Residential Revaluation Summary Report

2017 Mass Appraisal of All Regions for 2018 Property Taxes

Prepared For

Steven J. Drew

Thurston County Assessor

TABLE of CONTENTS

page

CERTIFICATE OF APPRAISAL 1

APPRAISAL TEAM 2

MASS APPRAISAL CONCLUSIONS 3

PREMISE OF THE APPRAISAL 6
Supporting Documents Used in the Mass Appraisal 6

CLIENT AND INTENDED USERS 7

ASSUMPTIONS AND LIMITING CONDITIONS 8

SPECIAL ASSUMPTIONS, LIMITING AND HYPOTHETICAL CONDITIONS 8

JURISDICTIONAL EXCEPTION 9

PURPOSE AND INTENDED USE 9

TRUE AND FAIR VALUE 9

DATE OF APPRAISAL 9

PROPERTY RIGHTS APPRAISED 10

PERSONAL PROPERTY NOT INCLUDED IN THE APPRAISAL 10

MARKET AREA AND PROPERTIES APPRAISED 10

CITY AND NEIGHBORHOO DESCRIPTION 10

ZONING 10

HIGHEST AND BEST USE 11

SCOPE OF THE APPRAISAL 11

RESIDENTIAL VALUATION PROCESS 13

COST APPROACH 14
Land Model Specification 14
Land Model Calibration 14
Multiple Regression Analysis Assumptions 15

VALIDATION OF LAND MODEL 16
Square Footage Model Normal Distribution of the Residual Errors 16
Scatterplot of Residual to Price as check for systemic bias 19
Front Footage Model Normal Distribution of the Residual Errors 21
Example of Land Square Feet Table Base Area Regions 4 & 5 23
Example of Acreage Table Base Regions 4 & 5 24
Example of Land Influences 25
Example of Saltwater Front Foot & Depth Tables 26
SALT WATER SPECIFIC INFLUENCES 28

BUILDING COST SPECIFICATION 29

2016 COST TABLE CALIBRATION 29
Introduction 29
Residential Structures 29
Construction Cost Tables 31

DEPRECIATION ANALYSIS 33
Effective Age 33
Depreciation Rate Tables 33
Condition 34

NEIGHBORHOOD ADJUSTMENT MODEL SPECIFICATION 36

NEIGHBORHOOD ADJUSTMENT CALIBRATION 36
Residential Adjustment Model Validation 38
Assessment Uniformity by Quality Grade 39
Assessment Uniformity by Condition 40
Assessment Uniformity by Size Group 41
Assessment Uniformity by Effective Age Group 42

RECONCILIATION AND CONCLUSION 43

APPENDIX....44
Multiple Regression Analysis Assumptions....44
MARKET / TIME ADJUSTMENT....47
SQUARE FOOT LAND MODEL SUMMARY....52
SALT WATERFRONT LAND MODEL SUMMARY....53
HEDONIC TIME MODEL....
NEIGHBORHOOD AND RATIOS....54

