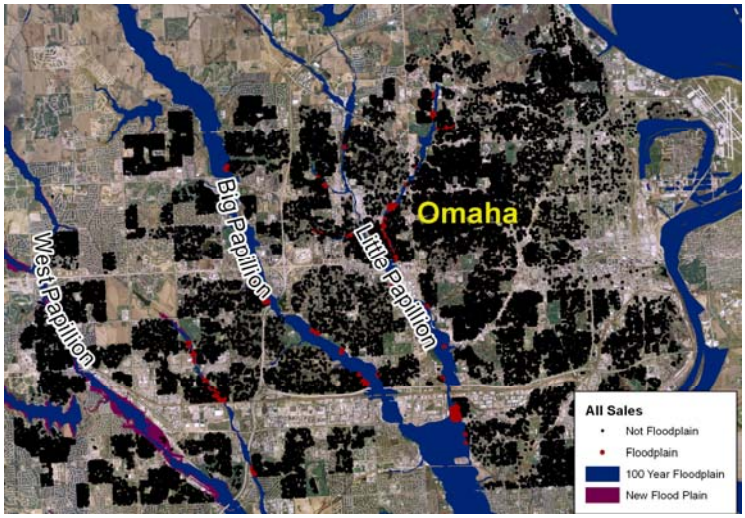
How Water Resources Limit and/or Promote Residential Housing Developments in Douglas County



Final Research Report (April 9, 2008)
Real Estate Research Center, College of Business Administration
University of Nebraska at Omaha

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Final Project Report

How Water Resources Limit and/or Promote Residential Housing Developments in Douglas County

Project Focus:

How do Floodplains, Man-made Lakes and Open Space/LID Subdivisions Impact Residential Property Values?

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Executive Summary

Objectives:

This research quantifies the relationships between water resources and residential property values in the Greater Omaha metropolitan area by measuring the impact of:

1. 100-year floodplain designations on residential housing prices to evaluate potential economic benefits of flood mitigation projects.

2. Man-made lakes on nearby residential property prices to identify strategies to maximize public benefits.

3. Alternative types of open space/low impact development (LID) subdivision designs on residential property values. This will help both the public and private sector better understand and promote successful and profitable LID subdivisions.

These analyses are expected to be of interest to both policy makers and resource managers in their ongoing efforts to design and implement cost-effective flood mitigation and stormwater water management projects in Douglas County.

Approaches:

The methodological approach of this study relied on empirical real estate transaction data that was referenced within a geographical information system (GIS) in order to quantify site-specific relationships between water resources and property values. In particular, hedonic price models (also known as ‘mass appraisal’ models) were estimated along with comparisons of the sale prices of residential lots. Earlier phases of this research have already been accepted for publication in peer-reviewed professional journals.

Results 1: Floodplain Impacts and Residential Property Values

Hedonic price models indicate that homes within Douglas-Papio Creek floodplains100-year floodplains have sold for 3.9% less than otherwise similar but non-floodplain homes

over the 1996 to 2007 time period. Based on these hedonic price impacts in conjunction with the estimated market value of all 1,123 Douglas-Papio floodplain homes, a hypothetical set of upstream flood mitigation projects which would remove all of these homes from the floodplain, would generate $5.3 million in increased property values.

Alternatively, potential flood mitigation benefits were also calculated based on the estimated cost of flood insurance premiums: $11.9 million for all Douglas-Papio floodplain homes versus $360,000 for only the homes designated to be in the newly revised floodplain in 2008 (based on 'grandfathered' non-floodplain insurance rates which are about 75% cheaper than typical 100-year floodplain rates).

These property valuation estimates related to floodplain status, could potentially be used by Douglas County for evaluating the economic feasibility of proposed flood mitigation projects in the Papio Creek Watershed. In particular, if it is known how proposed flood mitigation projects impact downstream floodplains (i.e. the number of homes removed from the 100-year floodplain), then either expected property value increases or avoided flood insurance could be considered as flood mitigation benefits. For example, depending on the likely effectiveness of a flood mitigation project, and the type of benefits deemed most appropriate for comparison, a range of possible economic benefits associated with future (hypothetical) Douglas-Papio Creek flood mitigation projects emerges: The low end of the range is $36,000 in benefits associated with a scenario of only 10% of homes being removed from the Douglas-Papio Creek floodplains, and considering only new insurance costs to homes placed in the floodplain in 2008-09. The high end of the range is $11.9 million based on avoided flood insurance when 100% of Douglas-Papio Creek residential properties are removed from the floodplain. This information could potentially be used in conjunction with results of hydrologic-based feasibility studies (by others) to evaluate the economic feasibility of proposed flood mitigation projects in Douglas and/or Washington County. However, two other key property types should be included in such analyses: Commercial property which is likely more valuable than residential property within these floodplains, and undeveloped land which would likely increase in value if it is removed from the 100-year floodplain.

Results 2: Amenity Values Created by Lakes

Hedonic valuation models of residential housing sales along with comparative lot sale analyses have demonstrated that substantial increases in residential property values have resulted from the construction of four different man-made lakes in the Omaha area. Lake views increase housing values by between 7% and 18% at the four different lakes and has created $26.7 million in increased housing values. Both view and access premiums are paid by home and/or lot buyers and based on the analyses of lot sales at two lakes, most of these premiums appear to be captured by landowners and/or developers at the time the lakes are first constructed. It is also evident that increased levels of exclusivity increase the premiums that homebuyers are willing to pay for both lake views and access.

An analysis of 'Dam Site 13' (the most recently constructed Omaha lake and the first 'public-private lake construction partnership'), demonstrated that the private sector partner contributed $1.6 million to the cost of lake construction and in return, is *expected* to generate an additional $7.7 million from incrementally higher lot sale values associated with view and access premiums. This corresponds to a discounted rate of return of 437% or, 87% annually for five years. These are *preliminary* estimates of potential profit levels and continued research on this topic is warranted particularly since it is suspected that part of the lot values in this subdivision may be due to proximity to a school and/or a very high quality subdivision design.

It was concluded that future public-private lake construction partnerships should more closely evaluate whether contributions from private developers are sufficient in relation to the increased profit levels associated with lake views and/or access that they are likely to capture. Alternatively, the design of future lakes should have more public recreation and buffer areas that improve both access and lake water quality in order to guarantee the public fully captures lake amenity values that are created through the use of public funds.

Results 3: LID Subdivision Design and Property Values

A set of 14 different hedonic valuation models were estimated across 326 different subdivisions in the western and southwestern (suburban) portions of Douglas County in

order to quantify how different types of open space characteristics, which are considered a proxy for alternative LID designs, impact residential property values. From this it was concluded that homeowners:

- Are willing to pay more for a home near open space if the open space is owned and/or managed by private versus a public entity.
- Prefer open space that is dominated by trees and mowed grasses over non-mowed areas, or open spaces with recreation (sports) facilities.
- Prefer open space with trails.
- Are willing to pay 1.1% more for clustered open space (LID) designs, and, 2.74% more for open (contiguous) open space (LID) designs than they would for conventional sub-division designs.

These research results should be useful to both public planners and private developers in the design and implementation of open space and LID subdivision designs within residential subdivisions. In particular, price premiums associated with alternative open space or LID subdivision designs can now be compared to their implementation costs and relative effectiveness for stormwater management.

Where These Research Methodologies Have Already Been Peer Reviewed

Shultz, S. and N. Schmitz. 2008 (forthcoming). Augmenting Housing Sales Data to Improve Hedonic Estimates of Golf Course Frontage. ***Journal of Real Estate Research.***

Shultz, S, and N. Schmitz, 2008. Viewshed Analyses to Measure the Impact of Lake Views on Urban Residential Property Values. ***The Appraisal Journal* (Summer, 2008).**

Shultz, S. and P. Fridgen. 2001. "Floodplains and housing values: Implications for flood mitigation projects". ***Journal of the American Water Resources Association*** 37(3)

Shultz, S. and D. King. 2001. "The use of census data for hedonic price estimates of open space amenities and land uses". ***Journal of Real Estate and Finance Economics*** 22(1)

Suggested Follow-Up Research

The original study objectives specified in the contract between UNO, Douglas County, and the NU Water Center, are considered to have been met by this Final Project Report. However, the UNO research team plans to conduct follow-up research on the various

suggested future research topics listed below (categorized by floodplain, lake amenities, and LID research themes). No additional funds are being requested from the sponsors for this continued research, and the resulting research results will be considered 'supplemental reports' and distributed to the Douglas County Board and the NU Water Center when they are completed (likely in the next 6 to 12 months).

Floodplain-Property Value Research

1) Conduct comparable sales based appraisal analyses.
2) Evaluate strategies to improve flood insurance cost estimates.
3) Conduct surveys of floodplain property owners.
4) Estimate the impact of floodplain status of commercial properties and for undeveloped land.
5) Determine total (residential, commercial and vacant) property values and related flood mitigation benefits in the Douglas-Papio floodplains

Lake-View Amenities

1) Conduct a hedonic analysis of sold lots at Standing Bear, and Zorinsky to better measure view and access values that were captured by developers
2) Continue to collect and monitor both lot and housing sales at Dam Site 13 to see if view and access premiums change over time
3) Conduct surveys of homebuyers at Dam Site 13 and nearby subdivisions to identify factors that may have influenced their purchase decisions and in particular, to assess the importance of lake views, access and other factors.

LID/Open Space Amenities

1) Replicate the open space hedonic price models using lot sales. This would potentially be more helpful for residential housing developers to identify different profit levels associated with different open space designs

2) Survey homebuyers to elicit their perceptions of and preferences for different open space amenities. This could potentially confirm many of the conclusions reached in this study based on observed property sales data

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The Impact of Floodplains on Residential Property Values

Background

The hedonic valuation method is a widely accepted approach to quantify the determinants of property values and for measuring the marginal contribution of environmental amenities (or disamenities). It relies on multiple regression where the dependent variable (usually housing price) is specified to be a function of structural housing characteristics, lot characteristics, neighborhood effects, transaction details (including time of sale), and environmental conditions. When the hedonic approach is used to quantify how floodplains impact residential property values, a dichotomous ('dummy') variable usually represents whether a property (usually a building) is located in the floodplain.

There are several reasons why it is important to quantify the relationship between 100-year floodplain status and property values. First, homeowners, appraisers and tax assessors regularly need such information to better understand how floodplain status affects the market value of residential properties. Second, such information can be used to help quantify the economic benefits associated with flood mitigation projects which are proposed to remove particular residential properties from the 100-year floodplain. Finally, an improved understanding of the relationship between floodplains and property values could potentially be used to determine how much individual floodplain property owners should contribute to the cost of specific mitigation projects which will potentially remove their properties from the floodplain and hence increase their property values.

It is expected that the development and refinement of methodologies to quantify the impact of floodplains on property values is particularly relevant in the Greater Omaha metropolitan area where 100-year floodplain maps have recently been re-drawn by the Papio-Missouri Natural Resource District (PMNRD) and the Federal Emergency Management Agency (FEMA). These new floodplain maps will become official by the end of 2008 or early 2009. The construction of new homes is not permitted in the 100-year floodplain but existing homes in these high flood-risk areas are usually permitted to

remain in existence and can be re-sold as long as their floodplain status is disclosed to potential homebuyers. Also, flood insurance administered by the National Flood Insurance Program (NFIP) is required for such homes by mortgage lenders. Preliminary estimates by the PMNRD indicated that there are about 2,600 properties in the 100-year floodplain (Douglas and Sarpy counties) and that approximately 700 to 900 of these properties have been designated to be included in the 100-year floodplain as a result of the new (2008-09) floodplain maps (PMNRD Spectrum Newsletter, Summer, 2007).

The impact of floodplain location on property values in Omaha has to date not been formally studied. In fact, the closest known location of a published hedonic floodplain study is Fargo, North Dakota, where it was determined that homes in the 100-year floodplain lowered home values by between 8.8% and 10.2% (Shultz and Fridgen, 2001). Another study in a suburban watershed in St. Louis, MO, measured a 4.7% floodplain impact on housing prices (Qui, Prato and Boehm, 2006). Negligible floodplain impacts have been noted in other regions, particularly in areas with high profile and recent flood events have not occurred and/or where homebuyers are not fully informed of the floodplain status of their homes prior to purchases (Chivers and Flores, 2002).

Study Objectives

1) Quantify Floodplain Impacts on Property Values

A hedonic price model is estimated to quantify the determinants of housing prices with a particular focus on the marginal impact of 100-year floodplain status. The study sample is a two-mile buffer around the Big, Little, and West reaches of the Papio Creek within Douglas County (hereafter referred to as the 'Douglas-Papio Creeks'). This study area was chosen since the Douglas-Papio Creeks contain the highest relative concentrations of floodplain properties in Douglas County, and because the Papio Creeks are the focus of several recently proposed flood mitigation projects.

2) Determine the Market Values of Floodplain Properties

Using Douglas County tax assessment records and GIS-based analyses of housing structures within FEMA D-Firm floodplain maps the market value of all residential

properties within the current and proposed (2008-09) Douglas-Papio Creek floodplains are estimated. This is based on ratios between assessed and sale values and site specific determinations of the floodplain status of individual homes.

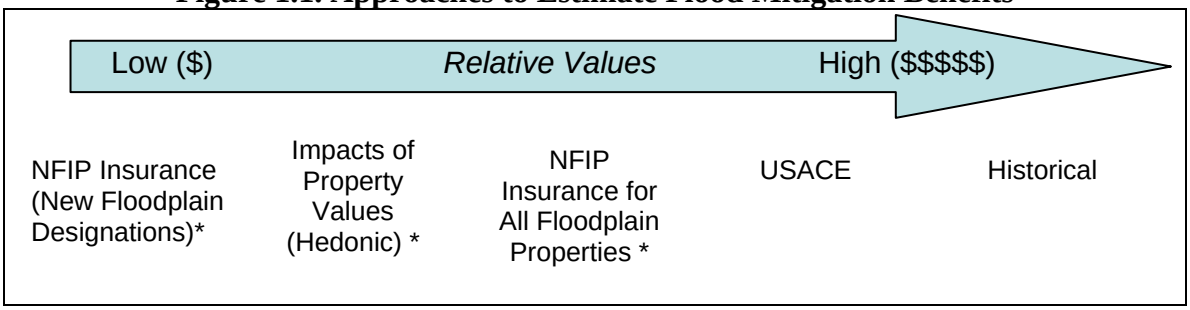
3) Estimating Potential Flood Mitigation Benefits

Here the potential economic benefits associated with flood mitigation projects that eliminate the 100-year floodplain status of residential properties in the Douglas-Papio Creek floodplains are calculated based on alternative criteria: a) Observed marginal impacts of floodplain location on property values; b) Flood insurance premium costs associated with all residential floodplain properties; and c) Flood insurance premiums costs only for homes designated to be in the new (2008-2009) 100-year floodplain.

In addition to identifying potential property value losses associated with floodplains, this research effort will demonstrate an approach for calculating the potential financial benefits which individual property owners could capture as a result of flood mitigation projects. This in turn could become a mechanism for objectively calculating special assessment taxes on these property owners who would directly benefit from specific flood mitigation projects and hence reduce the financial burden of such projects on taxpayers who will not receive any direct flood mitigation benefits.

It should be noted that there are other approaches used by policy makers to quantify flood mitigation benefits that were not evaluated by this present research. These include quantifying actual flood damage after specific flood events (i.e. historical flood data), and/or the standard USACE approach to quantifying potential flood damages which involves determining the value of first floor residential structures and a fixed amount of personal contents measured as percentage of structural value that would be potentially damaged during a 100-year flood events. The relative values of estimated flood mitigation benefits associated with each approach are shown in Figure 1.1. Insurance cost savings for homes determined to be in the 100-year floodplain after an earlier home purchase generate the lowest expected economic values, while observed historical flood damages are expected to generate the highest values flood mitigation benefits.

Figure 1.1. Approaches to Estimate Flood Mitigation Benefits



** Indicates approaches/values quantified by this present study*

The selection of a particular type of flood mitigation benefit for use in a cost-benefit analysis (CBA) of a specific flood mitigation project depends on which approach or value is most suitable from the dual perspectives of: 1) Reliability of data and estimation approaches (usually a function of available data); 2) Who is expected to received flood mitigation benefits (i.e. from whose perspective is the CBA being analyzed)?

For example, from the federal government's perspective, the use of the standard USACE inventory-based approach is likely the most appropriate as it accounts for damages from a wide societal perspective. In cases where extensive flood damage has occurred the use of historical data has benefits particularly for local and state governments who often want to determine how much flood damage has occurred above and beyond what is covered by flood insurance of other related federal emergency relief programs. Flood reduction benefits based on avoided flood insurance premiums primarily accounts for benefits captured by individual property owners (who may no longer be required to purchase flood insurance as the result of a specific flood mitigation project). Similarly, marginal property value impacts associated with flood reduction are also usually captured by, and of most interest to, private property owners. However, these price impacts usually generate lower flood reduction benefits due to the fact that many homebuyers either do not understand the present value of a future stream of insurance premium costs, or, they are not aware of floodplain risks. The final and lowest expected relative benefit associated with flood reduction is avoided flood insurance for properties placed into the floodplain after purchasing their homes (i.e. when floodplain maps are updated by FEMA). Although these are captured by private property owners, these benefits and costs

are often of societal concern under the premise that such property owners did not voluntarily purchase floodplain properties.

Historical damage data does not exist in sufficient frequency or detail in the Douglas-Papio Creek floodplains and the estimation of potentially avoided flood damage using the USACE approach requires information and data associated with flood mitigation projects and specifically impacted properties. However this information can be very difficult and time consuming to accurately estimate. As well, most of these USACE flood reduction benefits should be accounted for by the avoided insurance approach. Therefore, this study concentrates on the remaining three approaches: property price impacts (hedonic-based estimates), flood insurance for homes in the original 100-year floodplain, and alternatively, in the new (2008-09) floodplain.

Methods and Procedures

Hedonic Price Impacts of Floodplains

The hedonic price analysis quantifies the impact of the 100-year floodplain on residential housing sale prices within 2 miles of Douglas-Papio Creeks over the 1996 to 2007 time period. The study area includes the Big, Little, and West reaches of the Papio Creek within Douglas County (Figure 1.2). There are approximately 7,200 acres of existing (pre 2008) floodplains within this study area. The corresponding floodplain area in the Sarpy county portions of the Papio Creeks is approximately 6,200 acres.

Figure 1.2 Douglas-Papio Creek Study Locations

The real estate transaction dataset used for the study was generated by combining a Douglas county parcel database with real estate transaction data from the Great Plains Realtors Multiple Listing Service (MLS) over the January 1996 – June 2007 time-period. The MLS data was deemed necessary to account for detailed structural housing characteristics and transaction information (particularly the existence of any seller concession). The resulting database includes 22,350 arms-length sales.

