APPENDIX 5C

Natural Gas Pipelines and Residential Property Values: Evidence from Clackamas and Washington Counties

Natural Gas Pipelines and Residential Property Values: Evidence from Clackamas and Washington Counties

Eric Fruits, Ph.D.

ECONorthwest
888 SW Fifth Avenue, Suite 1460
Portland, Oregon 97204
Tel: 503-222-6060
Fax: 503-222-1504
www.econw.com

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Executive Summary

Oregon LNG proposes to construct, own, and operate a liquefied natural gas import facility on the Skipanon Peninsula in Warrenton, Oregon. As part of the project, Oregon Pipeline LLC would construct a natural gas pipeline running approximately 130 miles from the proposed Warrenton facility through Clatsop, Columbia, Tillamook, Washington, Yamhill, Marion, and Clackamas Counties in Oregon.

ECONorthwest was retained by CH2M HILL, the project's environmental consultant, to evaluate the potential impacts of the proposed pipeline on the property values of adjacent and nearby properties.

To evaluate the potential impacts of Oregon Pipeline's proposed pipeline on the property values of adjacent and nearby properties, this study statistically estimates the impacts of a similar intrastate pipeline that went into service in September 2004. The South Mist Pipeline Extension ("SMPE") is a 24-inch diameter natural gas pipeline, approximately 62 miles long. Its northern terminus is located in forest land just south of the Washington and Columbia County border. It extends generally south and east through rural lands in Washington, Marion and Clackamas Counties. Its most southerly point is the Williams Pipeline Gate Station located northwest of Molalla, Oregon.

Using geographic information system software and data, this study identified properties in Washington and Clackamas Counties within one mile of the SMPE. Assessors' offices from the counties provided databases of transactions and property characteristics. With information on more than 10,000 property transactions, this study statistically estimates hedonic housing prices to evaluate the extent to which proximity to the SMPE is associated with differences with the sales price of single family housing.

Based on the key findings of this study, the proposed Oregon Pipeline project would have no impact on the value of adjacent or nearby residential properties. The following are the study's key findings.

The SMPE pipeline has no impact on property values. The SMPE pipeline has no statistically significant or economically significant impact on residential property values, whether calculated on the combined Clackamas County and Washington County data or on each of the counties individually.

- **The SMPE pipeline has no *statistically* significant impact.** This study performs three different statistical tests to evaluate how proximity to the pipeline affects residential sales prices. Each of the statistical tests indicates no relationship between proximity to the pipeline and properties' sales prices. In other words, the pipeline has no impact on property values. Previously published research has found that

pipelines have no relationship—or a slightly positive relationship—with property prices.(Hansen, Benson and Hagen 2006, Simons 1999, *Northwest Natural Gas Co. v. Shirazi* 2007).

- **The SMPE pipeline has no *economically* significant impact.** Even though the estimates are not statistically significant, they suggest that the completion of the SMPE *decreased* property values by less than one-tenth of one percent for each additional 100 feet distance from the pipeline. Hypothetically, if every property that sold after the pipeline was operating was moved to be 1 mile from the pipeline (i.e., further from the pipeline than the property actually is), the total change in the value of the sales would be lower by less than 1 percent. In other words, the *further* a property is from the pipeline, the *lower* the calculated sales price. Conversely, the *closer* a property is to the pipeline, the *higher* the calculated sales price. This hypothetical demonstrates that (1) closer proximity to the pipeline is associated with higher sales prices, and (2) the association is so small as to be economically insignificant.

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Natural Gas Pipelines and Residential Property Values: Evidence from Clackamas and Washington Counties

Eric Fruits, Ph.D.
ECONorthwest*

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1 Background and assignment

Oregon LNG proposes to construct, own, and operate a liquefied natural gas import facility (also known as a re-gasification facility) located on the Skipanon Peninsula in Warrenton, Oregon. The Oregon LNG Project is designed to include a marine receiving terminal, three full containment LNG storage tanks, and facilities to support ship berthing and cargo offloading. The project would convert the liquified natural gas back to its vapor state prior to its delivery into the pipeline system built and operated by Oregon Pipeline LLC. Therefore, the pipeline would transmit natural gas, rather than LNG.

Oregon Pipeline's proposed pipeline would run approximately 130 miles from the proposed Warrenton facility to the Molalla Gate Station and connect with Northwest Natural's pipeline. It would be buried approximately 5 feet underground. The pipeline would be 36 inches in diameter and be made of plastic coated welded steel, with a wall thickness of 0.5 to 0.75 inches.

The pipeline would run through Clatsop, Columbia, Tillamook, Washington, Yamhill, Marion, and Clackamas Counties in Oregon. The proposed route would run parallel to existing electric transmission line, power line, and railroad easements.

ECONorthwest was retained by CH2M HILL, the project's environmental consultant, to evaluate the potential impacts of proposed pipeline on the property values of adjacent and nearby properties.