REGION 02 MAP....59

REGION 02 NEIGHBORHOOD MAP....59

REGION 03 MAP....60

REGION 03 NEIGHBORHOOD MAP....62

REGION 04 MAP....63

REGION 04 – CENTRAL....63

REGION 04 - NORTH CENTRAL....65

REGION 05 MAP....66

REGION 05 NEIGHBORHOOD MAP....67

REGION 06 MAP....68

REGION 06 NEIGHBORHOOD MAP....69

REGION 06 NEIGHBORHOOD MAP....70

REGION 07 MAP....71

REGION 07 NEIGHBORHOOD MAP....72

REGION 08 MAP....73

REGION 08 NEIGHBORHOOD MAP....74

REGION 09 MAP....75

REGION 09 NEIGHBORHOOD MAP....76

REGION 10 MAP....77

REGION 10 NEIGHOBORHOOD MAP....78

REGION 11 MAP....79

REGION 11 EAST CENTRAL NEIGHBORHOODS....80

REGION 11 SE CENTRAL....81

REGION 11 SOUTH CENTRAL....82

REGION 11 SOUTHWEST NEIGHBORHOODS....83

REGION 14 MAP....84

REGION 14 NEIGHBORHOOD MAP....84

SALTWATER REGIONS 01....86

SALTWATER NEIGHBORHOOD MAPS-REGION 01....87

SALTWATER NEIGHBORHOOD MAPS-REGION 01....88

SALTWATER NEIGHBORHOOD MAPS-REGION 01....89

Certificate of Appraisal

I certify that, to the best of my knowledge and belief:

- The statements of fact contained in this report are true and correct.
- The reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are my personal, impartial and unbiased professional analysis, opinions, and conclusions.
- I have no (or the specified) present or prospective interest in the property that is the subject of this report, and I have no (or the specified) personal interest with respect to the parties involved.
- I have performed no (or the specified) services, as an appraiser or in any other capacity, regarding the property that is the subject of this report within the three-year period immediately preceding acceptance of this assignment.
- I have no bias with respect to any property that is the subject of this report or to the parties involved with this assignment.
- My engagement in this assignment was not contingent upon developing or reporting predetermined results.
- My compensation for completing this assignment is not contingent upon the reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal.
- My analyses, opinions, and conclusions were developed, and this report has been prepared, in conformity with *the Uniform Standards of Professional Appraisal Practice 2014-2015 edition with 2016-17 Update letter.*
- I have not personally inspected all of the properties that are the subject of this report. Other appraisers involved in the review of property are listed on the following page.

No one provided significant analytical assistance to the person(s) signing this certification in the final opinion and conclusions of this report. However, mass appraisal requires a division and specialization of some tasks. I may or may not have been involved in some specific tasks. Although, I did review the conclusions included in this report.

Appraisal Team

Often teams of appraisers complete one or more parts of a mass appraisal. Major contributors to this appraisal project include the following:

Physical Inspection:

006 - Senior Appraiser
028 - Senior Appraiser
029 - Appraiser Analyst
030 - Senior Appraiser
037 - Senior Appraiser
042 - Senior Appraiser
050 - Senior Appraiser
057 - Senior Appraiser
063 - Senior Appraiser
065 - Senior Appraiser
066 - Senior Appraiser
067 - Senior Appraiser
068 - Senior Appraiser

Sales Validation:

007 - Appraiser Analyst
013 - Appraiser Analyst
029 - Appraiser Analyst
035 - Appraiser Analyst
054 - Appraiser Analyst
056 - Appraiser Analyst

Land Model Building:

007 - Appraiser Analyst
013 - Appraiser Analyst
035 - Appraiser Analyst
056 - Appraiser Analyst