Since the database was in a GIS format, it was possible to determine whether homes were within FEMA 100-year floodplain zones (zones A, AE, AJ and AO) based on spatial overlays of residential parcels and both original and 2008-09 FEMA floodplain maps (which were provided to us in a GIS format by the PMNRD). The identification of the floodplain status of sold residential properties first involved a spatial overlay of floodplain and parcel boundaries and then manual (visual-on-screen) inspections of house locations and floodplain boundaries using NAIP air-photos. This manual approach was

necessary since while a lot may be in the floodplain, flood insurance is only required if the actual house boundary is located in the floodplain and because the GIS database of properties does not explicitly contain the boundaries of housing structures. The resulting map contained in Figure 1.3 shows the locations (in red) of all the floodplain homes sold between 1996 and 2007 within the study area. Examples of the manual (property-by-property) analyses of whether homes were in or out of the floodplain (both the old floodplain and the revised 2008-09 floodplain) are show in Figure 1.4.

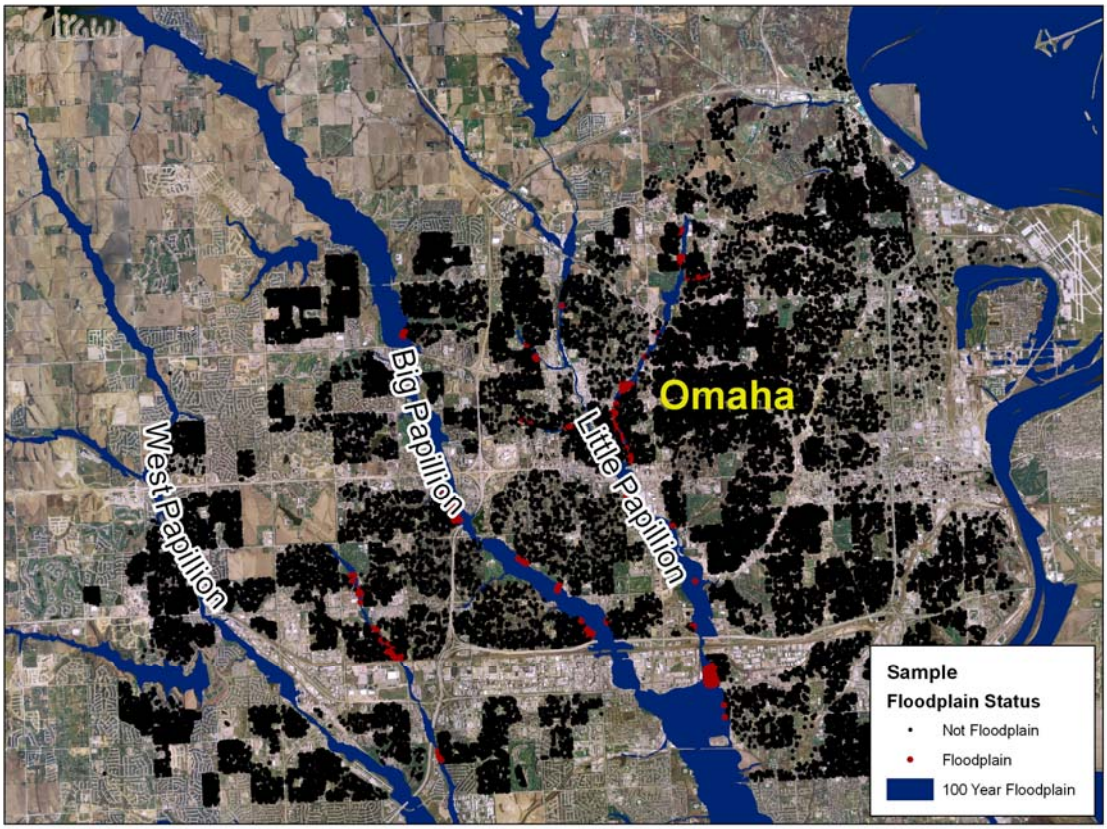


Figure 1.3 Sold Homes and Papio Creek 100-year Floodplain (1996-2007)

A. A Modern Subdivision Partially in the Original 100-Year Floodplain

B. Homes Previously Not in the Floodplain but now in the Year 2008 Floodplain (red areas)

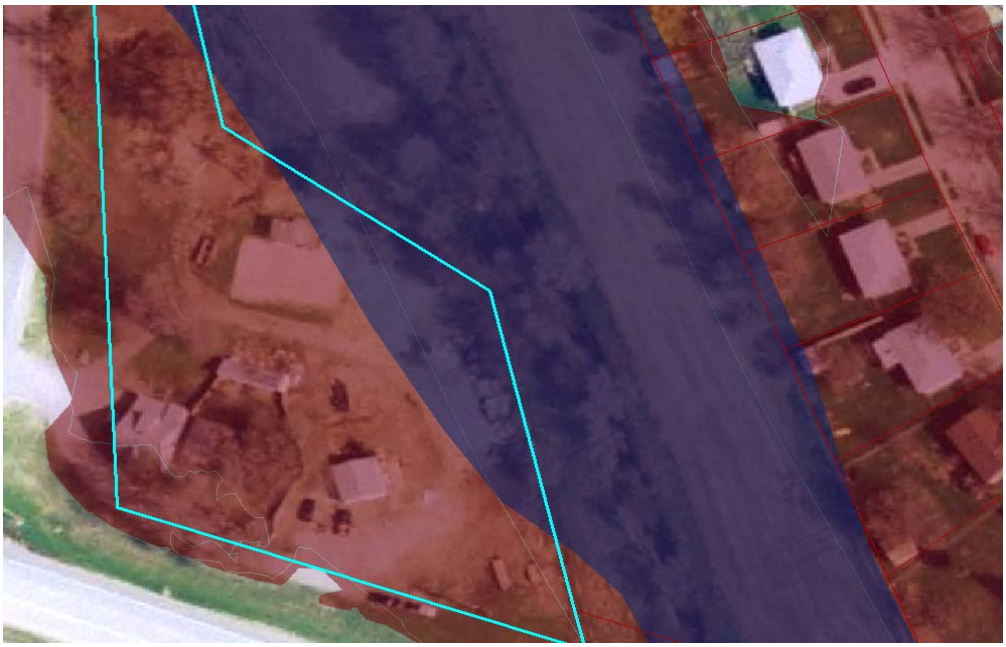


Figure 1.4 Examples of Sold Douglas County Floodplain Homes

GIS techniques were also used to quantify how far floodplain homes were from major roadways and/or, industrial areas, and water features (streams and/or impounded water bodies). The full range of explanatory variables used in the hedonic price model is summarized in Table 1.1. The functional form used to represent the relationship between

particular explanatory variables and housing prices varies based on the literature (previous studies) and our own experiences with hedonic price modeling in Omaha. Log terms are used with lot size, house size, distance to water, and distance to industrial locations in that the marginal effects of these characteristics are less as the magnitude of the variable gets larger, i.e. diminishing marginal returns.

With respect to the floodplain explanatory variable (whether or not a property is located within the floodplain) log-linear functional form is used. Therefore the resulting coefficient can be interpreted directly as percentage change in sale price resulting from whether or not a home is located in the 100-year floodplain. It has been pointed out previously by Kennedy (1981) that the interpretation of log-linear coefficients must be adjusted for by using the following equation: $\hat{g} = e(\hat{c} - (½)V(\hat{c})) - 1$ where $\hat{g}$ is the percentage effect of the dummy variable as adjusted by the variance of the coefficient $V(\hat{c})$.

The Market Value of Floodplain Homes

The market value of residential properties in the 100-year floodplain portions of the Douglas-Papio Creeks was estimated by cross listing Douglas County tax assessment records and our GIS based analyses of housing structures within the most recent FEMA floodplain maps. After quantifying sale assessment ratios of Papio Creek floodplain homes in Douglas County (i.e. comparing assessed values to actual sale prices while accounting for any potential seller concession), the reciprocal of these ratios are multiplied by the aggregate (total) assessed values of all residential properties in the Douglas-Papio Creek floodplains to generate an estimate of the market value of all residential properties both within the original and the revised (2008-09) floodplains.

Table 1.1. Variables in the Douglas County Hedonic Price Model

Variable Name	Definition	Functional Form Used	Expected Sign (impact)
1) Dependent Variable (Y)			
Adjusted Price	Sale Price minus any seller concessions ($)	(log Price)	
2) Explanatory Variables			
D Floodplain	In the 100-year floodplain? (yes/no)	linear	-
Industry	Distance to Industrial Land Uses (ft)	log	+
Road	Distance to Major Road (ft)	Linear	+
Water	Distance to Water Body	Log	-
House Size	Finished House Size (sft)	Log	+
LotSize	Lot Size	Log	
Age	The home age (years)	Linear	-
Fireplaces	Number of fireplaces	Linear	+
Garage Spaces	Number of garage stalls	--	+
Bathrooms	Number of bathrooms	Linear	
DAvg	Home is average condition	Linear	+
DAboveAvg	Home is above avg. condition	Linear	+
Year	Year of Sale 1999-2007	Linear	Varies

Potential Flood Mitigation Benefits

The potential economic benefits associated with hypothetical flood mitigation projects that result in the elimination (removal) of the floodplain designation for residential properties in Douglas-Papio Creek floodplains involves using all the previously generated information on floodplain price impacts, floodplain properties and the market value of floodplain properties.

The marginal benefits of homes potentially removed from the floodplain based on estimated hedonic price estimates (i.e. homebuyer preferences) account for increases in property values (i.e. likely selling prices) resulting from the floodplain status of homes being eliminated. In particular, marginal price impacts of floodplains are multiplied by estimates of the total property value of all Douglas-Papio Creek floodplain homes.

Estimates of the present value of floodplain insurance premiums they are assumed to no longer be required for Douglas-Papio Creek floodplain homes in the original 100-year floodplain first requires multiplying the assessed values of homes (buildings only) by an estimated average cost of a floodplain policy that covers the building and personal contents valued at 30% of building value. These flood insurance costs were obtained from the National Flood Insurance Program website of FEMA (NFIP, 2008) and should be considered only approximate estimates for floodplain insurance costs for properties located in floodplain zones A, AE, AJ and AO. In reality, premiums are based on site specific home and site data. To determine the present value of insurance premiums over time, annual premiums are discounted over a 30-year period using a 7% discount rate.

Flood insurance premium costs for homes designated to be in the new (2008-09) 100-year floodplain are assumed to be 25% of the cost of flood insurance associated with the original 100-year floodplain. This is due to the widely known loophole that allows homeowners in the new floodplain designation to obtain a flood insurance policy based on the previous (non-floodplain) status prior to the official approval of revised and expanded floodplain maps.

Results

Properties in the Douglas-Papio Creek Floodplains

A total of 1,643 residential homes were found to potentially be in the Douglas-Papio Creek 100-year floodplain (based on original and new 2008 floodplain maps). Visual (GIS-based) inspections of individual homes found that only 1,123 (or 68%) of these homes were actually in the floodplain (i.e. parts of the property lot may have been in the floodplain but the house structure itself was not).

Over the 1996 to 2007 time-period, 243 Douglas-Papio Creek floodplain homes with lots (in the original, pre-2008 floodplain) were sold through the MLS and manual inspections of house locations determined that only 200 (82%) of these homes were actually located in the floodplain. The characteristics of floodplain versus non-floodplain homes sold over this period are summarized in Table 1.2 Floodplain homes are on average priced 16% lower than sold non-floodplain homes, but these homes were also smaller and had fewer fireplaces, garage spaces, and bathrooms. However, floodplain homes on average have larger lot sizes and were farther from major roads or industrial areas, and were closer to water bodies. The advantage of using a hedonic price equation to quantify the marginal effect of floodplain location on sale prices is that it controls for different characteristics of properties.

Hedonic Price Estimates of Floodplains

The multiple regression model summarizing the hedonic floodplain results is summarized in Table 1.3. All of the explanatory variables in the model are statistically significant at the 90% confidence level or higher and have the expected directional impact on property values. The R^2 of the model is 0.79 meaning that 79% of the variation in price is explained by the model and the F-statistic was significant at the 1% level indicating that all variables considered jointly have a statistically significant impact on sale prices.

Coefficients for non-linear variables (with logs) need to be numerically manipulated before directly interpreting their marginal effects on sale price but the linear coefficients can be interpreted directly. For example, each additional year of age decreases a home's

sale price by 0.3% while each additional bathroom contributes 4.2% and an ‘above average condition home would be worth around 15% more than an otherwise similar home. The dummy variable coefficient for floodplain location was negative and statistically significant and indicates that floodplains reduce property values by 3.9% (based on both the original coefficient and the Kennedy coefficient transformation).

This floodplain price discount of 3.9% observed in Douglas County is substantially lower than floodplain impacts noted in other locations of the country and appears to be considerably less than the present value cost of flood insurance premiums that are required for mortgage loans. There are three possible explanations for this. First, these homes may have natural resource amenities that are not being fully accounted for in our model. That is, homebuyers may be overlooking floodplain risk because these homes are on large lots with streams and/or nearby other open space amenities (views, wildlife etc). A second possible explanation is homebuyers may not be fully aware of the full extent of floodplain risks in light of the fact that no major flood events have occurred in the region in recent years. Third, homeowners may not fully understand the present value costs of flood insurance premiums required over time.

Table 1.2 Floodplain/Non-Floodplain Housing Sale Characteristics (Douglas-Papio Floodplain, 1996-2007)

Variable	Non-Floodplain Sales(n=22,150)				Floodplain Sales (n= 200)			
	Mean	Median	Min	Max	Mean	Median	Min	Max
Adjusted Price	$138,413	$123,000	$14,000	$899,000	$100,803	$95,000	$26,759	$212,500
Industry	4,450	3,448	38	16,462	2,437	2,120	139	6,291
Road	804	720	30	2,616	838	823	85	2,460
Water	2,185	1,904	27	7,606	517	372	53	4,764
LotSize (sqft)	10,045	8,712	0	460,429	9,322	7,841	2,178	62,726
HouseSize (sqft)	1,900	1,724	400	6,511	1,453	1,415	750	3,698
Age [Years]	34.3	33.0	0.0	136.0	38.1	41.5	0.0	96.0
Fireplaces	0.73	1.00	0.00	4.00	0.34	0.00	0.00	2.00
Garage Spaces	1.73	2.00	0.00	4.00	1.35	1.00	0.00	4.00
Bathrooms	2.42	2.00	0.00	4.00	1.81	2.00	1.00	4.00
D Avg.*	0.32	0.00	0.00	1.00	0.44	0.00	0.00	1.00
D Above Avg.*	0.34	0.00	0.00	1.00	0.20	0.00	0.00	1.00
D 1997 to D 2007 (% Sold in)	0.07	0.00	0.00	1.00	0.06	0.00	0.00	1.00
D 1998	0.08	0.00	0.00	1.00	0.09	0.00	0.00	1.00
D 1999	0.08	0.00	0.00	1.00	0.06	0.00	0.00	1.00
D 2000	0.08	0.00	0.00	1.00	0.07	0.00	0.00	1.00
D 2001	0.09	0.00	0.00	1.00	0.07	0.00	0.00	1.00
D 2002	0.10	0.00	0.00	1.00	0.11	0.00	0.00	1.00
D 2003	0.11	0.00	0.00	1.00	0.09	0.00	0.00	1.00
D 2004	0.11	0.00	0.00	1.00	0.14	0.00	0.00	1.00
D 2005	0.12	0.00	0.00	1.00	0.14	0.00	0.00	1.00
D 2006	0.10	0.00	0.00	1.00	0.11	0.00	0.00	1.00
D 2007	0.05	0.00	0.00	1.00	0.05	0.00	0.00	1.00

Table 1.3 Regression Results: Douglas County-Papio Creek Hedonic Model

Variable	Coef.	Std. Err.	P>t
D Flood	-0.039	0.013	0.003
Ln Industry	0.016	0.002	0.000
Ln Road	0.006	0.001	0.000
Ln Water	-0.006	0.002	0.001
Ln LotSize (sqft)	0.079	0.003	0.000
Ln HouseSize (Sqft)	0.618	0.006	0.000
Age [Years]	-0.001	0.000	0.000
Fireplaces	0.067	0.002	0.000
Garage Spaces	0.081	0.002	0.000
Bathrooms	0.020	0.002	0.000
D Avg.	0.003	0.005	0.537
D Above Avg.	0.051	0.005	0.000
D 1997	-0.022	0.006	0.000
D 1998	0.021	0.006	0.000
D 1999	0.076	0.006	0.000
D 2000	0.103	0.007	0.000
D 2001	0.115	0.007	0.000
D 2002	0.146	0.007	0.000
D 2003	0.177	0.006	0.000
D 2004	0.219	0.006	0.000
D 2005	0.263	0.006	0.000
D 2006	0.257	0.005	0.000
D 2007	0.227	0.006	0.000
Constant	5.907	0.048	0.000
Obs.		22350	
F(26, 35704)		3656.22	
Prob > F		0.0000	
R^2		0.7902	
Adj R^2		0.7900	
Root MSE		0.1831	
Interpretation*		-3.9%	

** Calculated using Kennedy's (1981) equation*

Flood Insurance Costs

Based on NFIP flood insurance calculators and our sample of floodplain homes, annual flood insurance premiums among Papio-Creek properties are assumed to be 1% of the building (improved value) of properties. This also assumes that contents up to 30% of building value are also insured. Based on the average $100,000 property value of these

homes in the sample this indicates that the average value of buildings/improvements would be $86,000 and that the typical cost of a flood insurance policy for such a home (covering the structure and contents) is therefore $860 per year. The present value of these insurance premiums over 30 years (and using a 7% discount rate) is $10,672 which corresponds to 11% of the total property value or 12% of the improved (home value). Alternatively, flood insurance costs over a hypothetical 30-year ownership period represent 11% of the value of Douglas-Papio Creek floodplain homes located in the original 100-year floodplain

Corresponding present values of floodplain insurance costs for homes designated to be in the new (2008-09) floodplain (based on an insurance premium calculated for non-floodplain homes) is therefore 2.8% of the value of homes (25% the cost of a regular insurance policy).

Market Values of Douglas-Papio Creek Homes

The total value of all 971 residential properties in the original Douglas-Papio Creek floodplains is $111,166,877 or $96,517,196 for improvements (buildings). The corresponding values for the 152 residential properties in the new (2009-09) Douglas-Papio Creek floodplains are $13.9 million, or $11.8 million for improvements.
The ratio of assessed values to market sales among 200 Douglas County-Papio Creek floodplain homes sold between 2002 and 2007 ranges from 80% to 91% (in 2007 based on 26 sale ratio comparisons). These observed year 2007 assessment ratios are used to convert year 2007 assessed improved values to market value improved values (i.e. assessed improved values are multiplied by 1.1).

Therefore the estimated market value for properties in all Douglas-Papio Creek floodplains (both the original and the revised 2008-09 floodplains) is $136.3 million or $118 million for improvements (buildings). Corresponding values specific to the original floodplain (971 properties) are $121.2 million and $105.2 million (improved). Corresponding values for the new 2008-09 floodplain (152 homes) are $15.1 million and $12.9 million (improvements).