*888 SW Fifth Avenue, Suite 1460, Portland, Oregon 97204, Tel: 503-222-6060, Fax: 503-222-1504, www.econw.com.

2 Qualifications

ECONorthwest is the Pacific Northwest's largest economics consulting firm. Since 1974, the firm has completed more than 2,500 projects in economics, finance, statistics, planning, and policy evaluation. The firm has a reputation for objective analysis and a rigorous quantitative approach. The firm's economists have provided expert analysis to both plaintiffs and defendants in legal disputes and have provided objective analysis to a wide range of clients with widely diverging objectives. For private parties, public entities, and other interested parties, ECONorthwest has worked on many projects involving petroleum products and natural gas pipelines.

Eric Fruits, Ph.D. is a Senior Economist at ECONorthwest's Portland office. He is an adjunct professor at Portland State University, where he teaches a course in real estate finance and investments in the School of Business Administration and the School of Urban Studies & Planning. Dr. Fruits has been engaged on many projects involving property pricing and valuation. He has worked on behalf of the U.S. Department of Justice on evaluating the impacts of fighter jet noise on the values of residential properties under the planes' flightpaths. Dr. Fruits was assisted by **Rob Wyman**, a research associate in ECONorthwest's Portland office.

3 Previous studies

Little research effort has been directed toward evaluating the extent to which distance from a pipeline affects residential property values. Indeed, no published research has been directed toward the effect of natural gas pipelines. Instead, past research has focused on petroleum and petroleum products pipelines and the effects of accidents, such as ruptures and explosions, on residential properties. It is important to distinguish natural gas pipelines from petroleum pipelines. For example, spills from petroleum pipeline can cause wide-ranging and long-term environmental contamination. The environmental consequences associated with natural gas leaks tend to be less severe and relatively short term.

Previous published research has relied on the *hedonic housing price methodology*. This methodology assumes that the value of the item being researched (e.g., houses) can be decomposed into the values of its constituent characteristics (e.g., bedrooms, bathrooms, distance from amenities, etc.). Statistical analysis estimates how much each characteristic contributes to the value of the item being researched. Hedonic models are commonly used in real estate appraisal. The methodology is often used to estimate the value of environmental amenities and disamenities. Past published research has evaluated how much residential property values are affected by proximity to parks, greenspace, and other

amenities. Published research has also attempted to measure the extent to which residential property values are affected by distance from potential environmental hazards such as toxic waste sites, nuclear power plants, chemical plants, incinerators, and landfills.

Simons (1999) uses a hedonic analysis of the housing markets in Fairfax County, Virginia, to address the effect a petroleum pipeline rupture had on residential property values elsewhere along the pipeline right-of-way. For the period prior to the rupture, he estimates that houses on a pipeline corridor had a 6.4 percent *higher* selling price than homes that were not on the corridor. Townhouses on the pipeline corridor had a 1.7 percent *higher* selling price. Both estimates are statistically significant. Because his study focuses on the effects of the rupture on the property prices, Simons (1999) does not explain why pre-rupture selling prices would be higher for properties on the pipeline corridor.

Hansen et al. (2006) use a hedonic price model to estimate the effect of proximity to a major fuel pipeline on housing prices. They examine housing prices both before and after a high-profile petroleum product (gasoline) pipeline rupture and explosion near Bellingham, Washington. Their statistical analysis finds no significant effect of proximity to the pipeline prior to the accident. Hansen et al. (2006) explain that, in some cases, close proximity to a pipeline could provide a positive amenity in the form of a greenbelt or buffer.

In *Northwest Natural Gas Co. v. Shirazi (2007)*, the Court reports that one of the parties presented the testimony of an expert appraiser. The appraiser's firm had conducted a study that compared sales of properties through which a pipeline traveled with sales of properties nearby but through which the pipeline did not travel. The expert testified that the estimates of the effect of the pipeline on property values were not statistically significant (i.e., no different from zero).

4 Data and methodology

To evaluate the potential impacts of Oregon Pipeline's proposed pipeline on the property values of adjacent and nearby properties, this study uses the hedonic housing price approach to estimate the impacts of a similar intrastate pipeline that went into service in September 2004. The South Mist Pipeline Extension ("SMPE") is a 24-inch diameter natural gas pipeline, approximately 62 miles long.[1] Its northern terminus is located in forest land just south of the Washington and Columbia County border. It extends generally south and east through rural lands in Washington, Marion and Clackamas Counties. Its most southerly point is the Williams Pipeline Gate Station located northwest of Molalla, Oregon.

The SMPE is underground its entire length, with the exception of certain above ground valves and inspection points that are required by federal code. In most locations, the

[1] See Oregon Energy Facility Siting Council (2003) for a detailed description of the SMPE path and properties.

pipeline is buried at a depth of 5 feet on average. The pipeline requires a permanent easement directly over the pipeline for maintenance and safety. In general, this maintenance easement is 40 feet wide. After construction of the pipeline is complete, the maintenance easement is restored to its pre-construction condition and use except that large trees or other vegetation with potentially damaging root structures are not allowed to grow in close proximity to the pipeline.