Potential Flood Mitigation Benefits

1) Observed Homebuyer Preferences (Hedonic Price Estimates)

Multiplying the total assessed value of all 1,234 Douglas-Papio Creek residential floodplain properties (both the original and new floodplains) by the observed price impact of floodplain status (-3.9%) results in a total property value reduction due to the existence of the Douglas-Papio Creek floodplain of $5.3 million.

This means that if the 100-year floodplain status for all Douglas-Papio Creek floodplain homes was changed (i.e. removed) through a hypothetical upstream flood mitigation project then it is likely that these property values would increase by 3.9% (i.e. $5.3 million). This marginal price effect for an assumed 100% effective flood mitigation project (a highly optimistic scenario) can be adjusted downwards to reflect the actual impacts of flood mitigation projects. For example, if such a flood mitigation project was expected to reduce the floodplain status of only 50% of the homes in the floodplain than projected benefits would be cut in half to 1.95% (or $2.7 million). It should be noted that such benefits are captured directly by private property owners and some people in society may object to using public funds to create economic gain for private individuals, particularly when property owners either paid discounted prices for floodplain properties and/or receive other offsetting amenity benefits associated with floodplains areas (open space, wildlife, viewing, etc).

Besides being useful for cost-benefit analyses, the approach used here to estimate benefit measures from the perspective of marginal increases to property values, are useful in that they identify who specifically receives the flood mitigation benefits (in this case it is private property owners), and by how much (here, it is 3.9% of the market value of properties.) This monetary estimate could therefore be used to assign special tax assessments to individual property owners based on the relative value of flood mitigation project benefits they receive. For example, if it is assumed that floodplain property owners would be willing to paying $5.3 million in flood mitigation project costs in order for their property values to increase by the same amount (3.9%), then the proponents of flood mitigation projects should attempt to capture contributions from these private

property owners. Hopefully this would reduce the tax cost burden of other residents who will receive little or no specific private benefits from flood mitigation projects.

2) Avoided Flood Insurance Costs

Multiplying the total estimated market value of improvements in the original 100-year floodplain ($105.2 million) by the observed present value cost of flood insurance (11% of structural values), generates a present value flood insurance policy cost (specific to the original pre-2008 floodplain) of $11.6 million.

This means that if the 100-year floodplain status for these 1,123 Douglas-Papio Creek properties was changed (removed) through some upstream flood mitigation project, then it is likely $11.6 million of combined flood insurance costs would be avoided. Again, these benefits accrue directly to private property owners.

It should be noted that these flood insurance premiums are only estimates and likely to be lower since many floodplain owners are likely to have obtained lower cost flood insurance policies (issues prior to official floodplain status notification from the Federal Government) and the fact that some property owners are likely to own their homes outright and hence are not legally required to have flood insurance policies. Nevertheless, this insurance cost estimate does provide a possible measure of the marginal benefits of a flood mitigation project that is 100% successful.

Since many floodplain property owners do not appear fully aware of the full costs of their flood insurance policies (in that these insurance costs are not fully capitalized into the price discounts they pay for floodplain properties), it is not very likely that these property owners would be willing to pay $11.6 million for a flood mitigation project that would reduce the present value of flood insurance costs. For this reason, the earlier hedonic based economic flood mitigation project benefits are considered more reliable for use in cost benefit analyses. Further support of the use of these potential project benefits could easily be measured through surveys of floodplain property owners in order to gauge their willingness to contribute specific monetary amounts for expected floodplain risk benefits.

Corresponding flood insurance costs for the 152 homes recently designated to be in the new (2008-2009) floodplain is only $360,000. Therefore if it was assumed that for whatever reasons Douglas County was responsible for the floodplain status of these properties, it would cost the County only $360,000 to compensate these property owners by paying their insurance premiums. Alternatively this $360,000 cost could be compared to the potential costs of proposed flood mitigation projects to determine whether it is feasible for the County to contribute to such projects.

Finally, it should be noted that there are other approaches used by policy makers to quantify flood mitigation benefits that were not evaluated by this present research. These include quantifying actual flood damage after specific flood events (i.e. historical flood data), and/or the determination of the value of first-floor housing structures (and home contents) that would be potentially damaged during 100-year flood events. This issue is discussed further in the Policy and Implications section.

Summary and Policy Implications

This research has demonstrated a methodology to accurately measure flood mitigation benefits using empirical real estate transaction data. The observed price differences between floodplain and non-floodplain homes in Douglas County (3.9%) could potentially be used by the PMNRD and/or County governments or others in negotiating fair market prices to pay for floodplain homes as part of their floodway purchase program. These statistics may also be taken into consideration by county tax assessors when valuing floodplain residential properties.

Alternatively this floodplain impact measure can be used as a reliable measure of avoided flood damage (i.e. an economic benefit of particular flood mitigation projects). In this case it was shown that if a future flood mitigation project was able to remove the 100-year floodplain status for all of the Douglas-Papio Creek floodplain properties (which is a highly optimistic and perhaps impossible and/or expensive outcome), then it is likely that these property values would increase by 3.9% (i.e. $5.3 million). Similar benefits

associated with mitigation projects that reduce the floodplain status for fewer homes can also be estimated using the data and analyses contained in this report. This information is expected to be useful for Douglas County when evaluating the economic feasibility of participating in future flood mitigation projects associated with the Papio Creeks.

If flood insurance costs were considered a more relevant measure of potential flood mitigation benefits, then flood mitigation project costs should be compared to $11.9 million for all floodplain properties or $360,000 for only properties in the new floodplains.

A summary of potential estimated benefits of future (hypothetical) Douglas-Papio Creek flood mitigation projects requires multiplying property value impacts and/or insurance costs by the estimated value of properties expected to be removed from the floodplain (which would hopefully be quantified by the 'feasibility studies' of particular flood mitigation projects). A full range of these potential benefits associated with hypothetical flood mitigation projects that remove between 10% and 100% of homes from the Douglas-Papio Creek floodplain are summarized in Table 1.4. Depending on the likely effectiveness of flood mitigation projects and the types of benefits considered, the value of future (hypothetical) Douglas-Papio Creek flood mitigation projects ranges from $36,000 (only 10% of homes removed from the floodplains and considering only new insurance costs to homes placed in the floodplain in 2008-09) to $11.9 Million (100% of homes removed from the floodplains and considering all avoided insurance costs).

Table 1.4. Potential Estimated Benefits of Douglas-Papio Flood Mitigation Projects

	Homes Potentially Removed From the 100-Year Floodplain (from a hypothetical flood mitigation project)			
	10%	***25%***	***50%***	***100%***
A) Property Value Increases (hedonic estimates, all floodplain homes)		$ 1.3 million	$ 2.7 million	$ 5.3 million
B) Avoided Insurance Costs (All Floodplains homes)		$ 2.9 million	$ 6.0 million	$11.9 million
C) Avoided Insurance Costs (2008-09 Floodplain home additions only)	$36,000	$90,000	$180,000	$360,000

** Note these potential benefits should not be combined as this would be a form of double (or even triple) counting of the same benefits.*

A possible limitation in using this floodplain impact and benefit valuation research is that two other key property types have not been considered. These include commercial property which ***may*** be as much or more valuable than residential property within Douglas County floodplains, and undeveloped property, which if removed from the floodplain could have a significantly higher and best use.

It is therefore proposed that these two missing classes of floodplain properties be included on a list of recommended future research. But it should also be noted that if commercial property values are two, three or even four times the value of residential property values in the Douglas-Papio Creek floodplains, this does not necessarily mean that the marginal benefits of removing commercial floodplains from the properties will automatically generate flood mitigation benefits that are this magnitude or larger than observed with residential properties. This is due to various differences between structural characteristics of commercial and residential properties. For example, many commercial properties are multi-storied meaning that flood risk is only associated with ground floor portions of the structures. It is therefore highly recommended that future research be conducted on the impact of floodplains on commercial properties in the Douglas-Papio Creek areas. If and when this does occur it will be very important to identify the level of potential flood mitigation efforts captured by specific commercial property owners.

This research has generated transparent and replicable research that should in the future be useful to Douglas County or other local government entities for the task of evaluating the benefits and economic feasibility of flood mitigation projects. In particular the data provided here can be used to evaluate different types of economic benefits associated with flood mitigation projects that directly impact Douglas County. This information can also be used to determine how much individual property owners should contribute to flood mitigation projects, and to taxpayers in deciding whether or not they support particular flood mitigation projects.

Proposed Follow-up Studies

1) Comparable sales-based appraisal analyses.
It would be prudent to re-estimate these impacts using an alternative approach, namely the use of traditional appraisal-based comparable sales analyses where floodplain homes are compared directly to two or three nearby comparable sales not in the floodplain.

2) Improving flood insurance cost estimates.
More accurate estimates are needed based on home specific characteristics. This would likely require site inspections of individual homes and/or surveys of homeowners.

3) Surveys of floodplain property owners.
It would be interesting to determine the percentage of homebuyers who knew about the floodplain status of their homes when they were purchased, their understanding of the financial implications (required flood insurance costs), and their perception concerning flood risk and the pros and cons of living in the floodplain.

4**) Estimating the impact of floodplain status of undeveloped land.**
It may likely be that that floodplain status has a larger impact on undeveloped residential and/or commercial lots than what was observed for developed properties. It is expected that the hedonic methodologies used in this present study can be adapted to a lot-level analyses with recently collected lot sales data in Douglas County. This analysis is planned by the UNO research team in the coming months (a supplemental project for

which no additional funding is needed or sought). This is considered critical to estimating the total potential benefits of proposed floodplain mitigation benefits.

5) Estimating the impact of floodplain status on commercial properties.
It may be that commercial property values in the Douglas-Papio floodplain may be substantially (up to four times) higher than residential values. In addition to evaluating the accuracy of assessed tax values for estimating commercial market values in these floodplains, it will be necessary to quantify how floodplain designations impact commercial property values, and it is also necessary to estimate the present value of flood insurance premiums for commercial properties.

6) Replication of the entire research effort in Sarpy and Washington Counties.
It would be advisable to replicate these completed and proposed research items studies in Sarpy and Washington County. The acreage of Douglas-Papio Creek floodplains is around 7,200 acres versus around 6,200 acres for the Sarpy-Papio Creek floodplains.

Lake Views, Access, and Residential Property Values

Background and Objectives

In the last decade, several man-made lakes have been constructed in the Omaha area for the purposes of flood control, recreation, and to create amenities for adjacent and/or nearby residential housing. Additional lake construction is now actively being planned and promoted for these same purposes, as well as for stormwater management, primarily by the Papio Missouri Natural Resource District (PMNRD).

The intent of this present study component is to evaluate how different types of man-made lakes in the Omaha area impact residential property values. The goal is to quantify premiums that homebuyers are willing to pay for both lake views and access, and to determine how much of these premiums are captured by the private sector (i.e. residential housing developers) through the sale of residential lots that have views and/or good access to man-made lakes. Hopefully this information will be used in the future to ensure that private developers make adequate (fair market) contributions to future lake construction efforts which they will benefit from. It is assumed that such private sector contributions are only appropriate in cases where developers sell, trade, or contribute land or financial assistance to lake construction that is adjacent to land which they own.

This study relies on four interrelated approaches. First, hedonic price modeling is used to quantify the determinants of residential housing sales at four different lakes over the 2000 to 2007 time period. The lakes include: Zorinsky, Standing Bear, Candlewood, and Walnut Creek. The validity of the use of this hedonic valuation approach for valuing lake views has already been established as preliminary research results that focused on only two of these lakes (Zorinsky and Standing Bear) have recently been accepted for publication in the summer, 2008 issue of the peer reviewed The Appraisal Journal.

Second, comparisons are made between the sale prices of vacant lots with and without views in order to determine if original landowners and/or developers capture lake amenity premiums at the time lakes are constructed or alternatively, whether lake view

premiums develop gradually over time and hence are captured by subsequent homeowners. Third, comparisons are made between the prices of non-view lots with close access to lakes (within 2000 feet), and the prices of non-view lots that are further away (more than 2000 feet away but within ½ mile) to quantify access values.

Fourth, detailed comparisons of lot prices both within the Elk Ridge subdivision on the western shore of the Dam Site 13 Lake which is the most recent lake constructed in the Omaha area, and the first 'Public-Private Partnership' between the PMNRD and a residential housing developer. Since not enough homes within this sub-division have yet sold, it was not possible to estimate a conventional hedonic valuation model at this lake. Instead, several alternative comparisons are made between sold lot prices within and nearby the subdivision in order to estimate both view and access premiums that are likely to be captured over time by the developer. View premiums are based on observed differences between view and non-view lot prices within the subdivision.

In contrast, access premiums are based on observed differences between non-view lots in Elk Ridge and in several nearby subdivisions that do not have as good access to the Dam Site 13 Lake. View and access premiums are then used along with existing lot maps for the subdivision, to estimate total premium values be captured by the developer.

All of these analyses combined, are expected to be useful for demonstrating the economic value that Omaha area residents place on lake amenities, and to estimate the economic benefits generated by the construction of different types of new lakes in the Omaha area in the coming years. As well, the results of this study might be a useful tool for negotiating 'fair-market' financial contributions which real estate developers (who build single-family residences adjacent to and/or nearby future lakes) should make to the future lake construction efforts.

Background Information on the Five Study Lakes

The location of all five of the lakes evaluated by this study are shown in Figure 2.1. Standing Bear Lake was constructed by the USACE in 1977 and encompasses 135 acres.

It contains an extensive 396 acres of public parkland and buffers between the lake and nearby residences. Lake Zorinsky, completed in 1993 by the U.S. Army Corps of Engineers (USACE), covers 255 acres and is surrounded by private residential housing along with some public use areas and public buffers.

Candlewood Lake was constructed in 1978 entirely by a private developer after the USACE determined that it was not economically feasible for the purposes of flood control. It is only 34 acres in size and is completely surrounded by private residences (98 homes) and contains no public access of buffers. Water quality in the lake is marginal. In stark contrast is Walnut Creek Lake, which is 105 acres and was constructed in 1999 with funds from the PMNRD, the Nebraska Natural Resource Commission, and the Nebraska Game and Parks Commission. It contains very extensive (450 acres) public recreation areas and land buffers around the lake and so far appears to have good water quality.

The Dam Site 13 Lake was constructed in 2005 and 2006 by the PMNRD and with financial contributions from a private developer. The developer purchased the entire land parcel where the lake, parks and residential developments are for $53,000 per acre and then sold to the PMNRD all the land needed for the dam and lake as well as adjacent land on the western and southern shore for the same price (on a per acre basis). The developer retained control of the western shore of the lake as well as a small land tract on the eastern shore, and contributed $1 million in cash and $600,000 in future payments to help offset the cost of the dam and lake construction (Deed of Trust, PMNRD, 2006). The remaining project costs of around $6.4 million were met by PMNRD and the majority of these expenses were associated within land procurement and dam construction costs. The present value of dam maintenance costs over time (which will be the responsibility of the PMNRD) have not been explicitly stated.

Much of the adjacent land on the southern shore of the Dam Site 13 Lake has been turned over to the City of Omaha for a public park (‘Memorial Park of the West’), and this park area is connected to the western fringe of the lake via a public walking trail (See figure 2.3). Although none of the residential lots on the western shore that are being developed

have 100% exclusive access to the lake, their boundaries are very close to the lake and there are no visibly planned public parking or access points located on the western or northern shores of the lake (i.e. within the Elk Ridge housing development). Therefore, lake access for the majority of the public will have to be through the southern part of the lake. Alternatively, almost half of the lake appears to have been captured for private use. The developer also owns a small commercially-zoned area on the western shore of the lake that is next to a privately-owned industrial land use.

Finally, the PMNRD states that the lake will reduce runoff from the 2-square mile watershed by 90% in a 500-year flood event but will not reduce any of the main-stem Papio 100-year floodplain (Personal Communication March 4, 2008, Paul Woodward, PMNRD).

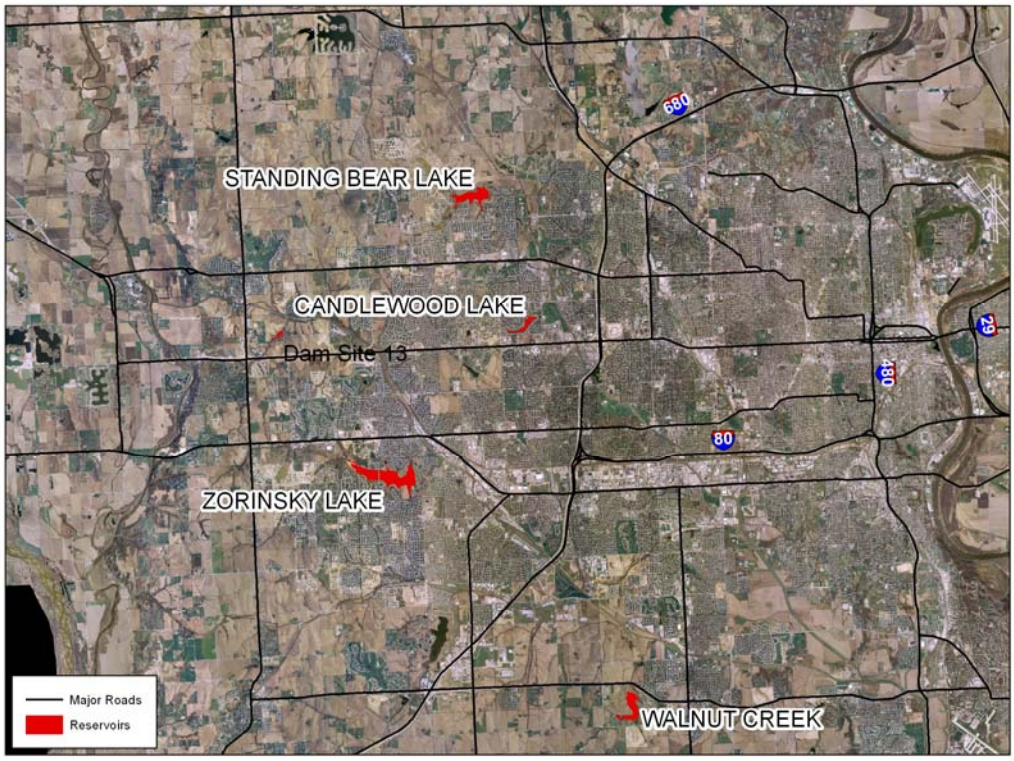


Figure 2.1. Location of the Five Lakes Evaluated

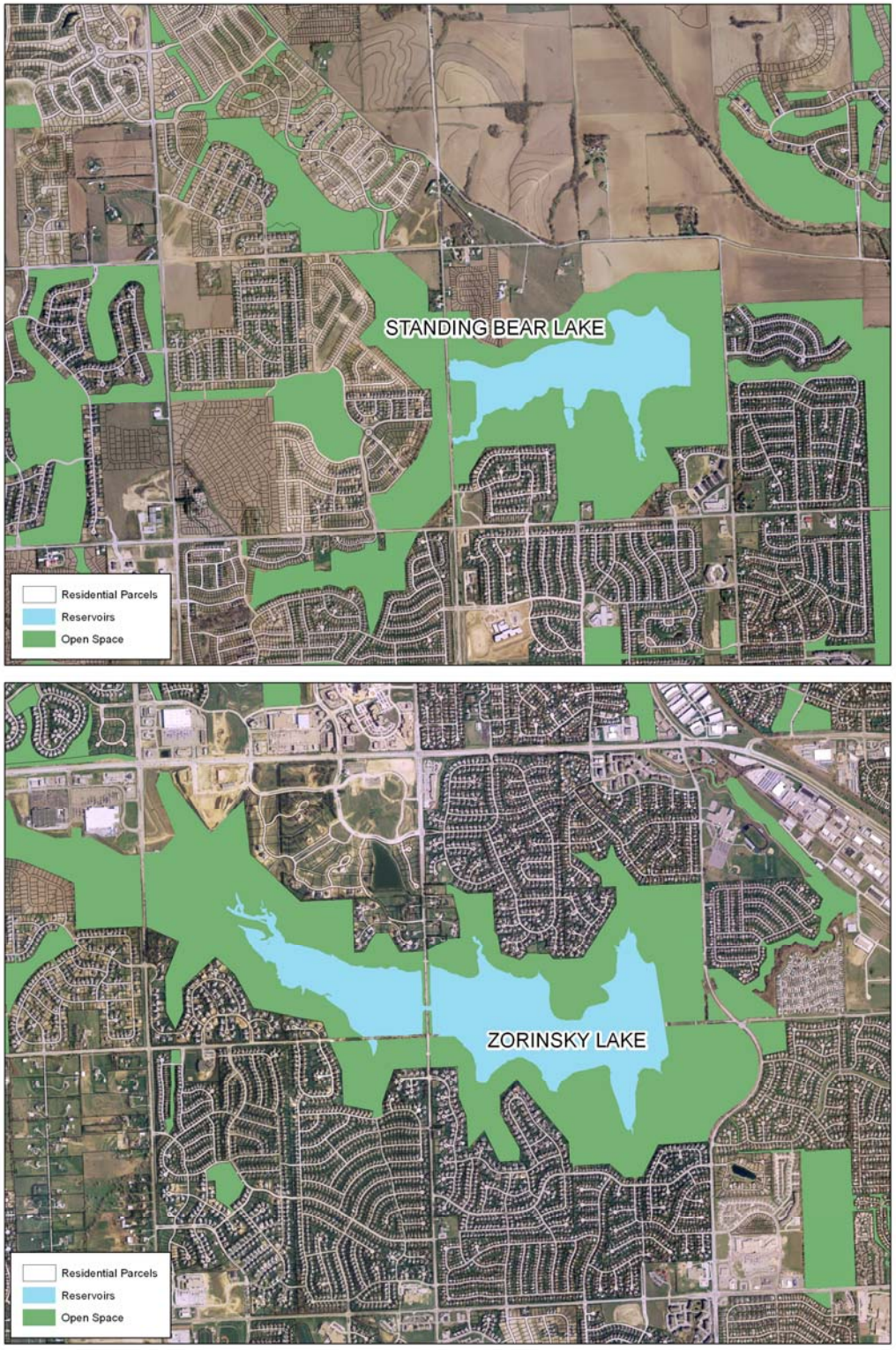


Figure 2.2 Land Uses Surrounding Standing Bear and Zorinsky

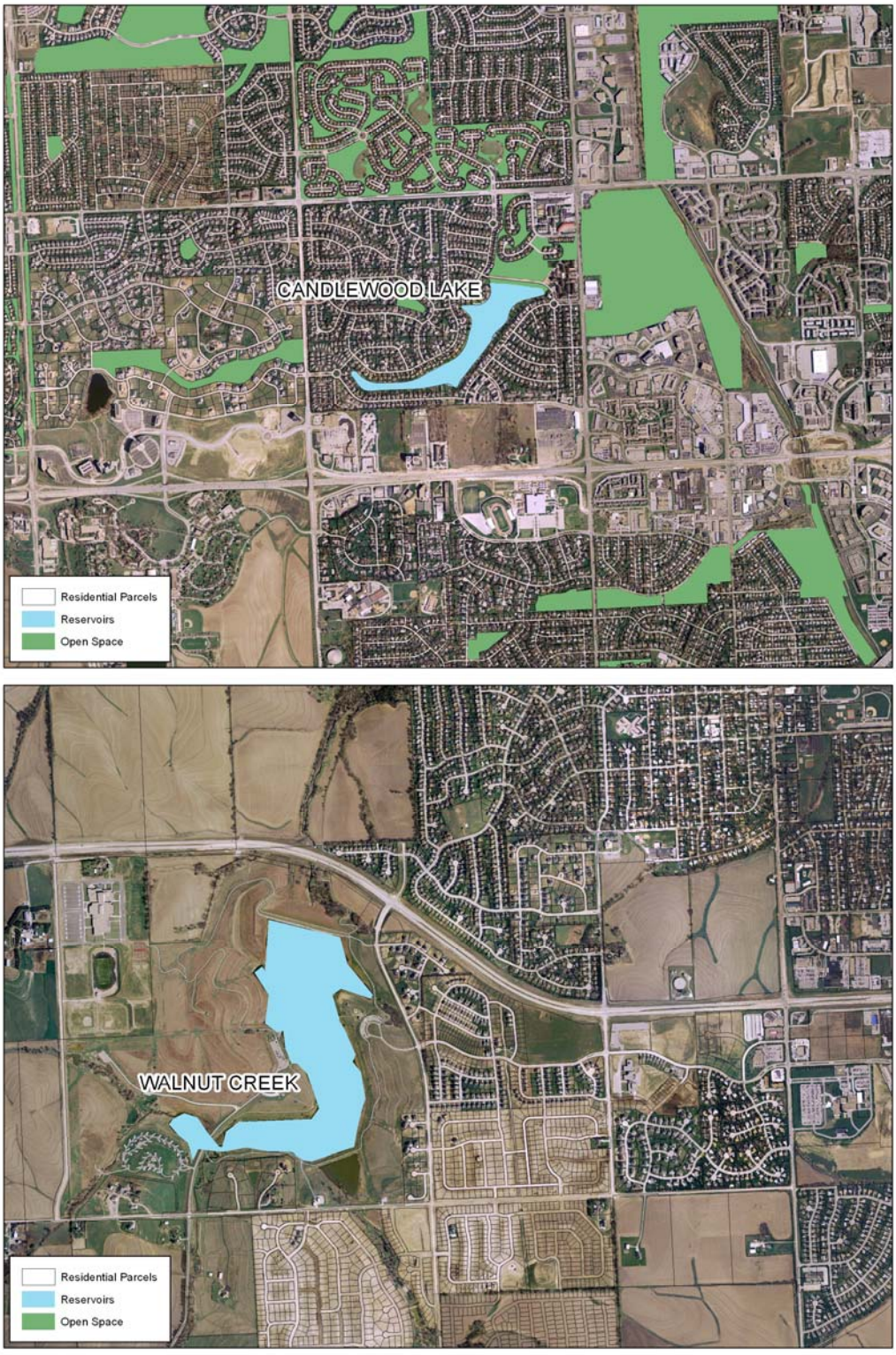


Figure 2.3. Land Uses Surrounding Candlewood and Walnut Creek

Figure 2.4. Land Uses Surrounding Dam Site 13
Source: http://www.elkridgelake.com/Elk%20Ridge/Images/newERdevplan.pdf

Methods and Procedures

Hedonic Price Models for Four Lakes

Four separate hedonic valuation models are estimated to quantify the factors influencing single-family housing sale prices over the 2000 to 2007 time period at Zorinsky, Standing Bear, Candlewood, and Walnut Creek. The specifications of these hedonic models are very similar to the floodplain hedonic model described in the previous section of this report. Sale prices (represented as natural logs), are regressed against structural, neighborhood characteristics, and the lake view status of individual homes.

The sale price and structural characteristics of homes were obtained from both the multiple listing service (MLS) and Douglas County property records, and referenced to a parcel-level GIS database. The resulting 2,188 sale transactions represent all sold homes within one half mile miles of the Zorinsky, Standing Bear and Candlewood lakes and within 1 mile of the Walnut Creek Lake. The additional half mile study area was needed at Walnut Creek due to the large public buffer areas around the lake and the infrequency of residential sales that have occurred around the lake.

Structural variables in the hedonic models include house and lot size, house age, presence of a walkout basement, number of fireplaces and garage stalls, and house style. Dummy variables representing the year a home was sold are also included to account for housing price appreciation over the study period. Condition is accounted for simply as a dummy variable equal to 1 if the home was classified as in average condition by the Douglas county assessors office (this variable was not available for Walnut Creek Lake in Sarpy County). The classification of whether a home has a lake view is based on GIS viewshed analyses in conjunction with drive-by inspections. Due to the use of the log-linear specification with the lake view variable, the marginal implicit price of views can be interpreted directly from the model coefficient and measures the percentage change in housing price due to the existence of a view. However, a more precise interpretation of this variable was calculated by using the Kennedy (1981) equation.

Comparative Analyses of Lot Sales (Zorinsky and Standing Bear)

Differences between the sale prices of undeveloped lots with and without views were evaluated at both Zorinsky and Standing Bear lakes in order to identify the extent of view premiums that were captured by developers (or homebuilders/buyers) at the time the lakes were first constructed. Such comparisons are made on a per square foot basis in order to control for varying lot sizes. Again, these comparisons were not possible at Candlewood Lake due to the infrequency of locatable lot sales with view of the lake (it appears that many lots were built by the developers themselves and not sold on the open market. Similarly, lot comparisons were not made at Walnut Creek Lake because not enough lot sales could be located (it appears that many multiple-lot sales were made directly to builders). Lot sales data for the remaining two lakes (Standing Bear and Zorinsky) was collected by performing backward deed searches for all of the residential housing lots within one-half mile of the lakes. Again, the GIS viewshed analyses were used to classify whether or not particular lots had lake views.

Similar comparative lot sale price analyses at Standing Bear and Zorinsky were made in order to capture potential **access** premiums. This involved comparing sold lot prices of lots (again on a square foot basis) of non-view lots within 2000 feet of lakes versus non-view lots that were between 2000 feet and one-half mile away from each lake.

Dam Site 13 (Elk Ridge) Analyses

The first methodological approach for the analysis of the Dam Site 13 Lake development was to create a GIS database of the lake site and all of the plotted residential parcels around the lake. This included those parcels immediately adjacent to the lake (within the Elk Ridge subdivision which is the focus of the analysis) and parcels in three nearby subdivisions (Elk Valley, Five Fountains, and Silverleaf). A detailed deed search was then conducted to identify the sale prices of all lots within each of these four subdivisions up to February 1, 2008. The asking prices and view status of all Elk Ridge subdivision lots were also obtained directly from an employee of the Elk Ridge Development. Finally, the view status of all lots was determined using both GIS viewshed analyses and manual drive-by inspections of all lots.

Lot view premiums were estimated by calculating the differences between view and non-view lot sale prices *within* the subdivision again, on a dollar per square foot basis in order to control for varying lot sizes. These view premiums were then multiplied by the total area (square feet) of actual and potential view lots within the development. Potential view lots involve the substitution of five residential lots (of average size) in the place of the existing assisted living building on the northwest side of the lake, and four more potential residential lots (again of average size), substituted in the place of the planned condos and office units on the east side of the lake. Since the assisted living and condo/office lots are likely to have relatively higher values than conventional residential lots, the resulting premium values associated with these substitutions are considered to generate conservative (lower bound) premium estimates.

Lake access premiums for non-view lots were estimated by calculating the difference between non-view lot prices *within* the Elk Ridge subdivision with non-view lot sale prices *outside* the subdivision (again on a dollar per square foot basis in order to control for varying lot sizes). The three nearby subdivisions used for the comparisons were Elk Valley, Five Fountains, and Silverleaf and all were within one-half to one-quarter mile from Elk Ridge (see Figure 2.10). Lot sales at these subdivisions have been recent except for Elk Valley, which was developed 2 years prior to Elk Ridge. Only non-view lots were used for these comparisons so as to not 'double count' view and access values.

It is hypothesized that access premiums exist at Elk Ridge since it's residents will be able to walk to the lake in contrast to the residents of the other subdivisions will need to cross busy streets to gain lake/park access and/or will only be able to park in the extreme southern part of the Omaha City Park (Memorial Park West) since there does not appear to be any public parking on the northern or western parts of the Lake.

Resulting access premiums are then multiplied by the total (aggregate) square footage of all non-view lots within Elk Ridge to generate an estimate of the total premium value associated with non-view access.

Finally, lake access premiums for view lots were calculated by subtracting the average price premium calculated for view lots from the average prices of view lots, and then multiplying this value by the percentage-based access premium associated with non-view lots. Access premiums for view lots are then multiplied by the total square footage of actual and potential view lots.

The combined (view and access) premiums expected to be captured by the Elk Ridge developers were then discounted over a five-year period under the assumption that no lot sales (and premiums) occurred in year one and that the remaining lot sales and premium captures are spread out evenly over the remaining four years. This five-year project cycle is based on the observations of lot developments at other Omaha lake sites.

Results

Hedonic Price Estimates

Table 2.1 contains a summary of the available housing sale transaction data for view and non-view properties within a half-mile of Standing Bear, Zorinsky and Candlewood Lakes and within one mile of Walnut Creek Lake, over the 2000 to mid 2007 time period. Actual sales by view status at each of the four lakes are shown in Figures 2.5 and 2.6.

Table 2.1. Sale Data for View and Non-View Properties (Houses and lots) by Lake

	Sales		Time Frame	Median Prices		Mean Size Finished (ft^2)	
	View	Non-View		View	Non-View	View	Non-View
Standing Bear	35	446	2000 – 2006	203,500	167,225	2,219	2,011
Zorinsky	62	755	2000 – 2006	331,250	184,900	3,874	2,442
Candlewood	15	295	2000 – 2007	330000	198000	4042	2905
Walnut Creek	26	233	2000 - 2007	307253	163500	2826	2137