Using geographic information system ("GIS") software and data, this study identified, by taxlot, single family residential ("SFR") properties in Washington and Clackamas Counties within one mile of the pipeline (Exhibits 1 and 2). Assessors' offices from the counties provided databases of transactions and property characteristics. GIS software and data calculate property size as well as whether the property is on a slope of 25 percent or more, whether a significant portion of the property is on a designated floodplain or adjacent to a river, and whether the property is within a designated urban growth boundary.[2] GIS was also used to calculate properties' proximity to major arterial roads and proximity to the pipeline.

Exhibit 3 provides descriptive statistics for the following variables.

PRICE Sales price of the property, in nominal dollars.

TREND Measures the passage of time, in years.

YEARxx Indicator variables for each year 1992 through 2006.

AGE Age of the house at the time of sale; equal to the year of sale minus the year the house was built.

PROPSF Land area of the property, in square feet.

LIVESF Living area of the house on the property, in square feet.

$PROPSF \times LIVESF$ Interaction between land area and living area.

BED Number of bedrooms.

BATHF Number of full bathrooms.

$LIVESF \times BED$ Interaction between living area and the number of bedrooms.

$LIVESF \times BATHF$ Interaction between living area and the number of full bathrooms.

[2]Under Oregon law, each city or metropolitan area in the state has an urban growth boundary that separates urban land from rural land. The boundary controls urban expansion onto farm and forest lands. Land inside the urban growth boundary is intended to support urban services such as roads, water and sewer systems, parks, schools and fire and police protection. Owners of land outside of the urban growth boundary typically cannot develop the land for residential, commercial, or industrial purposes.

BED × *BATHF* Interaction between the number of bedrooms and the number of full bathrooms.

NHOODxx Indicator variables for each of 17 neighborhoods.

SLOPE Indicator variable equal to 1 if a substantial portion of the property has a slope greater than 25 percent and zero otherwise.

UGBDIST Censored variable equal to the linear distance in feet to the urban growth boundary border; equal to zero if the property is within the urban growth boundary.

$UGBDIST^2$ Squared value of *UGBDIST*.

ARTDIST Censored variable equal to the linear distance in feet to nearest arterial road border; equal to zero if the property is adjacent to arterial road.

FLOOD Indicator variable equal to 1 if a substantial portion of the property is in a floodplain.

RIVERDIST Linear distance from center of property to nearest river, in feet.

FLOOD × *RIVERDIST* Interaction of proximity to river and whether a substantial portion of the property is in a floodplain.

PIPEDIST Censored variable equal to the linear distance in feet to the pipeline; equal to zero if pipeline is on or adjacent to the property.

PIPEDIST × *INTENT* Interaction of pipeline distance with announcement of intent to construct the pipeline; *INTENT* is an indicator variable equal to 1 if the sale occurred after the announcement of the intent to construct the pipeline, and zero otherwise.

PIPEDIST × *OPER* Interaction of pipeline distance with completion and operation of pipeline; *OPER* is an indicator variable equal to 1 if the sale occurred after the the pipeline was operational, and zero otherwise.

The dependent variable in the regression analysis is the natural logarithm of the sales price, ln(*PRICE*). The use of natural logarithm is consistent with previous published studies estimating the effect of proximity to a pipeline on property values, such as Hansen et al. (2006) and Simons (1999).

The regressions include a trend as well as indicator variables for each year. *TREND* attempts to capture broader trends in property prices that are typically driven by demographic factors such as population and income growth. The indicator variables for each

year control for factors that may be idiosyncratic to a given time period. Neighborhood indicator variables account for localized differences in property prices.

The size of the property, size of the living area, number of bedrooms, and number of bathrooms are standard variables included hedonic analysis of residential property prices. Hansen (2006) indicates that some housing characteristics interact with other characteristics.[3] This study interacts the size of the property with the size of the living area, the size of the living area with the number of bedrooms and the number of bathrooms, and the number of bedrooms with the number of bathrooms.

Other variables, such as whether the house sits on relatively steeply sloped property, within an urban growth boundary, or in a floodplain control for factors identified in previous studies and potentially affecting property values.

Portions of the pipeline occupy roadway rights-of-way. Some studies indicate that proximity to an arterial road affects property values. Thus, this study controls for proximity to arterial roadways to separate the impacts associated with proximity to roads from the impacts associated with proximity to the pipeline.

This study uses three variables to estimate the extent to which proximity to the pipeline affects single family residential selling prices. The first, *PIPEDIST*, measures the distance between the property and the pipeline. This variable controls for other factors that are correlated with proximity to the pipeline, but are not included in the estimating model. For example, the proposed pipeline will coincide with power line and railroad easements. *PIPEDIST* controls for such easements and other factors that coincide with the pipeline, but were in place before the intent to construct the pipeline was announced.[4] $PIPEDIST \times INTENT$ interacts the pipeline proximity with the announcement of intent to construct the pipeline. The estimated coefficient measures the extent to which the announcement of the pipeline affects residential selling prices. $PIPEDIST \times OPER$ measures the extent to which the completion of the pipeline affects residential selling prices.