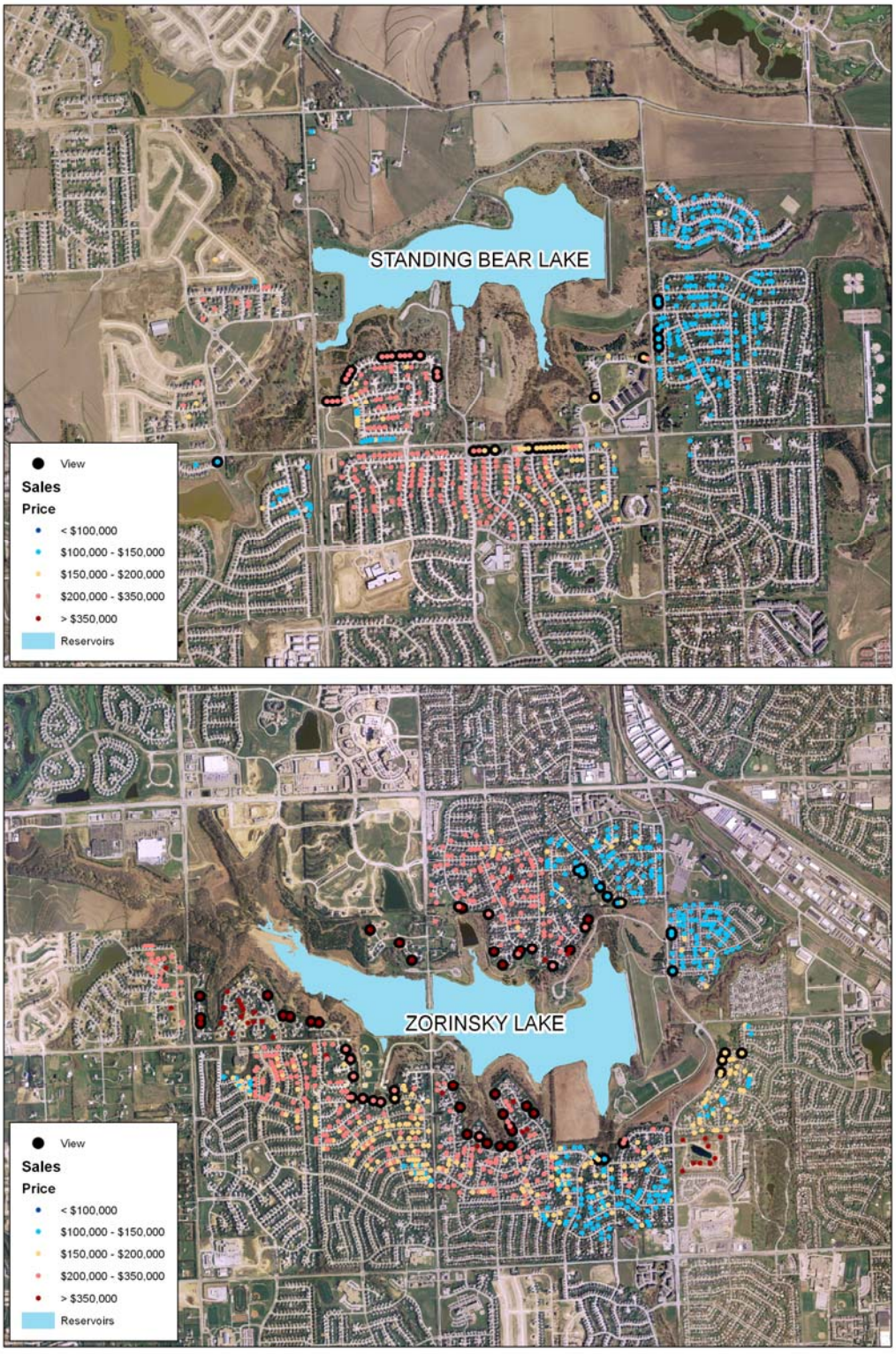


Figure 2.5. Sold Homes with Direct Views of Standing Bear Lake and Zorinsky

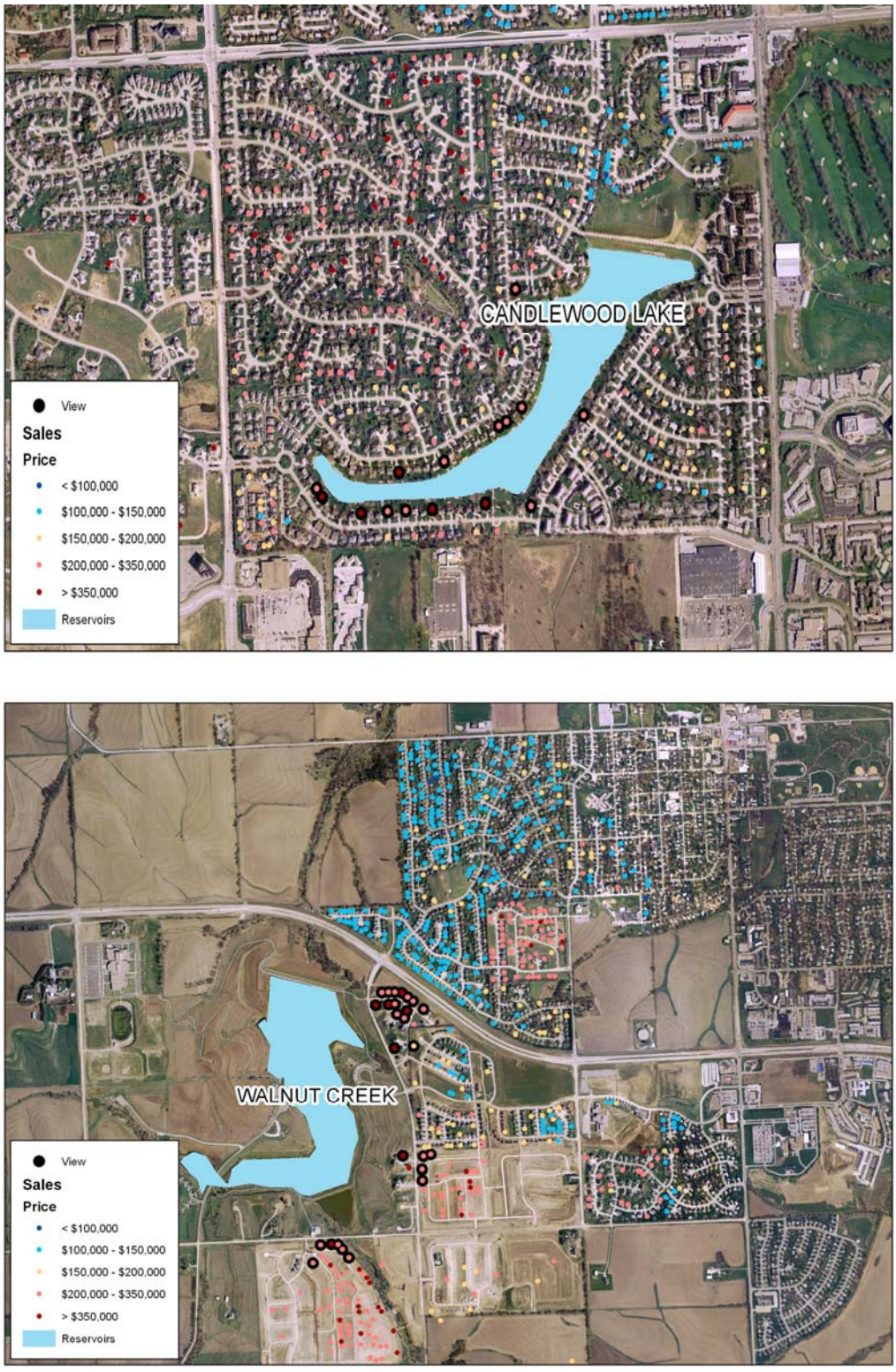


Figure 2.6. Sold Homes with Direct Views of Candlewood and Walnut Creak Lake

The hedonic valuation regression results measuring the marginal impacts of lake views and other housing characteristics (considered jointly) on housing prices at each of the four lakes are summarized in Table 2.2 (and described in greater detail in Tables 2.3 and 2.4). All four models have relatively high adjusted R^2 values of .92, meaning that 92% of the variation in housing prices is explained by the models. As well, the direction and magnitude of all of the model coefficients are as expected with most being statistically significant at the 1% level.

Of particular interest is the 'D View' variable measuring whether or not a home has a direct view of the lake. The coefficient can be interpreted as the marginal impact of a view on the sale price of a home holding all other factors constant.[1] This translates to 8.3% at Standing Bear, 7.5% at Zorinsky, 17.9% at Candlewood and 6.5% at Walnut Creek (Table 2.2). In dollar terms, this corresponds to an impact of $19,851 for an average-priced home at Standing Bear versus $44,589 at Zorinsky, $61,258 at Candlewood, and $20,420 at Walnut Creek.

Extrapolating these values to all the existing and potential homes with views of these lakes generates $15.4 million in premium value at Zorinsky versus $3.2 million at Standing Bear, $6 Million at Candlewood and $2.1 Million at Walnut Creek. This corresponds to an additional $26.7 million in increased property values.

Table 2.2. A Summary of the Hedonic Price Models and View Premiums by Lake

	R^2	Hedonic View Impact (Price Premium)		
		%	$/House(Avg.)	Total Value
Standing Bear	.92	8.3%	$19,851	$3.2 Million
Zorinsky	.91	7.5%	$44,589	$15.4 Million
Candlewood	.92	17.9%	$61,258	$6 Million
Walnut Creek	.92	6.5	$20,429	$2.1 Million

[1].When estimating a semi-log model a direct interpretation of the dummy variable coefficient as a percentage of sale price is not valid. Therefore, the equation presented by Kennedy is used to adjust the coefficients for interpretation: $\hat{g} = e(\hat{c} - (½)V(\hat{c})) - 1$ where c is the regression coefficient and V(c) is the variance of the coefficient or the standard error squared Kennedy (1981)

Table 2.3. Hedonic Regression Results: Standing Bear & Zorinsky

	Standing Bear			Zorinsky		
Variable	Coef.	Std. E.	P>t	Coef.	Std. E.	P>t
Constant	7.621	0.210	0.000	5.218	0.190	0.000
Structural Variables						
Ln Lot Size	0.147	0.020	0.000	0.246	0.019	0.000
Ln Sq. Ft.	0.364	0.023	0.000	0.563	0.021	0.000
Age	-0.008	0.001	0.000	-0.011	0.001	0.000
D Walk Base.	0.037	0.010	0.000	0.034	0.010	0.001
Fireplaces	0.028	0.010	0.005	0.059	0.009	0.000
Garage Stalls	0.071	0.009	0.000	0.098	0.011	0.000
D Avg_Cond	-0.007	0.012	0.531	-0.026	0.012	0.028
D 1.5 Story	0.429	0.046	0.000	0.104	0.026	0.000
D 2 Story	0.202	0.019	0.000	0.020	0.014	0.154
D Split	-0.021	0.012	0.085	-0.009	0.014	0.505
D Ranch	0.168	0.016	0.000	0.060	0.016	0.000
Time Trend Variables						
D 2001	0.022	0.014	0.129	0.054	0.016	0.001
D 2002	0.041	0.015	0.007	0.079	0.016	0.000
D 2003	0.048	0.015	0.002	0.114	0.015	0.000
D 2004	0.098	0.015	0.000	0.160	0.016	0.000
D 2005	0.119	0.015	0.000	0.190	0.016	0.000
D 2006	0.109	0.020	0.000	0.199	0.024	0.000
D View*	0.080	0.016	0.000	0.073	0.018	0.000
Obs.	481 (View = 35)			817 (View = 62)		
F	322.48			433.85		
p>F	0.000			0.000		
R2	0.9263			0.9073		
Adj. R2	0.9234			0.9052		
Root MSE	0.08421			0.11754		

** Note: These dummy variable coefficients cannot be interpreted directly as percentages (unlike continuous variables) using Kennedy's (1981) equation the marginal implicit values are 8.3% and 7.6% respectively.*

Table 2.4. Detailed Hedonic Regression Results: Candlewood & Walnut Creek

	Candlewood			Walnut Creek		
Variable	Coef.	Std. E.	P>t	Coef.	Std. E.	P>t
Constant	6.177	0.237	0.000	5.392	0.247	0.000
Structural Variables						
Ln Lot Size	0.099	0.020	0.000	0.169	0.022	0.000
Ln Sq. Ft.	0.637	0.036	0.000	0.639	0.025	0.000
Age	-0.013	0.001	0.000	-0.008	0.001	0.000
D Walk Base.	0.009	0.021	0.681	0.047	0.013	0.000
Fireplaces	0.051	0.016	0.001	-0.011	0.015	0.462
Garage Stalls	0.091	0.021	0.000	0.114	0.012	0.000
D Avg_Cond	-0.018	0.028	0.519	-	-	-
D 1.5 Story	0.068	0.030	0.022	0.104	0.034	0.002
D 2 Story	0.031	0.025	0.218	0.039	0.018	0.027
D Split	-0.068	0.029	0.021	-0.052	0.015	0.000
D Ranch	0.010	0.027	0.717	0.039	0.019	0.037
Time Trend Variables						
D 2001	-0.011	0.030	0.720	-0.023	0.025	0.360
D 2002	0.068	0.029	0.019	0.003	0.023	0.908
D 2003	0.079	0.030	0.010	0.036	0.020	0.081
D 2004	0.144	0.030	0.000	0.085	0.020	0.000
D 2005	0.194	0.031	0.000	0.151	0.020	0.000
D 2006	0.188	0.030	0.000	0.139	0.019	0.000
D 2007	0.176	0.033	0.000	0.105	0.023	0.000
D View/ Frontage*	0.166	0.042	0.000	0.063	0.026	0.017
Obs.	310 (View =15)			259(View =26)		
F	166.72			161.79		
p>F	0.000			0.000		
R2	0.9161			0.9239		
Adj. R2	0.9106			0.9182		
Root MSE	0.13502			0.11834		

** Note: These dummy variable coefficients cannot be interpreted directly as percentages (unlike continuous variables) using Kennedy's (1981) equation the marginal implicit values are 17.9% and 6.45% respectively.*

Lot Sale Comparisons to Quantify View and Access Values

At Standing Bear, view lots sold for 18.8% ($13,598) more than non-view lots. This value is more than twice as large as view premiums estimated by the hedonic approach which illustrates an interesting and somewhat surprising situation: It would appear that view premiums at Standing Bear appear to have declined over time. Alternatively, when Standing Bear Lake was developed, developers were able to capture a premium for lake view lots that is higher (in percentage terms) than subsequently observed lake view premiums determined though hedonic valuation models (and housing sale transactions).

At Zorinsky, developers captured a 5.7% premium ($3,507) when the lots were initially sold and over time this premium increased slightly to 7.5%.

The access premiums observed for lot sales at Standing Bear Lake is 11% and a similar 12% at Zorinsky. But there are several potential problems with the approaches used here to value access premiums at each of these lakes. In particular, simple distance measurements (lots less than 2000 feet from the lake but not being frontage or view lots versus lots that are more than 2000 feet from the lake) are not likely to perfectly measure the quality of lake access. Therefore, it is proposed that a future study measure the distances from individual lot sales to trail access points, and/or conduct comparisons of lots within particular subdivisions that are deemed to classified to have excellent versus poor access to lake recreation areas.

Lake View and Access Premiums at Dam Site 13

The platted parcels for the Elk Ridge subdivision classified by property types ('villas' without views, 'estates' with views, and frontage lots with views) are shown in Figure 2.7 and summarized in Table 2.4. The location of the five potential lake frontage lots in the northwestern part of the lake (where an assisted living facility is now located) and four potential frontage lots on the western shore of the lake (where a series of condos and commercial structures are located) can be seen in the earlier Figure 2.4.

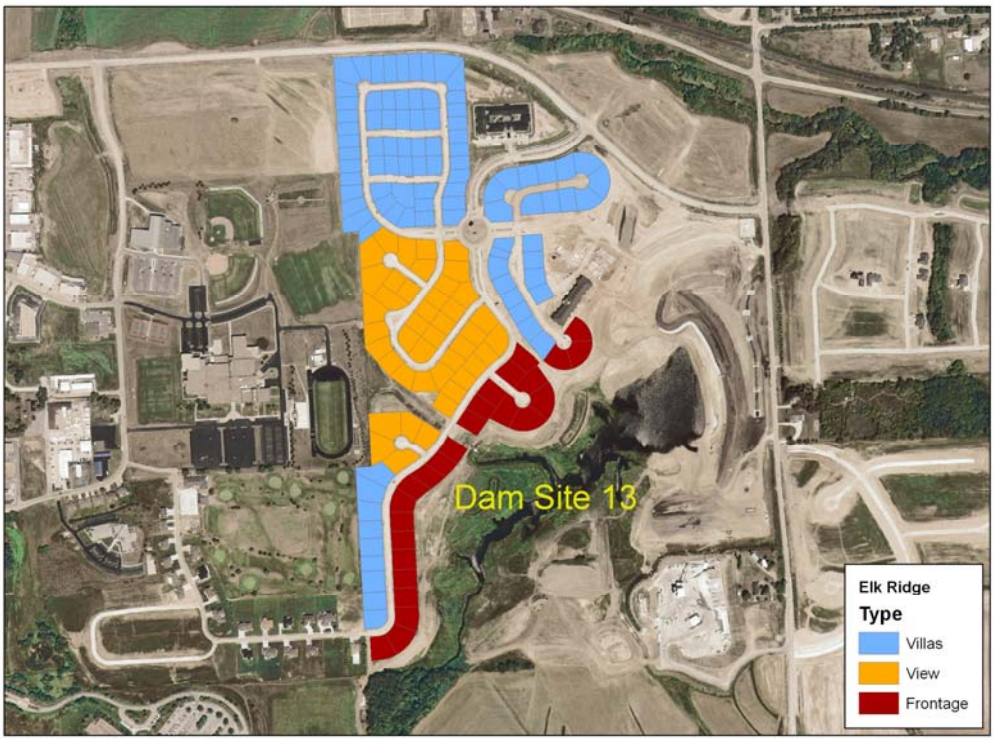


Figure 2.7. Residential Lots in the Elk Ridge Subdivision

Table 2.5. Summary Statistics of All Elk Ridge (Dam Site 13) Lots

Lot Type	N	Size			
		Mean	***Min***	***Max***	***Total***
'Villas' (non-view)	92	14,033	9,583	28,314	1,291,119
View ('Estates')	43	17,079	13,068	30,056	734,423
Frontage	25	19,096	16,988	24,829	572,898*
View/Frontage Lots (combined)	68	17,821	13,068	30,056	1,307,325*

** Nine average frontage size lots added to square foot total to account for potential lots in the areas of he assisted living care (northwest shore) and the condos (western shore)*

Figure 2.8 shows the location of the Elk Ridge parcels that have sold as of February 1, 2008. This includes 14 'Villa' (non-view) lots and four 'Estate' (view) lots. While none of the frontage view lots have sold as of February 1, it should be noted that the asking prices (on a square foot basis) are 36% higher than non-frontage view lots. And, according to a representative of the developer, they are planning to have frontage view lots be made part of a '2009 Street of Dreams' promotion.

The asking prices of all lots in the Elk Ridge subdivision are shown in Figure 2.9 and direct comparisons of the asking and sold lot prices from 2005 to February 1, 2008 are summarized in Table 2.6. Somewhat surprisingly, all of the lots have been selling for their asking prices and some have actually sold for amounts slightly above their asking prices. This demonstrates that the developer of Dam Site 13 was able to accurately estimate buyer premiums for views and access.

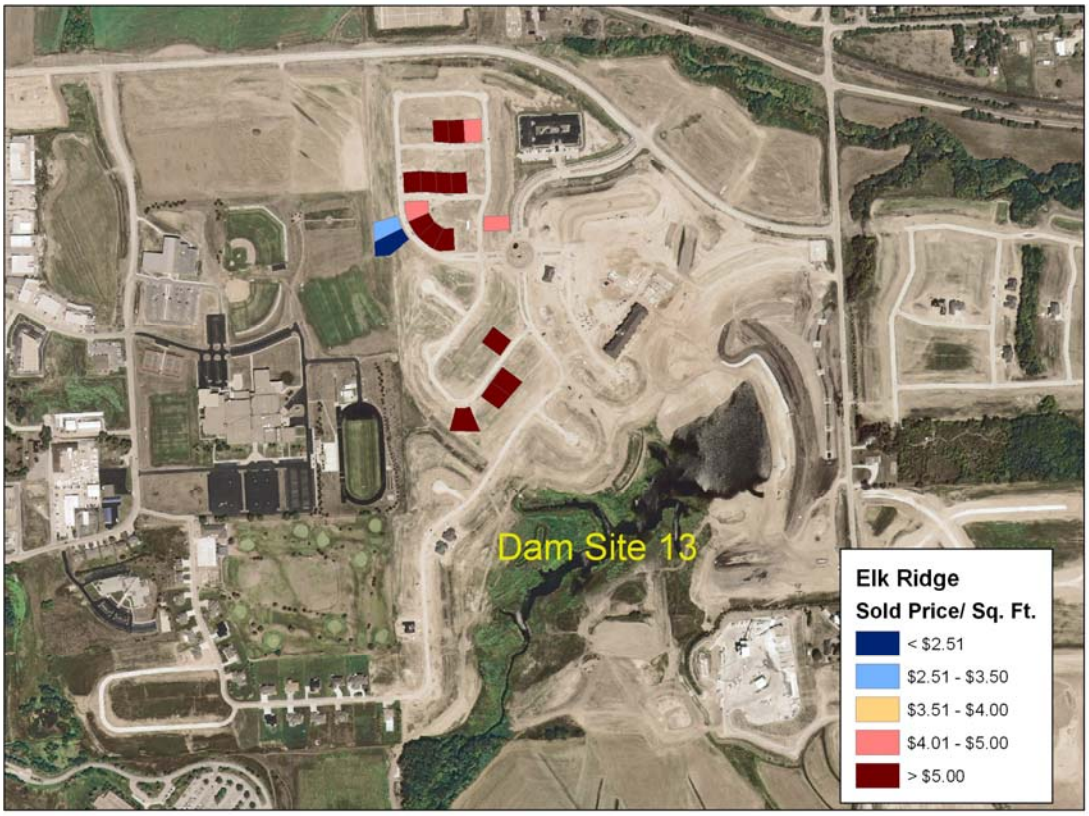


Figure 2.8. The Location of Sold Residential Lots in the Elk Ridge Subdivision

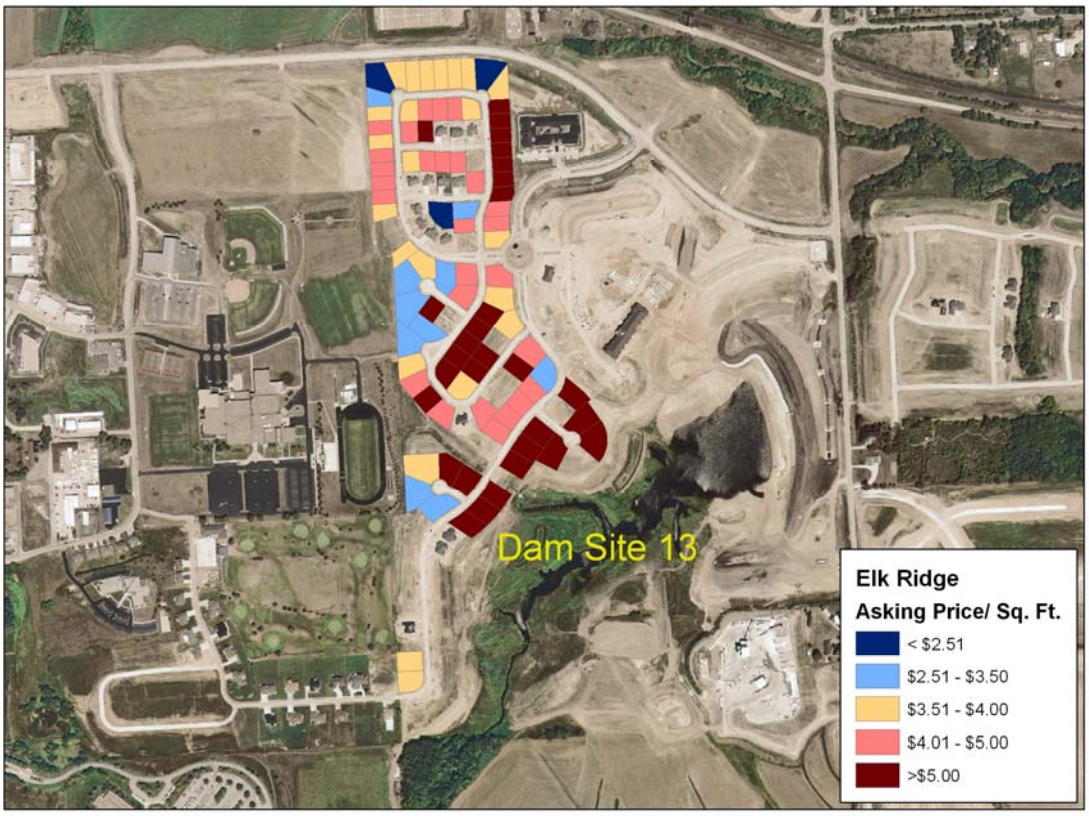


Figure 2.9. Asking Prices of Elk Ridge Lots

Table 2.6. Asking and Selling Prices of Elk Ridge Lots (2005 to February, 2008)

	Villas (Non-Views)	Views	Frontage	All
Asking Price Lot	$50,217 (46)	$74,486 (37)	$128,500 (10)	$68,290 (93)
Sold Price Lot	$54,954 (14)	$90,000 (4)	(0)	$62,742 (18)
Sold Price House	$458,414 (6)	(0)	(0)	$458,414 (6)
Asking Price/ Sqft	$4.14 (46)	$4.45 (37)	$6.73 (10)	$4.55 (93)
Sold Price Lot/ Sqft	$4.71 (14)	$5.96 (4)	(0)	$4.99 (18)

View premiums at Elk Ridge based on comparisons of the sold lot prices (on a square foot basis) of view versus non-view lots are 27% ($1.26/sft). This assumes assumption that frontage view lots will sell at the same price as regular view lots when in reality, it is likely that the frontage view lots will sell for much higher amounts (possibly 26% more

based on asking price differentials between view and frontage lots). Therefore a lower bound estimate for the view premium for all view lots in the subdivision (including nine substitute residential lots) is $1.7 million (Table 2.7).

Access premiums based on comparisons of the sale price of the smaller sized non-view lots at Elk Ridge (i.e. Villas) with similar sized and non-view lots at three other nearby subdivisions (shown in Figure 2.10), are as follows: Non-view access premiums are 58% or ($1.72/sft.) which totals $2.2 million. Alternatively, access premiums for view lots were calculated by subtracting view premiums of $1.26/sft from the average value of all view lots ($5.26/sft.) and then multiplying this value by the estimated access premium of 58%. The resulting access value for view lots therefore separates view and access values and is $2.73/sft. which is 46% of the value of view lots and generates access values for view lots of $3.6 million. Combined view and access premiums are $7.7 million.

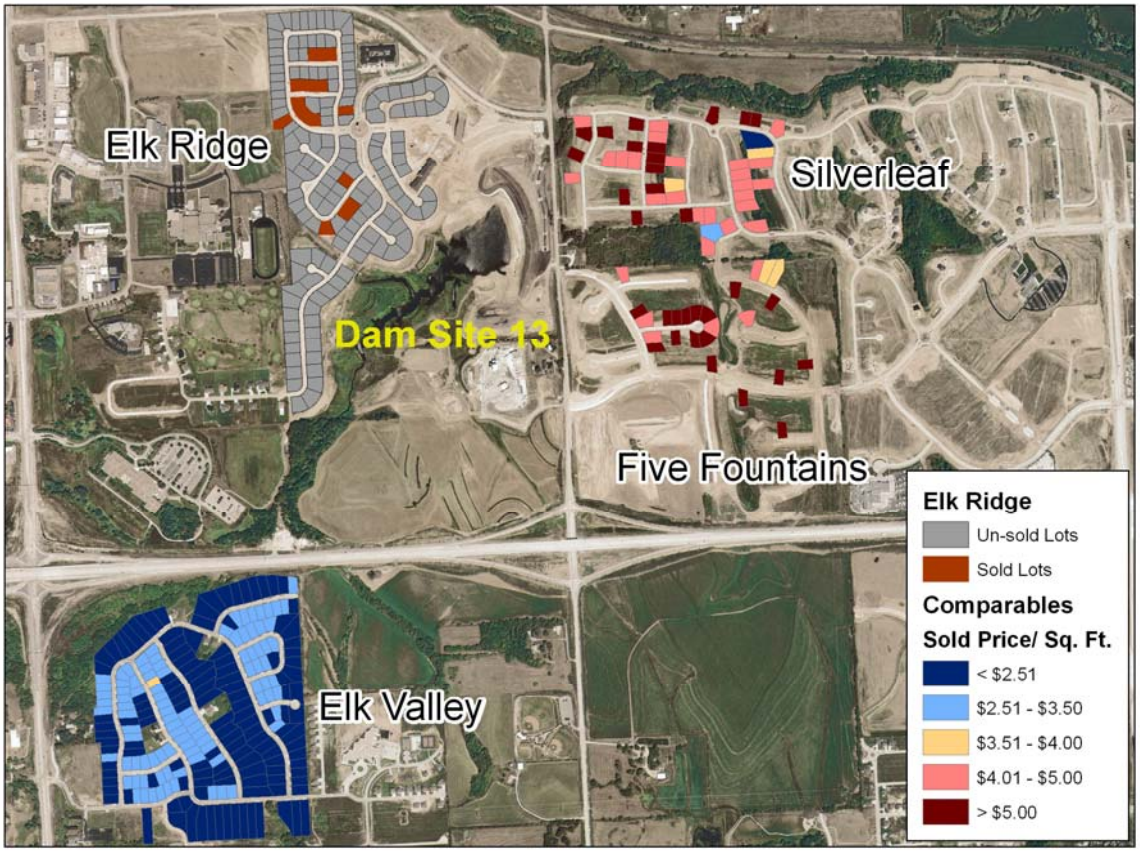


Figure 2.10. Sold Comparisons Across Four Subdivisions

Both the view and access premiums captured by the Elk Ridge Developers as a result of the creation of Dam Site 13 are considerably higher than those observed at other area lakes. This is assumed to be a direct result of level of exclusivity and privacy (i.e. lack of public access) associated with the Elk Ridge development. While technically it is true that Elk Ridge lot owners do not have exclusive (100%) private access to the lake, they for the most part, they have captured accessibility and frontage characteristics of the lake since no public parking or access points are located on the western or northern shores of the lake, meaning that lake access for the majority of the public will have to be through the southern shore (Memorial Park) area. As well, the frontage lots at Elk Ridge come very close to the shoreline which enhances the value of frontage lots but could potential threaten the long-term water quality of the lake due to potential fertilizer run-off from adjacent lawns.

There are three possible scenarios that could lead to Elk Ridge lake view and access premiums being lower than the values estimated by this study. First, if the already built senior care/living building and the planned condo/office developments are actually less valuable than residential lots, then actual premiums will be lower than estimated. Second, it may be that the Elk Ridge development is of higher quality than the other nearby subdivisions for which lot price comparisons were made in order to determine access values. In particular, we have noted that the promotional website for the Elk Ridge development is of higher quality, and the multi-housing style aspects of the development as well as the road planning and lot preparation of this development appear to be superior to those observed in the other subdivisions. While these impacts may exist they are difficult to quantify and it is unlikely that they themselves would explain the large price premiums discovered at Elk Ridge. Third, it is possible that access values to the lake may be influenced by the close proximity to the nearby high school, the golf course and/or the city park that is adjacent to the lake (Memorial Park West). The park amenity value is particularly interesting since it may be creating a prestige factor since in the last century many of the most valuable homes in Omaha were built around Memorial Park East. Therefore, we are proposing some follow-up studies that would further evaluate these issues (these are described in the next section).

In summary, the developer of the Elk Ridge subdivision made a $1.6 million contribution to the project (a $1,000,000 cash contribution in year 1, interest payments of 7.5% interest on $180,000, and final balance of balance of $480,000 to be paid in 2010. Comparing these discounted project costs to the present value of expected lot sale premiums (spread out from years 2 through 5 of the project which results in a value of $6 million) generates an estimated rate of return of 437% or an annual return of 87% per year over 5-years (table 2.7).

Table 2.7. A Summary of Captured Premiums and Returns at Dam Site 13

	View Premiums	Access Premiums		Total Premiums
		Non-View Lots	View Lots [b]	
Level of Analysis	*Within Elk Ridge*	*Elk Ridge Vs. 3 Subdivisions*	*Based on non-view Access Premium* [d]	
Comments				
Sample Size (sold comparisons)	18	370	225	613
Premium %	27% [a]	58% [b]	46% [c]	
Premium $	$1.26	$1.72	$2.73	
Total Square Feet	1,378,609 [b]	1,291,119	1,378,609[b]	
Total Premium Value	$1,737,047	$2,220,725	$3,625,742	**$7,715,860**
Present Value of Premiums (5 years, 7.5%)				**$6,009,984**
Discounted Marginal Return				**437%**
Discounted Annual Return				**87%** [d]

Explanatory Notes:

a. This is a lower-bound estimate as frontage/view lots are combined with non-frontage view lots (they are assumed to have the same value because no frontage/view lots have yet sold). Since frontage/view asking prices are 36% higher than non-frontage view lots, actual view premiums are likely higher

b . Includes five view/frontage lots where the Assisted Living Building is on the northwest shore of the lake and 4 view/frontage lots where the condos are located on the western shore (based on average view lot sizes of 17,821 sqft)

c. Estimated by multiplying the difference between average view lot values ($5.96) and view premiums ($1.26) by the estimated access premium of non-view lots (58%).

d. If a 10% discount rate is used the discounted average annual return is 84%.

Summary and Policy Implications

This analysis of the relationships between residential housing and lot sales surrounding five different Omaha area man-made lakes indicates that reasonably large but varied price premiums are associated with view and access amenities associated with the lakes. It appears that landowners and/or developers capture the majority of those premiums at the time the lakes are constructed. It is also evident and that the level of exclusivity or privacy of the lake and residential housing designs has a large impact on the magnitude of the premiums that are captured by developers (i.e. captured amenity values increase with exclusivity and decline with public facilities, land buffers and/or access).

This Dam Site 13 analysis is of particular interest since it is the first 'public-private lake construction partnership'. In this case, the developer appears to have been very well compensated for their participation. However, before a final conclusion is drawn regarding the extent to which the PMNRD potentially under-charged their private partner, additional analyses and follow-up studies are warranted. In particular, continued analyses of lot sales are planned and it is proposed that a hedonic valuation model of lot sales be conducted at Elk Ridge and nearby subdivisions in order to determine whether or not some of the access value premiums at Elk Ridge have been influenced by other (non lake related) factors. Nevertheless, based on these preliminary study results, if and when the PMNRD or others plan additional public-private partnerships for the purposes of lake construction, it is recommended that:

1) Higher contributions be sought from private developers (increased cash payments or reduced land sale prices). This could be facilitated by relying on empirical research (such as this report) which quantifies view and access premiums that can be expected from different types of lake designs.

2) Scenarios be considered where the PMNRD purchase entire land parcels (quarter to full sections of land), and then after planning and/or constructing a lake, conduct a public auction off available adjacent residential development areas (either all together or in individual sections). This would help ensure that a fair

('market') price is paid for land adjacent to publicly funded lakes. Again, empirical research which quantifies ranges of possible view and access premiums could help developers determine optimal bid prices for land adjacent to lakes.

3) In cases where it is not possible to negotiate a mutually acceptable fair market price for land adjacent to man-made lakes, the PMNRD should consider having larger public buffer areas surrounding lakes which would ensure more public access, improved recreational opportunities, and better water quality in the lakes. At a minimum, such policies would ensure that the public captures all (or at least most) of the economic amenity values that are created with public funds.

Suggested Future Research

1) Conduct a hedonic price analysis of sold lots at Standing Bear, Zorinsky, and Dam Site 13 that account for lot-specific characteristics (size, shape, location, nearby land uses, etc) in order to better quantify the access values of lakes.

2) Continue to collect and monitor both lot and housing sales at Dam Site 13 and in the nearby subdivisions to confirm view and access premium estimates over time and to conduct a more detailed hedonic price analysis of these access based amenity values.

3) Conduct surveys of homebuyers at Dam Site 13 and nearby subdivisions to identify factors that may have influenced their purchase decisions and in particular to assess the importance of lake views, access, and other factors.

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LID, Open Space and Single Family Housing Values

Background and Study Objectives

In the Omaha Metropolitan Area, typical Midwestern urbanization trends are the cause of increasing flooding and water quality problems. One proposed solution is the promotion (or requirement) of Low Impact Developments (LIDs) which can generally be defined as the use of Best Management Practices (BMPS) ranging from more impervious surface materials to local retention basins, and other measure that jointly reduce surface runoff from precipitation events. Alternatively LIDs in the context of subdivision designs, provide for a 'de-centralized' management of stormwater. That is, LIDs attempt to mimic naturally hydrology by using techniques that capture storm water where it falls.

One of the critical questions regarding the feasibility (in addition to their cost and their effectiveness in reducing runoff) is how LIDs will be perceived and accepted by homebuyers and, in particular, if they will pay a premium or discount for homes within LID subdivisions. Therefore, the focus and goal of this present research is to determine homebuyer preferences for different types of subdivision open space design that is intended to proxy for alternative LID designs. For example, do homebuyers prefer clustered or more open landscape design? Do they prefer managed or native/natural plant systems? What are their preferences for trails, public recreation access, and trees? And finally, do they prefer these open spaces to be publicly or privately managed?

The classic example of an LID subdivision involves *clusters* of homes, often with small lots, surrounded by publicly-owned open-space (Figure 3.1). The open-space is usually planted in natural vegetation and may or may not have trails and other recreational features. Another example of LID is the use of *greenways* where **not** all homes abut (face) the open space, yet all residents have access to a relatively large undeveloped open space area (Figure 3.1). Open space areas can be publicly or privately owned or managed (by city or county governments, Natural Resource Districts, utilities, homeowner associations, or even SIDs).

Figure 3.1 An Example of Clustered Low Impact Development

Figure 3.2 An Example of Greenway Low Impact Development

No actual LID subdivisions (designed exclusively for storm water management and with a history of housing sales) currently exist in the Omaha area. However, a wide variety of different subdivision designs with respect to quantities and types of open space do exist. It is hypothesized that homebuyers will be most concerned with the open space components of different LID designs when they are deciding whether or not to purchase a home and/or how much to pay for that home. In other words, open space designs are assumed to proxy for different LID designs. It is important to note however that open space requirements for new subdivisions are currently regulated by non-LID goals in Douglas County.

These research results are expected to be useful to both the public and private sector. In particular it is expected that real estate developers and builders will have a greater self-interest in developing LID subdivisions if they can be shown the relative profit levels they can obtain from different open space/LID subdivision designs. From the public sector perspective, it is also necessary for planners and/or regulators to understand the homebuyers' preferences for open space designs, and hence potential profit margins for developers who build LID subdivisions. For example, if it turns out that a particular open space design leads to property price premiums then the value of these premiums could potentially offset some (if not all) of the potential LID development costs borne by developers. Alternatively, if it was discovered that a particular LID/open space design was discounted by homebuyers, the public (through local governments) might justify subsidizing developers who voluntarily adopt such LID designs.

Methods and Procedures

The study area is based in Douglas County and encompasses all of the area North of Harrison Street, South of Lake Cunningham Road, East of 204th Street, and West of I680/I80. The study area was chosen because it contained a large percentage of undeveloped land and the drive time to major employment centers (downtown Omaha) was similar for the entire area (Figure 3.3). Furthermore, most homes in the area are of newer construction (post-1950) therefore eliminating much of the modeling difficulties associated with older historical neighborhoods. In addition, newer development often

exhibits high degrees of housing homogeneity (many similar home styles and sizes). For example, see the price consistency (and clustering) of homes across 321 different subdivisions across the study area (Figure 3.3).

The real estate transaction database used for this study was the same one used for the floodplain impact study described earlier except it focused on different areas and included sales up to May 30, 2007. Again this database includes sales transaction and housing characteristics data from the Multiple Listing Service with county parcel and housing data, all within a GIS framework. Only sales that are contained in a platted subdivision are used in the analysis. Other homes that may have sold in the study area but were either original farmsteads or were platted independently on an individual basis were removed from the sample. The resulting sales are shown in Figure 3.3.

This research effort required the estimation of 14 different hedonic price models. Alternative models were needed to evaluate different types of open space amenities at different levels of spatial scale (for example, subdivisions versus buffers of different sizes). The focus was to evaluate open space impacts on housing prices from the perspectives of public versus private ownership and management of the open space, the type of open space measured by it's groundcover type, and location aspects (distances abutments, etc). A reporting of all the model results is beyond the scope of this present study report but readers interested in the full study results should refer to the Masters Thesis of Nick Schmitz after April 1, 2008.