5 Results

Exhibit 4 presents the results from three hedonic regression models:

1. Both Clackamas and Washington counties combined,
2. Clackamas County only, and

[3] Rather than a multiplicative interaction, Meese and Wallace (1997) include the ratio of ratio of the number of bedrooms to the number of total rooms. This is based on their observation that a house subdivided into too many bedrooms detracts from house value.

[4] Rogers (2000) suggests that many studies of environmental amenities and disamenities are misspecified because they do not have a variable to control property values *before* the amenity or disamenity appears. By including *PIPEDIST*, this study avoids this type of misspecification.

3. Washington County only.

For the both counties data and the Washington County data, most of the estimated coefficients on variables describing property characteristics are statistically significant. All the significant coefficients have the expected sign with the exception of the floodplain indicator variable. The coefficient indicates that properties on a floodplain have higher selling prices than those that are not on a floodplain. The estimated coefficient on proximity to a river may explain the estimated coefficient on floodplain. The estimated coefficient on proximity to a river is negative, meaning that sales price declines the further a property is from a river. Conversely, properties closer to a river are associated with higher property prices. The proximity variable measures distance to a river only, not proximity to streams, creeks, or other bodies of water. Thus, to the extent streams and creeks are associated with floodplains, then the floodplain variable is providing information that the proximity to a river variable is not. In other words, the floodplain variable is a proxy for distance from rivers and other bodies of water.

5.1 The Pipeline Has No Statistically Significant Impact on Sales Price

Neither the announcement of the intent to construct the pipeline nor the completion and operation of the pipeline has any significant effect on the sales prices of properties within one mile of the pipeline. The estimated coefficients are not statistically significantly different from zero.[5]

This study performs three statistical tests to evaluate the statistical significance of proximity to the pipeline on sales prices: (1) *t*-test, (2) *F*-test, and (3) Likelihood Ratio test.

***t*-test** The *t*-test uses the *t*-statistic which is calculated from the estimated coefficient and standard errors reported by most statistical software. The *t*-statistic measures the precision of the coefficient estimate. It is equal to the estimated coefficient divided by its standard error. The *t*-statistic is easier to use than the standard error because it accounts for differences in units of measurement. The *t*-statistic expresses the standard error as a ratio of the coefficient estimate. If the *t*-statistic is above some critical value (approximately 2.0), then a hypothesis can be rejected that true value of the estimated coefficient is zero.

Exhibit 4 shows that none of the estimated coefficients on the pipeline intent announcement or completion are statistically significantly different from zero at any of the traditional levels of significance. Thus, the *t*-test indicates that proximity to the pipeline has no statistically significant relationship with sales price.

[5] *PIPEDIST* increases with distance from the pipeline; the further from the pipeline is a property, the larger is *PIPEDIST*. A negative estimated coefficient indicates that properties *closer* to the pipeline are associated with *higher* sales prices.

***F*-test and Likelihood Ratio test** The *F*-test and the *Likelihood Ratio* test are two widely used tests by which alternative models are evaluated. They test whether the addition of one or more variables yields a model that is statistically significantly different from the model without the added variables. For example, they can test whether adding the pipeline intent announcement and pipeline completion variables to the regression produces a model that is statistically significantly different from a model that does not include the variable. If so, then the variables together are statistically significant.

Calculation of the *F*-test statistic is straightforward. Two regression models are estimated, one of which constrains one or more of the regression coefficients according to the null hypothesis, usually by excluding the variable from one of the models estimated. The *F*-test statistic uses the sum of squared residuals (usually abbreviated *SSR*) reported by the statistical software to calculate a ratio of the *SSR*s between the two regression models. Using the subscript r to the denote the restricted model (i.e., the model with the pipeline variable excluded) and u to denote the unrestricted model, n to denote the number of observations, k the number of parameters being estimated in the restricted model, and g the number of *additional* parameters being estimated in the unrestricted model, the *F*-statistic is presented below and it follows the *F*-distribution.

$$F\text{-statistic} = \frac{(SSR_r - SSR_u)/g}{SSR_u/(n-k-g)} \tag{1}$$

The *F*-test cannot reject the hypothesis that estimated coefficients on the pipeline intent announcement or completion together are statistically significantly different from zero at any of the traditional levels of significance. Thus, the *F*-test indicates that proximity to the pipeline has no statistically significant relationship with sales price.