All of the estimated hedonic price models share a set of explanatory variables intended to account for structural housing, lot and neighborhood factors. These variables are listed in Table 3.1

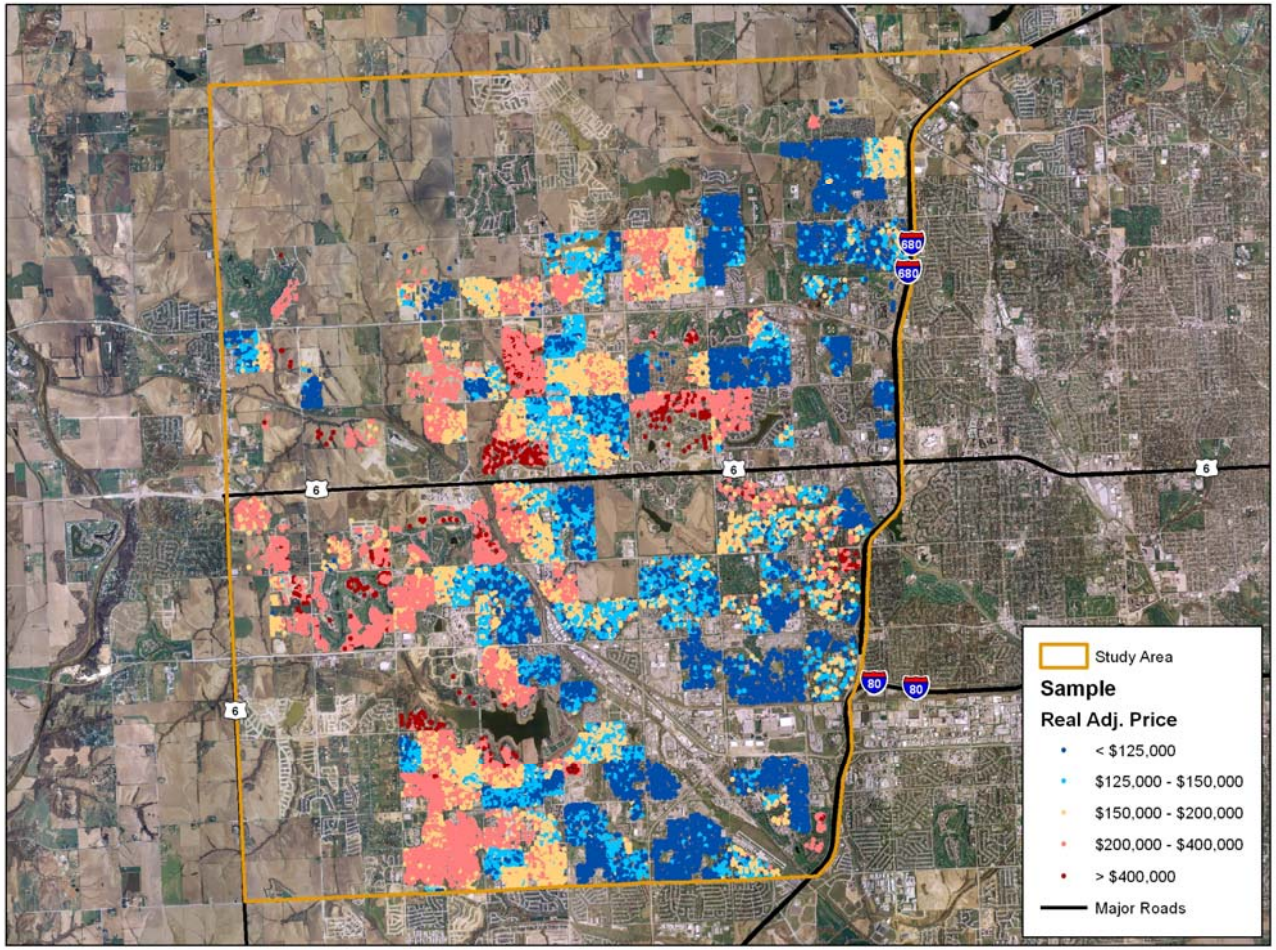

Figure 3.3 Study Area with Sales and Prices shown as Classes of Points

Table 3.1 Explanatory Variable Descriptions and Expected Signs

Variable	Description	Source	Expected Sign
LN Lot Size	Size of Lot in Square Feet	County	+
LN House Size	Finished Square Feet of the House	MLS[a]	+
Age	Age in Years	MLS	-
D New	Dummy = 1 if House is New	MLS	+
D Walk Out	Dummy =1 if Walk Out Basement	MLS	+
Fireplaces	Number of Fireplaces	MLS	+
Garage Stalls	Number of Garage Stalls	MLS	+
D 1.5 Story	Dummy = 1 if 1.5 Story House	County	+
D 2 Story	Dummy = 1 If 2 Story House	County	+
D Split Foyer	Dummy = 1 if Split Foyer	County	-
D Ranch	Dummy = 1 if Ranch	County	+
D 1997	Dummy = 1 If Sold Year is 1997	MLS	+
D 1998	Dummy = 1 If Sold Year is 1998	MLS	+
D 1999	Dummy = 1 If Sold Year is 1999	MLS	+
D 2000	Dummy = 1 If Sold Year is 2000	MLS	+
D 2001	Dummy = 1 If Sold Year is 2001	MLS	+
D 2002	Dummy = 1 If Sold Year is 2002	MLS	+
D 2003	Dummy = 1 If Sold Year is 2003	MLS	+
D 2004	Dummy = 1 If Sold Year is 2004	MLS	+
D 2005	Dummy = 1 If Sold Year is 2005	MLS	+
D 2006	Dummy = 1 If Sold Year is 2006	MLS	+
D 2007	Dummy = 1 If Sold Year is 2007	MLS	+
D Double Frontage	Dummy = 1 if Lot is Double Frontage Lot i.e. Abuts Two Streets	Aerial Photos[b]	-
D Floodplain	Dummy = 1 if Home is in the Floodplain	FEMA [cf]	-
Housing Density	Housing Units per Square Mile	US Census[f]	-
LN Dist. Com	Distance to Commercial Property in Feet	County[f]	+
LN Dist. Ind	Distance to Industrial Property in Feet	County[f]	+
LN Dist. Arterial Road	Distance to Arterial Road in Feet.	MAPA[df]	?
LN Dist. Dodge St.	Distance to Dodge Street in Feet	ESRI[ef]	?
LN Dist. I80/I680	Distance to I80/I680 in Feet	ESRI[ef]	?
LN Dist. High School	Distance to Nearest High School in Feet	Douglas County[f]	?
LN Dist Other School	Distance to Nearest Middle/Elementary School in Feet	Douglas County[f]	?
D Omaha	Dummy = 1 if Omaha Public School District	MLS	-
D Millard[g]	Dummy = 1 if in Millard Public School District	MLS	-

[a] Great Plains Multiple Listing Service (MLS)
[b] Manual Classifications
[c] Federal Emergency Management Agency (FEMA) Digital Flood Insurance Rate Map (DFIRM)
[d] Metro Area Planning Association (MAPA)
[e] Environmental Systems Research Institute
[f] Spatially Integrated With Sale Points using GIS
[g] Omitted Classification is Elkhorn School district which is generally considered to be the preferred district in the study area

Classifying Open Space Conditions

A wide variety of open space models intended to proxy for alternative LID subdivision designs were evaluated. These are summarized in Table 3.2 and shown in a map in Figure 3.4. Recall however, that not all these variables are contained in a single hedonic model. Images showing examples of these open space variables at different levels of geographic scales (for example, within subdivisions, buffers, and for abutting properties) are shown in Figures 3.5 to 3.10.

The procedures used to quantify these open space characteristics involved complex GIS operations which are described in detail in Schmitz (2008) and summarized here. Each open space parcel is grouped into one of five ownership classes: homeowners association, sanitary improvement district (SID), public, private, and golf course. Homeowner association parcels are owned jointly by all residents of the subdivisions who pay dues to the homeowners association who in turn manages the open space along with other aspects of the neighborhood. SID-owned parcels are in new subdivisions which have not been formally annexed into the city. Public parcels can be owned by local governments such as the City of Omaha or the PMNRD, or other public entities. In most instances these parcels are managed as public parks with varying levels of accessibility. Private parcels are owned by individuals, in many instances they are tilled and placed in row crops or pasture.

Besides ownership type, explicitly defined characteristics for each parcel were made using manual classifications. These open space classifications were made qualitatively based on GIS land use coverages, street and subdivision designs, and NAIP aerial imagery. Specifically the presence of trails, parking lots, pool, baseball diamonds, or soccer fields was noted for each parcel. Groundcover variables are defined as percent trees, mowed, prairie, wooded and tilled. It should be recognized that ground cover is inherently complex and can be represented by different plant species grouped into different distributions. Percentage values of these land uses are calculated in an effort to simplify the description of each parcel.

The study characterizes *mowed* areas as any manicured grass not covered or shaded by a tree canopy with *trees* being shade trees in a maintained setting, i.e. the grass underneath them is mowed such as one would find in a city park. *Grass* (not mowed) and *prairie* are grouped into a single category, while there are a number of prairie restoration projects in the study area it is impossible to distinguish these from parcels simply planted in grass. Wooded areas are considered different from trees in that the ground underneath the canopy is not maintained in any way. Finally, tilled parcels were almost all located on the fringe of the city and in almost all instances only affect the new homes in the sample.

After defining the characteristics for each parcel the objective is to summarize these proximate open areas with respect to the sold homes in the sale sample. The literature and conventional wisdom describe three distinct ways to reference a parcel with respect to open space, abutments where a lot borders an open area, neighborhoods where a home references a defined area around itself, and proximity which in this study is the Euclidean (straight line) distance in feet to an open area. Finally, a home is defined as abutting open space when its lot boundary is shared with an open area. Lots located directly across the street from common areas are not considered as abutting open space. For abutment parcels each groundcover type is measured as a percentage within neighborhoods for each parcel and expected signs being positive except for woods which may be negatively signed due to perceived externalities such as animal populations or lack of maintenance.

Neighborhood classifications (in which a parcel was located) were made using two defined areas through which the percentage of open space can be estimated and taken into consideration by home buyers. Neighborhoods can be defined as 400 meter buffers and platted subdivisions. This study does not attempt to determine the long-term existence of open space that currently exists.

Ownership type is measured both on a neighborhood percentage basis and by distance calculations (distance to the nearest of each type). The effects of ownership type are unknown. No known studies have shown a significant *negative* relationship between ownership types of open space and home values although some discussion of negative

externalities has been noted (Dehring and Dunse 2006) and other researchers have noted that ownership types will realize different magnitudes in effects (Irwin 2002).

Due to the conjunctive use of groundcover and ownership variables in this study it is expected that certain open space amenities may appear to negatively impact property values not because of the open space amenity per se, but rather because of who owns or manages the open space. For that reason the study makes the distinction between public and privately-owned open space throughout the analyses.

The hedonic models are also estimated separately for homes that are near open space and homes that actually abut open space. This is considered particularly important when analyzing public facilities such as trails, parking lots, pools, baseball diamonds, and soccer fields. Pools and trails are expected to positively impact housing prices as they are a positive use amenity. Parking will likely have negative effects on parcels since parking lots allow people outside the neighborhood or immediate area to use the park. Both baseball and soccer fields will likely have negative signs due to the noise and congestion associated with sporting events.

Table 3.2 Open Space Variables and Expected Signs

	Variable	Description	Expected Sign
Percentages	*Within Neighborhoods*		
	% Trees	% Trees within the parcel (i.e. trees where grass underneath is mowed; shade trees)	+
	% Mowed	% of the parcel that is mowed and not covered by trees i.e. open mowed fields	+
	% Grass/Prairie	% of the parcel that is planted in un-mowed grass or natural prairie	+
	% Wooded	% of the parcel that is wooded i.e. non manicured trees or forests	-
	% Tilled/ Farmed	% tilled or farmed this can be row crops or hay land	+
Distance to and Percentages	*In Proximity and Within Neighborhoods*		
	Homeowners Association	If parcel is owned by a homeowners association	?
	SID	If parcel is owned by an SID	?
	Public	If a parcel is owned by a public entity i.e. County, City, etc.	?
	Private	If the parcel is owned by a private individual or company	?
	Golf Course	If the parcels land use is a gold course or is owned by a particular golf course	?
Dummies	*Individual Open Space Parcels*[a]		
	Trails	If there are visible trails on the parcel	+
	Parking	If there is a parking lot on the parcel	-
	Pool	If there is a pool on the parcel	+
	Tennis	If there are tennis courts on the parcel	+
	Baseball	If there is baseball/softball diamond on the parcel	-
	Soccer	If there is a soccer field on the parcel	-

[a]Analyzed only with respect to abutment homes in this report (mainly due to the fact that within neighborhoods it would be impossible to tell the relative location of these amenities/disamenities to other parcels)

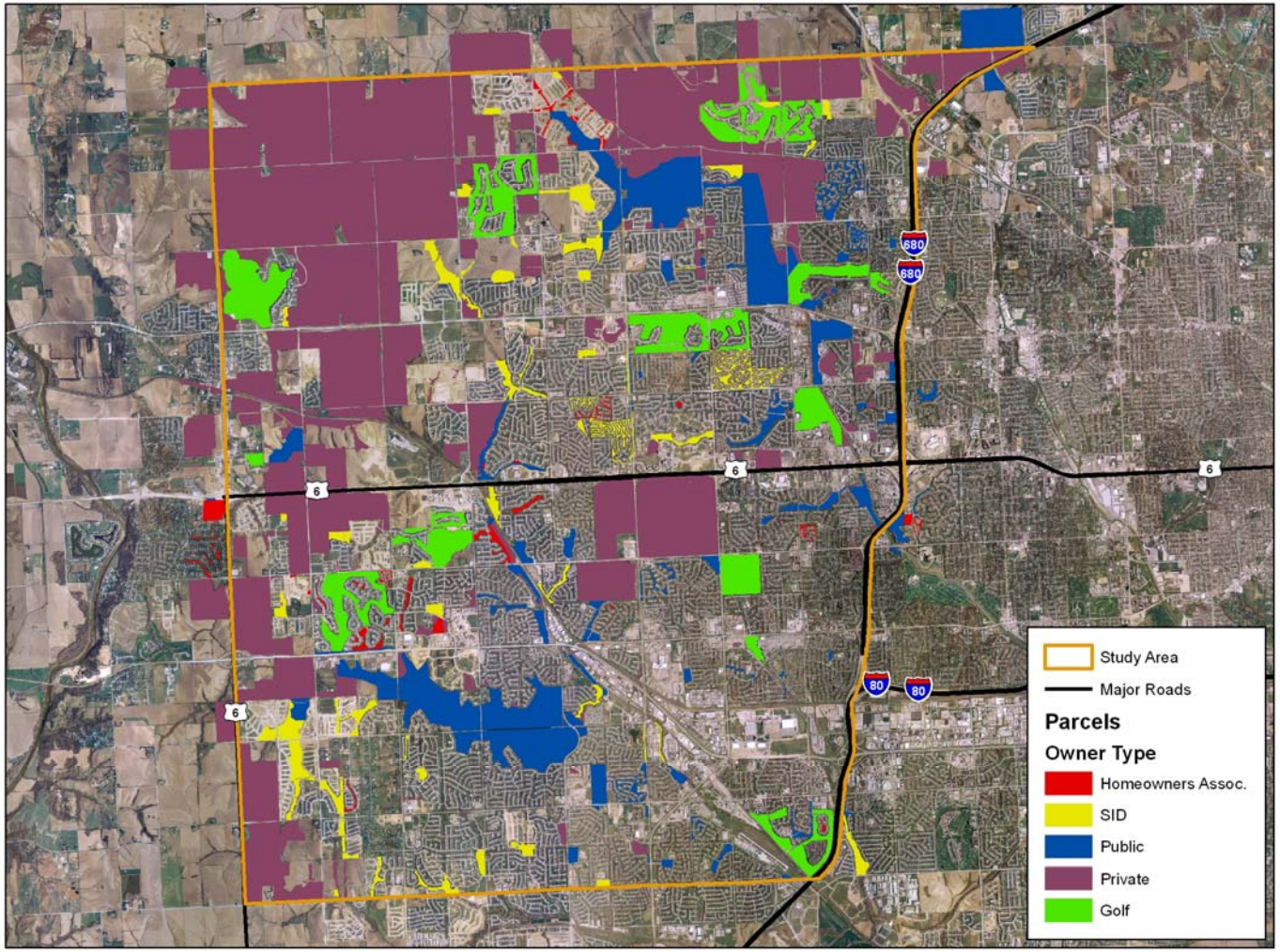

Figure 3.4 Distribution of Open Space in the Study Area

Figure 3.5 Open Space With Baseball Diamonds, Trails, and Parking

Figure 3.6 Open Space with 50% Trees and 50% Mowed

Figure 3.7 Open Space 80% Grass/Prairie and 20% Wooded

Figure 3.8 100% Tilled Open Space

Figure 3.9 Parcels Abutting Open Space (Shown in Red)

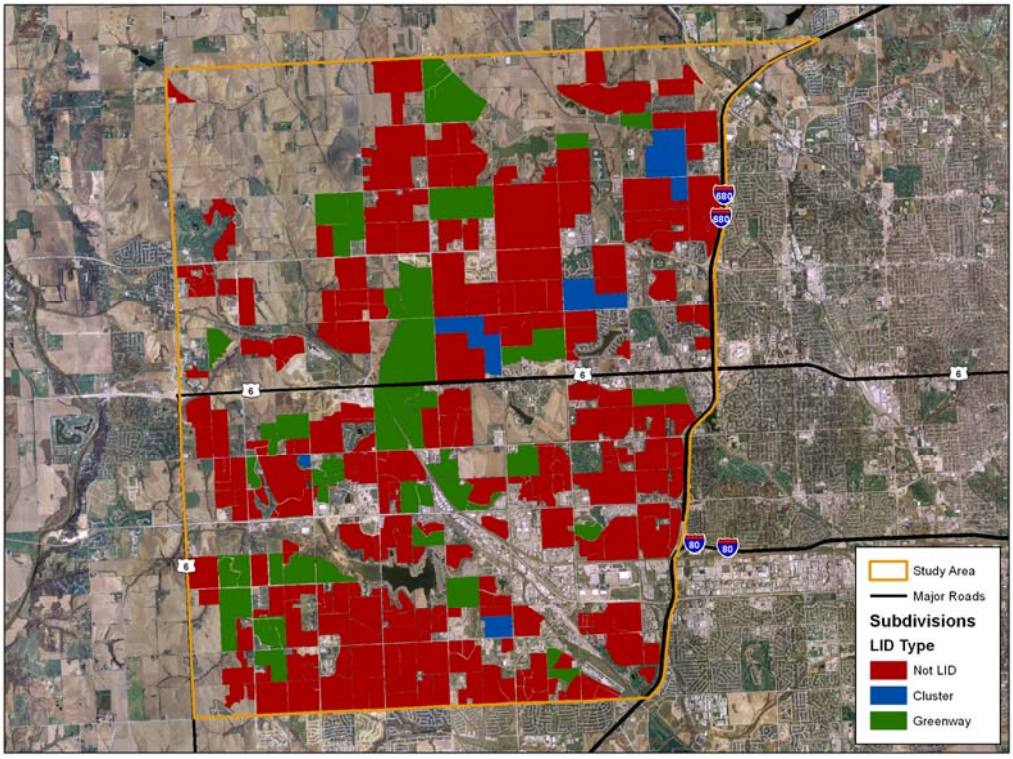

Figure 3.10 Emphasis Subdivisions by LID Type

Results

Table 3.3 summarizes the mean sale prices of homes by open space percentages across subdivisions across the study area. In general, as open space increases within a neighborhood, home values tend to increase and the highest open space premiums appear to be in neighborhoods with at least 20% open space

Table 3.3 Prices by Open Space Percentages Across Subdivisions

Percent of Open Space	Mean	Median	Min	Max	n
<5%	$161,583	$145,391	$64,294	$981,395	10,117
5% - 10%	$183,419	$181,750	$63,103	$624,205	3,706
10% - 20%	$190,317	$135,927	$67,673	$789,123	2,543
20% - 40%	$176,687	$156,451	$71,324	$539,522	1,781
> 40%	$248,621	$247,087	$80,479	$629,203	245

Table 3.4 adds an additional dimension to the analysis of housing prices and open space by including the size of sold parcels. This required omitting parcels that directly abutted open spaces since these parcels tended to skew the results. It can be seen that prices tend to increase as open space increases with smaller lot sizes. With larger lot sizes these results are not consistent. In particular, prices in bold in the table indicated incidences where prices tend to have fallen with more open space. The two conclusions from this are: 1) Public open space is likely less important to large parcels that often have their own open space, and in fact this open space is publicly managed may have a negative impact on its relative value; 2) More complex (multivariate) analyses of the factors influencing sale prices are needed .