Calculation of the Likelihood Ratio test statistic is straightforward. As with the *F*-test, two regression models are used, one of which constrains one or more of the regression coefficients according to the null hypothesis. The likelihood ratio statistic uses the log likelihood (usually abbreviated *L*) reported by the statistical software to calculate a ratio of the log likelihoods between the two regression models. Using the subscript r to the denote the restricted model and u to denote the unrestricted model, the likelihood ratio statistic is as follows.

$$\text{Likelihood Ratio statistic} = -2(L_r - L_u) \tag{2}$$

The Likelihood Ratio statistic follows the chi-squared distribution. The Likelihood Ratio test cannot reject the hypothesis that estimated coefficients on the pipeline intent announcement or completion together are statistically significantly different from zero at any of the traditional levels of significance. Thus, the Likelihood Ratio test indicates that proximity to the pipeline has no statistically significant relationship with sales price.

5.2 The Pipeline Has No Economically Significant Impact on Sales Price

The estimated coefficients suggest that the combined effect of the announcement of intent to construct and the completion of the pipeline decreased selling prices by less than one-tenth of one percent for each additional 100 feet distance from the pipeline. The estimated coefficients indicate that a 1 mile variation in proximity to the pipeline would be associated with a 3.8 percent change in selling prices (Exhibit 5). Such a small effect of pipeline proximity on sales price is economically insignificant.

If every property that sold after the pipeline was operating, instead of its current proximity to the pipeline, was 1 mile from the pipeline (i.e., further from the pipeline), the total value of the sales would be only 0.7 percent lower. Such a small effect of pipeline proximity on sales price is economically insignificant.

5.3 Estimating Separate Coefficients for Clackamas County and Washington County

Much of the data was provided by the assessor's offices of Clackamas County and Washington County. Each county has different information systems, record different property characteristics, and often record similar characteristics in different ways. For example, each county defines single family residential properties in different ways. In Washington County, only residential properties in urbanized areas are considered single family residential. In Clackamas County, however, rural residential properties may be classified as single family residential.

In addition, Washington County areas in which the pipeline runs are more suburban and, in some place, located within the urban growth boundary. For this reason, Washington County properties in the sample tend to be smaller and grouped closer together than properties in Clackamas County.

Statistics has developed techniques to test whether two samples could be considered separately or together. One test is known as a Chow (1960) test. It is a test of whether the coefficients estimated over one group of the data are equal to the coefficients estimated over another. The Chow test indicates that the coefficients estimated over the Clackamas County observations are not equal to the coefficients estimated over the Washington County observations.

Exhibit 4 presents regression results for the Clackamas County and Washington County observations. For each of the counties, *t*-tests, *F*-tests, and Likelihood Ratio tests indicate that none of the estimated coefficients on the pipeline intent announcement or completion are statistically significantly different from zero at any of the traditional levels of significance. Thus, statistical test indicate that proximity to the pipeline has no statistically

significant relationship with sales price in either county.

The estimated relationship is also economically insignificant. In Clackamas County, the only positive—but statistically insignificant—coefficient is on the intent to construct announcement (suggesting that sales prices declined with the announcement). Even so, if every property that sold after the pipeline was operating, instead of its current proximity to the pipeline, was 1 mile from the pipeline (i.e., further from the pipeline), the total value of the sales would be only 1.9 percent different (lower). Such a small effect of pipeline proximity on sales price is economically insignificant.

6 Conclusion

Oregon Pipeline LLC proposes to construct a natural gas pipeline that would run approximately 130 miles from Warrenton, Oregon through Clatsop, Columbia, Tillamook, Washington, Yamhill, Marion, and Clackamas Counties in Oregon. To evaluate the potential impacts of Oregon Pipeline's proposed pipeline on the property values of adjacent and nearby properties, this study statistically estimates the impacts of a similar intrastate pipeline that went into service in September 2004, the South Mist Pipeline Extension. With information on more than 10,000 property transactions, this study statistically estimates hedonic housing price models to evaluate the extent to which proximity to the SMPE is associated with differences with the sales price of single family housing.

Based on the key findings of this study, the proposed Oregon Pipeline project would have no impact on the value of adjacent or nearby residential properties. In particular, this study finds that the SMPE pipeline has no statistically significant or economically significant relationship with residential property values. The findings are supported by data from Clackamas County, Washington County, and both counties combined.

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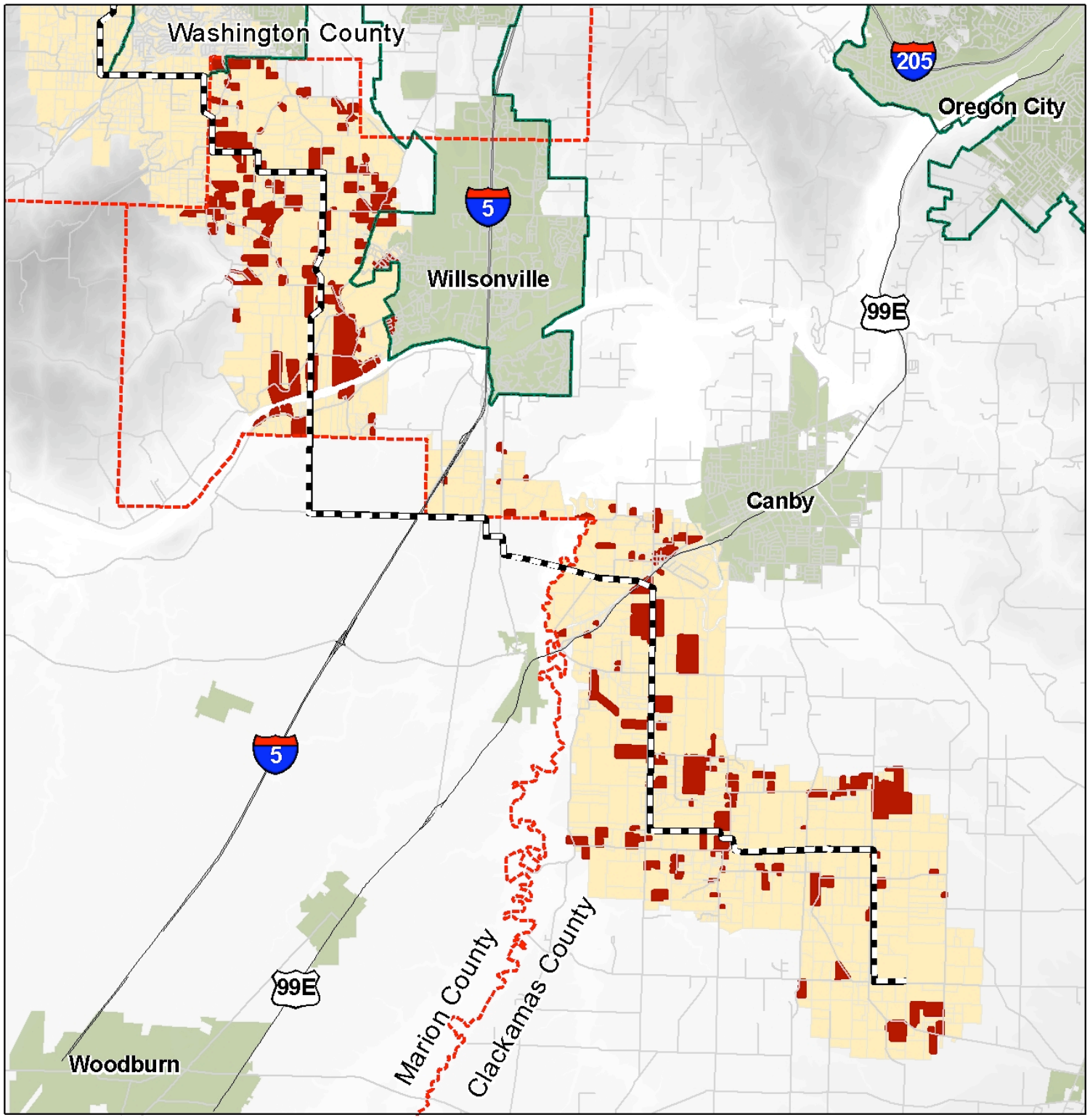
Exhibit 1



Clackamas County
Sample Properties

Legend

- Sample Properties
- One Mile Property Buffer
- South Mist Pipeline Extension
- Urban Growth Boundary