Table 3.4 Mean Housing Prices by Open Space and Lot Classes (in subdivisions)

	Acres			
% Total Open Space	<0.2 Acres	0.2 – 0.25	0.25 – 0.3	>0.3
<5%	$129,449	$162,172	$180,423	$218,936
5% - 10%	$126,239	$188,885	$217,909	$243,988
10% - 20%	$125,953	$155,367	$215,897	$345,687
20% - 40%	$130,035	$183,065	$198,523	$239,224
> 40%	$111,754	$166,834	$292,887	$373,117

Finally, Table 3.5 shows how sale prices change mean prices by distance away from different types of open space that are categorized across ownership types. From this it can be seen that in general home values are positively related to private open space versus a negative impact associated with publicly-owned open space.

Table 3.5 Housing Prices by Distance Classes across Ownership Type

Distance Classes (ft)	Homeowner Assoc.	SID	Public	Private	Golf
<500	$253,281	$187,172	$153,523	$187,973	$231,490
500-1000	$221,835	$214,835	$156,425	$175,766	$184,720
1000 – 2000	$190,566	$232,192	$162,605	$174,344	$160,633
2000 – 4000	$172,619	$179,011	$188,488	$176,079	$162,096
>4000	$156,033	$144739	$211,389	$131,086	$174,224

Hedonic Price Estimates

The hedonic price regression results for the model that measures the impact of open space within different ownership classes is presented in Table 3.6. In this case the relationship between sold homes and open space ownership classes is measured by distances between them (i.e. proximity). Most variables are statistically significant with their expected signs (i.e. their impacts on sale prices are as expected). The adjusted coefficient of determination is 0.88 indicating that the model explains 88% of the variation in home prices. The f-statistic of 3429.92 signifies that all variables considered jointly have a statistically significant impact on price at the 1% level.

In this model, the distance to open space coefficient is negative and significant indicating that as homes are closer to open space they increase in value. Ownership classification are statistically insignificant in this model and this is expected to be a result of the distance measure not accounting for abutments and/or the actual open space amenities associated with particular neighborhoods or subdivisions. Ownership issues are further evaluated in subsequent models.

Table 3.6. Hedonic Results Related to Open Space Ownership Impacts

Variables	Ownership Dummies				Ownership Distances		
	Coef.	*Sd. Err.*	*p>|t|*		*Coef.*	*Sd. Err.*	*p>|t|*
LN Lot Size	0.197	0.004	0.000		0.195	0.004	0.000
LN House Size	0.534	0.005	0.000		0.525	0.005	0.000
Age	-7.6E-03	1.5E-04	0.000		-8.2E-03	1.6E-04	0.000
D New House	0.074	0.004	0.000		0.075	0.004	0.000
D Walk Out	0.026	0.002	0.000		0.029	0.002	0.000
Fireplaces	0.039	0.002	0.000		0.039	0.002	0.000
Garage Stalls	0.081	0.002	0.000		0.081	0.002	0.000
D 1.5 Story	0.139	0.007	0.000		0.136	0.007	0.000
D 2 Story	0.037	0.003	0.000		0.032	0.003	0.000
D Split Foyer	-3.2E-02	0.003	0.000		-3.0E-02	0.003	0.000
D Ranch	0.060	0.003	0.000		0.053	0.003	0.000
D 1997	-3.6E-02	0.005	0.000		-3.7E-02	0.005	0.000
D 1998	-7.1E-03	0.005	0.146		-7.6E-03	0.005	0.118
D 1999	0.029	0.005	0.000		0.029	0.005	0.000
D 2000	0.037	0.005	0.000		0.038	0.005	0.000
D 2001	0.037	0.005	0.000		0.039	0.005	0.000
D 2002	0.053	0.005	0.000		0.055	0.005	0.000
D 2003	0.065	0.004	0.000		0.067	0.004	0.000
D 2004	0.079	0.004	0.000		0.083	0.004	0.000
D 2005	0.074	0.004	0.000		0.079	0.004	0.000
D 2006	0.057	0.004	0.000		0.062	0.004	0.000
D 2007	0.043	0.005	0.000		0.049	0.005	0.000
D Double Front.	-5.0E-02	0.004	0.000		-5.0E-02	0.004	0.000
D Floodplain	-4.4E-02	0.011	0.000		-2.6E-02	0.011	0.018
Housing Density	-2.5E-05	1.8E-06	0.000		-2.8E-05	1.8E-06	0.000
LN Dist. Com.	-1.7E-03	0.001	0.220		9.1E-04	0.001	0.505
LN Dist. Industrial	0.021	0.002	0.000		0.016	0.002	0.000
LN Dist. Art. Road	-1.6E-03	0.001	0.232		0.001	0.001	0.355
LN Dist. Dodge St.	-1.9E-02	0.002	0.000		-1.1E-02	0.002	0.000
LN Dist. I80/I680	-1.7E-02	0.002	0.000		-1.5E-02	0.002	0.000
LN Dist. H. Sch.	-6.3E-03	0.002	0.000		-8.1E-03	0.002	0.000
LN Dist O. Sch.	0.006	0.001	0.000		0.007	0.001	0.000
D Omaha	-4.1E-02	0.004	0.000		-9.1E-03	0.005	0.048
D Millard	-1.9E-02	0.004	0.000		0.003	0.005	0.529
LN Dist Open	-1.3E-02	0.001	0.000		-	-	-
D Homeowners'	8.8E-04	0.006	0.873	**LN Dist**	-2.5E-02	0.001	0.000
D SID	-4.3E-02	0.005	0.000	**LN Dist**	0.007	0.001	0.000
D Public	-3.9E-02	0.004	0.000	**LN Dist**	0.001	0.001	0.232
D Private	-5.4E-02	0.004	0.000	**LN Dist**	0.004	0.001	0.001
D Golf[a]	-	-	-	**LN Dist**	-1.6E-02	0.002	0.000
Constant	6.248	0.057	0.000		6.372	0.059	0.000
Observations	18392				18392		
F-Value	3429.92				3565.81		
Prob > F	0.000				0.000		
R-squared	0.8820				0.8834		
Adj. R-squared	0.8818				0.8832		
Root MSE	0.13145				0.13067		

Note: Ownership Delineated by Dummy Indicators and Through Separate Distance Variables

[a] Dropped to prevent a dummy variable trap, represented by the constant or intercept.

Ownership and Groundcover Impacts by Area Analyses

The full hedonic regression results that evaluate open space from an ownership perspective and by different groundcover classifications are summarized in Table 3.7. The thesis document of Schmitz (2008) contains the reporting of these full regression model results.

Table 3.7. Price Impacts: Ownership & Groundcover

	% Homeowners	% SID	% Public	% Private	% Golf
% Trees	30%	14%	14%	24%	27%
% Mowed	15%	-1%	-1%	9%	12%
% Prairie/Grass[a]	7%	-8%	-9%	1%	4%
% Wooded	18%	2%	2%	12%	15%
% Tilled/Farmed	-14%	-30%	-30%	-20%	-17%

Note: For a $172,356 Home With 30% Open Space.
[a] Coefficient was not significant at the 10% level in the subdivision model.

Table 3.7 demonstrates the relative impacts that both ownership status and open space groundcover have on residential housing prices. For example, homes with nearby tree dominated open space which is homeowner association owned has 24% of their value impacted by this open space scenario. Alternatively, 24% of the value of such homes is influenced by this nearby privately owned tree open space. From this it can be that all types of open space increase property values (except for the case of farmland next to subdivisions). SID-managed open space in most cases has a negative impact on property values (unless it is in trees or woodlands). Finally, golf course-based open space is positive under all ownership classes while native prairie or mowed open space is positive only when these spaces are privately owned and managed.

Open Space Impacts for Abutment Homes

Table 3.8 summarizes the hedonic regression models that specifically focused on sold homes that abutted open spaces (i.e. frontage homes)**.** From this it can be seen that the presence of trails increases values by around 17.2%, i.e. if a home abuts a parcel with trails its value will increase considerably. Parking lots, as expected, cause a negative stigma. The presence of a pool is insignificant possibly because this can be both a

positive or negative amenity depending on tastes and preferences. Baseball and soccer fields are both negatively signed indicating that homeowners prefer not to abut parcels with these amenities which is expected due to the noise and congestion associated with baseball, soccer, and football games.

Table 3.8 Impacts of Recreation Amenities on Housing Prices

Variable	Percentage Effect
D Trails	17.20%
D Parking Lot	-16.52%
D Pool	3.80% (insig.)
D Tennis	29.80%
D Baseball	-12.26%
D Soccer	-9.25%

Hedonic Results Specific to LID Subdivision Designs

Table 3.9 evaluates the impact of two particular types of LID subdivision design on property values: clustered open space versus greenway open space. The greenway subdivisions generate a premium of between 1.1% to 2.74% depending on whether greenway areas were observed or calculated using a GIS approach. In contrast, the impacts of clustered subdivisions range from 0.7% to 1.1%. These are considered to be lower-bound estimates since homebuyers will likely be willing to pay for non-open space related benefits of LID designs (i.e. ‘green’ or ‘environmentally friendly’ developments).

Table 3.9. A Summary of LID/Subdivision Price Impacts

Variable	Greenway Observed			Greenway Calculated[a]		
	Coef.	*Sd. Err.*	*p>|t|*	*Coef.*	*Sd. Err.*	*p>|t|*
D Double Front.	-4.6E-02	0.004	0.000	-4.5E-02	0.004	0.000
D Floodplain	-4.4E-03	0.010	0.673	-6.1E-03	0.010	0.558
Housing Density	-2.8E-05	1.8E-06	0.000	-2.6E-05	1.8E-06	0.000
LN Dist. Com.	-2.8E-03	0.001	0.034	-2.3E-03	0.001	0.091
LN Dist. Industrial	0.019	0.002	0.000	0.020	0.002	0.000
LN Dist. Art. Road	-1.6E-03	0.001	0.222	-5.6E-04	0.001	0.671
LN Dist. Dodge St.	-1.9E-02	0.002	0.000	-2.0E-02	0.001	0.000
LN Dist. I80/I680	-1.3E-02	0.002	0.000	-1.5E-02	0.002	0.000
LN Dist. H. Sch.	-4.1E-03	0.002	0.007	-5.4E-03	0.002	0.000
LN Dist O. Sch.	0.006	0.001	0.000	0.004	0.001	0.000
D Omaha	-4.2E-02	0.004	0.000	-4.6E-02	0.004	0.000
D Millard	-2.4E-02	0.004	0.000	-2.6E-02	0.004	0.000
D Cluster	0.007	0.006	0.225	0.011	0.006	0.065
D Greenway	0.014	0.003	0.000	0.027	0.002	0.000
D Abut Open	-8.6E-03	0.006	0.134	-8.5E-03	0.006	0.138
Constant	6.062	0.055	0.000	6.092	0.055	0.000
Observations	19,589			19,589		
F-Value	3917.51			3940.94		
Prob > F	0.0000			0.0000		
R-squared	0.8811			0.8818		
Adj. R-squared	0.8809			0.8815		
Root MSE	0.1327			0.1323		

[a] Subdivision is Considered Greenway if it has > 10% Open Space

Summary and Policy Implications

This research has direct implications for policy makers and developers planning residential housing developments in the Omaha market that include open space amenities and/or LID practices (also known as 'conservation design'). Clustered open space tends to negatively impact sale prices or in some cases have neutral effect. In contrast, the more wide open greenway-based open spaces have larger positive impacts on home prices. It is also clear that home buyers prefer open space to be owned and maintained by a homeowners association or a private entity and that they prefer open areas to be mowed and/or planted in trees. In conclusion, while many types of open space generate positive values there are some combinations of open space, ownership and ground cover characteristics that negatively impact property values.

Planners and residential housing developers are suggested to evaluate the specific neighborhood and open space conditions associated with existing and planned subdivisions in conjunction with these research results (particularly the full thesis results of Schmitz, 2008). Combined with information on the relative costs to plan, design and build specific open space amenities, this information is expected to maximize homeowner preferences and hence development profits. In the case of planning LID/open space designs, it is recommended that developers rely more on open greenway designs rather than clustered open space designs and that the maintenance of these open spaces be privatized (i.e. under the control of homeowner associations or SID's).

Proposed Follow-Up Research

1) Replicate these hedonic price models focusing on open space using only undeveloped lot sales. This would potentially be more helpful for residential housing developers to identify different profit levels associated with different open space designs

2) Surveys of homebuyers to elicit their perceptions of and preferences for different open space amenities. This could potentially confirm many of the conclusions reached in this study based on observed housing sale prices.

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Appendix A: World Herald Study Article 1

Published Saturday | June 16, 2007
UNO dam-study offer rejected by Papio NRD
BY NANCY GAARDER
WORLD-HERALD STAFF WRITER

The Papio-Missouri River Natural Resources District, which has proposed partnering with developers on up to $380 million in dam construction, rejected an offer by UNO to analyze whether the costs would be fairly divided between taxpayers and the private sector.

Board members voted 6-5 against taking part in the study.

In opposing the study, some board members said they fear the results could be used against the NRD, while others saw little merit in the study.

Board members supporting the analysis said it would help the district make sound decisions and bring greater transparency to dam projects.

At issue in part is whether the $500 per residential lot fee that builders would pay is enough.

Preliminary analysis by the University of Nebraska at Omaha Real Estate Research Center indicates, for example, that views of Zorinsky Lake add an average of $43,000 in value to a home. Views of Standing Bear Lake add an average value of $19,000 to a home.

The NRD, the City of Omaha and other local governments are proposing that taxpayers shoulder about two-thirds of the cost of building up to 29 dams.

Builders would pick up the remainder through the new fee on all home lots and a higher fee on all multifamily, commercial and industrial property. Developers might chip in more money on a dam-by-dam basis.

The district is studying two dam construction plans, and both would rely on partnering with the private sector.

The first is the 29-dam plan with an estimated cost of $282.5 million. The other initiative involves two large reservoirs in Washington County at a cost of about $100 million.

The board faced conflicting advice on the UNO offer at its Thursday meeting.

District staff recommended in writing and at the meeting that the board approve the study. Paul Woodward, water resources engineer for the NRD, told the board that the study would give the district a better understanding of what to charge developers.

But General Manager John Winkler, when asked directly by the board, said he was not taking a position.

The district's legal counsel, Paul Peters, gave a legal opinion to the board before the meeting. Board members spoke indirectly about the opinion at the public meeting without anyone, including Peters, explaining what it said.

Board member Rich Tesar questioned the secrecy.

"What do we have to hide here?" he asked. "We seem to be very nervous about an opinion that somebody wrote. So what? It's an opinion. It may have credence, it may not. Why don't we just open up our hands here and be transparent and tell the truth?"

Board member Rick Kolowski, who had supported the study earlier in the week, reversed his position Thursday.

"If there is even a modicum of potential threat, that we might have it (the study results) used against us," Kolowski said, "that raises a flag for me."

Kolowski said he hopes the study will be done, but that the NRD shouldn't be connected to it.

Board members who had not read the legal opinion asked for someone to explain what the potential risk might be.

Board member John Conley said the study could be used against the district if it does not successfully extract from developers the amount that the proposed study would recommend.

Steve Shultz, director of the UNO Real Estate Research Center, told the board that most developers in the Omaha area are willing to pay fair market value, but that they, too, lack information.

Better data, he said, lead to better decisions for all involved.

Board member Rick Patterson said the study could help the district overcome the perception that it is "cozying up" to developers.

"The more information, the better," he said.

Bob Doyle, an attorney who often represents developers, was not at the meeting, but he said Friday he would have no problem with the study.

The results, Doyle said, will show that everyone along the way benefits. Farmers are paid well for their land, developers and builders earn a profit. And the public, he said, benefits through flood control and recreational access to the lakes.

The study would have been subsidized by UNO. The district's share would have been $15,000.

Voting against the study: Conley, Dick Connealy, David Klug, Kolowski, John Schwope, Jim Thompson. Voting for: Fred Conley, Tim Fowler, Dorothy Lanphier, Patterson and Tesar

Appendix B: World Herald Study Article 2

Published Tuesday | September 25, 2007
Douglas County Board may join study on dams' impact
BY JUDITH NYGREN
WORLD-HERALD STAFF WRITER

The Douglas County Board, an opponent of a plan to build as many as 29 dams, is considering spending $30,000 on a study that some commissioners say could save taxpayers millions in ill-spent dollars.

Commissioners are considering partnering on a study rejected just three months ago by the Papio-Missouri River Natural Resources District.

The NRD decided not to support the analysis after a few of its members raised concerns that the findings could undermine plans to spend up to $380 million on dams in the Omaha-metro area.

That possibility is exactly why Douglas County needs to get involved in the study by University of Nebraska at Omaha researchers, said Commissioner Clare Duda. Taxpayers deserve to know if they are being asked to subsidize dams that benefit developers more than the public, he said. They also need to know the cost and benefit of pursuing low-impact, water-containing development, the county's alternative proposal to dams, he said.

Douglas County has been a vocal opponent to the dams, arguing the NRD's plan is too costly as flood control and does nothing to clean up area waterways as required by federal law. Commissioners last week agreed to oppose any state legislation that would give the NRD bonding authority to fund the dams.

On Tuesday, they listened as UNO professor Steven Shultz outlined his plan to study the impact that dams — and alternately, low-impact development — could have on the local real estate market. The Nebraska University Water Center is providing $10,000 for the research. Douglas County will decide next week whether to provide the remaining $30,000.

Preliminary analysis by the UNO Real Estate Research Center indicates that homes with a view of Zorinsky Lake are worth about $43,000 more than surrounding homes with no view. Views of Standing Bear Lake add an average value of $19,000 to a home.

Shultz said UNO plans to expand its analysis to determine if views of smaller lakes add similar values to homes. The center also will try to determine if the $500 that builders would pay for each residential lot near the proposed dam sites is enough. Some waterfront projects have cost developers considerably more, costing taxpayers little to nothing, Shultz said.

Shultz said open spaces created to collect storm water in low-impact development hasn't always led to higher property values, as some proponents have claimed. The key to maximizing the value of low-impact development might be the size of the green space, he said.

The study will look at, among other things, the amount of green space and type of vegetation needed to make low-impact development more appealing to developers and home buyers.

Commissioner Kyle Hutchings challenged the worth of the study. Common sense is enough to determine that developers will benefit from the creation of more waterfront land, he said.

He also noted that the study isn't even done and some commissioners already hope to use it to prove dam-supporters wrong. What will the county do if its $30,000 pays for a study that supports the economic benefit of dams? he asked.

"Are we going to say, 'Let's do it'?"