N

0 1 2
Miles

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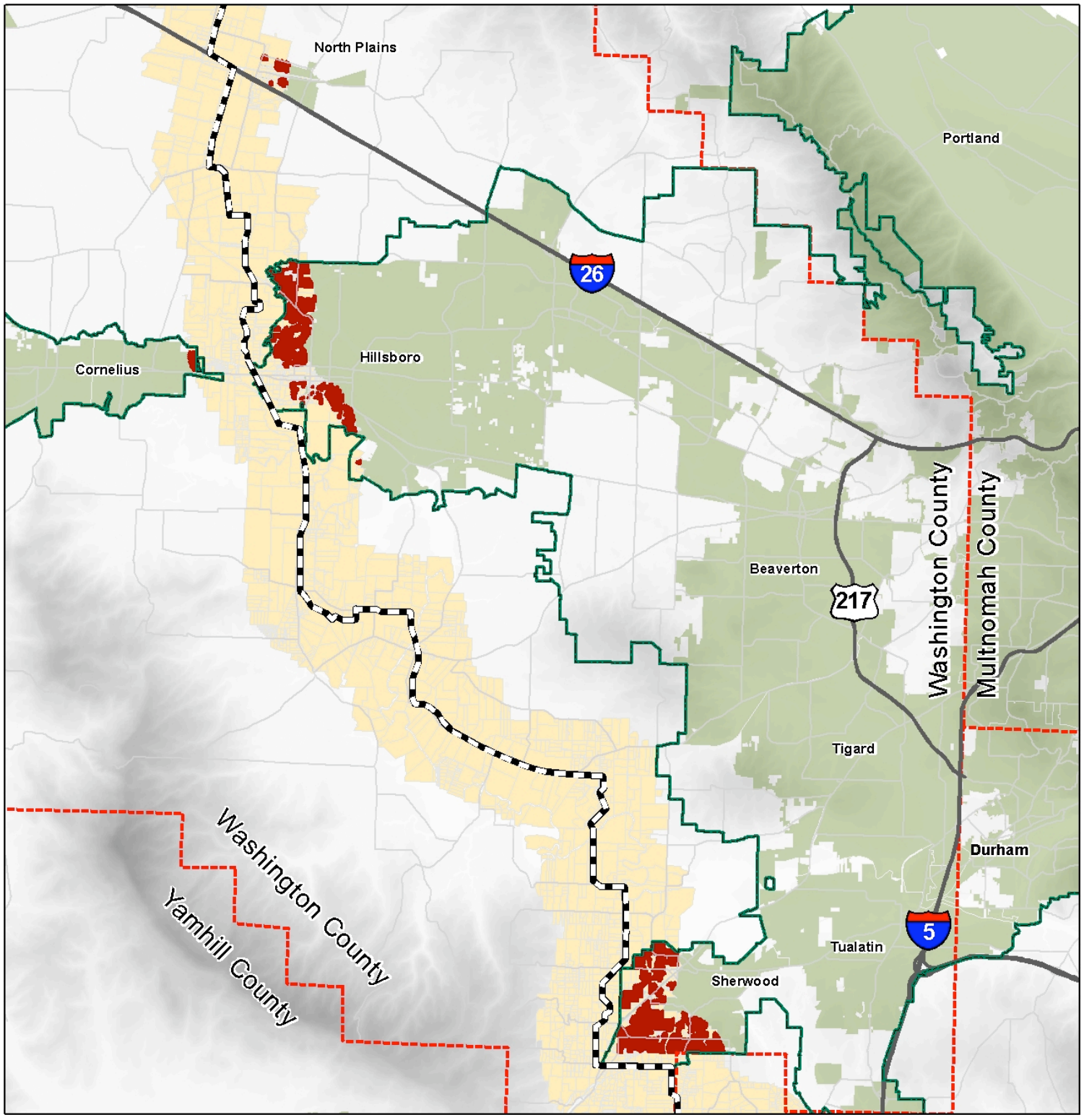
Base Map Data Source: Metro RLIS Lite, 2007

Exhibit 2



Washington County Sample Properties

Legend

- Sample Properties
- One Mile Property Buffer
- South Mist Pipeline Extension
- Urban Growth Boundary

N

0 2 4

Miles

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Base Map Data Source: Metro RLIS Lite, 2007

Exhibit 3: Descriptive Statistics

	Both Counties				Clackamas County Only				Washington County Only			
Variable	**Mean**	**Std. Dev.**	**Max.**	**Min.**	**Mean**	**Std. Dev.**	**Max.**	**Min.**	**Mean**	**Std. Dev.**	**Max.**	**Min.**
Sales price, dollars	205,584	156,779	5,330,850	20,800	438,214	455,918	5,330,850	34,000	192,325	104,364	4,175,000	20,800
Age at sale	9.26	18.47	111	-	27.30	27.04	107	-	8.25	17.32	111	-
Property sq. ft.	16,654	108,684	6,565,782	1,048	183,749	431,748	6,565,782	1,915	7,130	13,996	1,116,372	1,048
Living area sq. ft.	1,203	534	8,360	-	2,469	1,171	8,360	-	1,131	357	3,604	448
Bedrooms, no.	3.28	0.71	8	-	3.16	0.83	6	-	3.29	0.70	8	1
Baths, full, no.	2.62	0.75	11	-	2.15	0.78	4	-	2.64	0.74	11	1
Distance from arterial road, feet	740	590	7,795	52	1,226	1,393	7,795	55	713	493	3,420	52
Distance from UGB, feet	853	4,513	51,850	-	10,976	13,560	51,850	-	276	2,212	19,441	-
Distance from river, feet	8,270	4,879	21,946	35	8,136	5,246	21,946	35	8,277	4,858	14,949	59
Distance from pipeline, feet	3,478	1,130	5,278	-	3,125	1,594	5,275	-	3,498	1,094	5,278	835
Slope over 25%	0.016				0.079				0.012			
Property in floodplain	0.020				0.084				0.016			
1992 year of sale	0.018				0.014				0.019			
1993 year of sale	0.030				0.016				0.031			
1994 year of sale	0.038				0.009				0.040			
1995 year of sale	0.042				0.005				0.045			
1996 year of sale	0.076				0.010				0.080			
1997 year of sale	0.082				0.007				0.086			
1998 year of sale	0.063				0.009				0.066			
1999 year of sale	0.056				0.040				0.057			
2000 year of sale	0.062				0.086				0.061			
2001 year of sale	0.070				0.081				0.069			
2002 year of sale	0.072				0.081				0.071			
2003 year of sale	0.071				0.112				0.069			
2004 year of sale	0.091				0.088				0.091			
2005 year of sale	0.110				0.141				0.109			
2006 year of sale	0.068				0.202				0.060			
2007 year of sale	0.042				0.098				0.039			
Neighborhood 1	0.001				0.014				-			
Neighborhood 2	0.002				0.029				-			
Neighborhood 3	0.009				0.160				-			
Neighborhood 4	0.009				0.169				-			
Neighborhood 5	0.010				0.190				-			
Neighborhood 6	0.001				0.012				-			
Neighborhood 7	0.003				0.055				-			
Neighborhood 8	0.003				0.047				-			
Neighborhood 9	0.007				0.134				-			
Neighborhood 10	0.008				0.152				-			
Neighborhood 11	0.002				0.033				-			
Neighborhood 12	0.000				0.005				-			
Neighborhood 13	0.286				-				0.302			
Neighborhood 14	0.011				-				0.011			
Neighborhood 16	0.014				-				0.014			
Neighborhood 17	0.002				-				0.003			

Exhibit 4: Hedonic Regression Results

Dependent Variable: Natural Logarithm of Sales Price

	Both Counties		Clackamas County Only		Washington County Only	
Variable	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**	**Coefficient**	**t-Statistic**
Constant	9.44	61.57 **	9.06	12.94 **	9.48	58.36 **
Trend	0.14	8.72 **	0.15	2.11 *	0.14	8.49 **
Age at sale	6.19E-05	0.20	3.34E-04	0.28	-6.51E-05	-0.21
Property sq. ft.	4.61E-07	1.98 *	3.06E-07	1.80	3.34E-06	1.33
Living area sq. ft.	3.40E-04	7.27 **	2.18E-04	1.84	2.09E-04	3.30 **
(Property) x (Living Area)	8.35E-11	-0.77	-2.82E-11	-0.39	-1.72E-09	-1.08
Bedrooms, no.	0.19	8.52 **	-0.06	-0.65	0.26	10.05 **
Baths, full, no.	0.12	5.26 **	0.09	0.66	0.07	2.89 **
(Living area) x (Bedrooms)	-5.60E-05	-5.69 **	1.35E-05	0.47	-8.56E-05	-4.90 **
(Living area) x (Baths, full)	2.99E-06	0.17	-4.84E-05	-1.73	1.02E-04	4.95 **
(Bedrooms) x (Baths, full)	-0.02	-2.61 **	0.01	0.16	-0.03	-4.93 **
Slope over 25%	-0.18	-3.85 **	-0.20	-2.32 *	-0.17	-3.20 **
Distance from UGB, feet	-4.87E-06	-0.52	1.24E-05	1.07	-4.78E-05	-0.73
Distance from UGB, squared	3.38E-10	1.67	-7.34E-11	-0.32	1.66E-09	0.49
Distance from arterial road, feet	1.38E-05	1.78	9.91E-06	0.48	1.45E-06	0.17
Property in floodplain	0.10	2.69 **	0.05	0.29	0.06	1.65
Distance from river, feet	-5.27E-06	-3.53 **	8.62E-06	0.87	-6.87E-06	-4.68 **
(Floodplain) x (Distance from river)	-7.40E-06	-0.71	-4.39E-05	-3.74 **	1.67E-05	2.16 *
Distance from pipeline, feet	-4.12E-05	-6.02 **	-4.75E-05	-1.08	-3.93E-05	-5.66 **
(Distance from pipeline) x (Intent announcement)	**-4.95E-06**	**-0.67**	**3.72E-05**	**0.88**	**-6.41E-06**	**-0.85**
(Distance from pipeline) x (Operation announcement)	**-2.45E-06**	**-0.54**	**-1.60E-05**	**-0.76**	**-1.40E-06**	**-0.31**
R-squared	0.57		0.62		0.53	
Adjusted R-squared	0.56		0.59		0.53	
Sum of squared residuals	1,862.81		86.83		1,751.16	
Log likelihood	-5,827.31		-272.58		-5,481.33	
Observations	10,642		566		10,076	

* denotes the *t*-statistic is significant at 5 percent level of significance; ** denotes significance at the 1 percent level of significance.
Coefficient estimates for neighborhood and date of sale indicator variables are not displayed because of page-size considerations.

Exhibit 5: Estimated Impact of Pipeline on Property Values

Simulation Based on Regression Estimates for Hypothetical Property

	2007 Sales Price	Percent Difference
Value if on or adjacent to pipeline	$350,102	
Change in estimated sales price associated with distance from pipeline		
Distance in feet		
100	-$259	-0.07%
250	-647	-0.18%
500	-1,292	-0.37%
1,000	-2,580	-0.74%
2,500	-6,414	-1.83%
1 mile = 5,280 feet	-13,408	-3.83%