Final Review: 062 - Chief Deputy

MASS APPRAISAL CONCLUSIONS

Appraisal Date: **January 1, 2017**

Area Name / Number: **County Wide all Regional Summary**

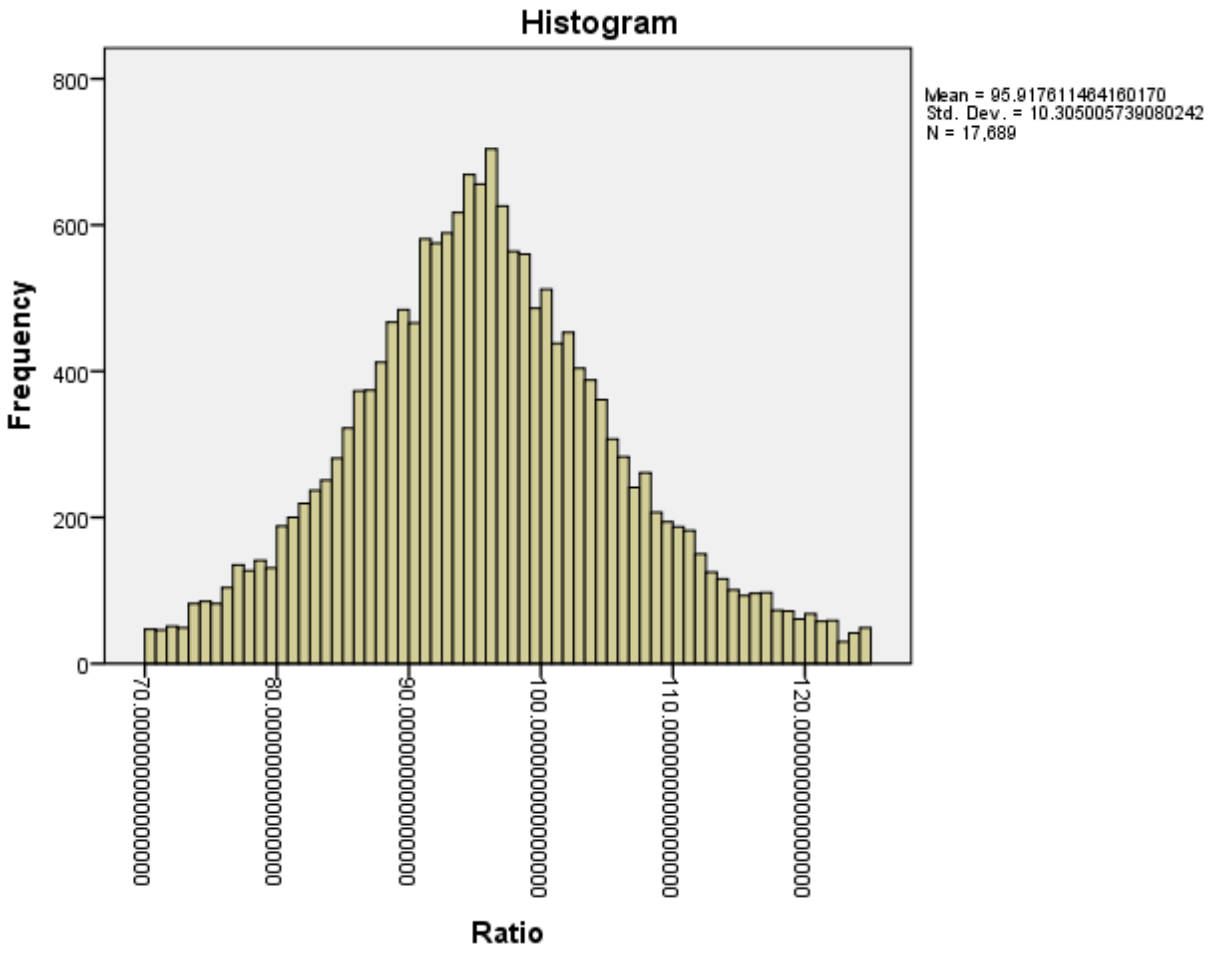
Physical Inspection: **Active Inspections of 17,352 parcels in Regions 04**
Non-inspected Updates **Non-Inspected Updates 91,903 Regions 1,2,3,5,6,7,8,9,10,11,13,14**

Summary of Regional Sales Ratios

Region	Mean	Median	W Mean	St. Dev	AAD	PRD	COD
01	.970	.967	.941	.141	.110	1.031	.113
02	.965	.959	.968	.107	.084	.997	.088
03	.965	.955	.968	.099	.076	.997	.080
04	.953	.951	.957	.106	.084	.997	.088
05	.965	.960	.966	.095	.075	.999	.078
06	.963	.960	.963	.081	.064	1.000	.067
07	.962	.960	.965	.088	.068	.997	.071
08	.956	.953	.956	.109	.090	.999	.095
09	.956	.960	.960	.104	.083	.996	.087
10	.959	.956	.960	.119	.096	.999	.100
11	.955	.956	.956	.104	.083	.999	.087
14	.947	.954	.952	.102	.080	.994	.084
Overall	.960	.957	.961	.096	.075	.998	.079

Sales used in Analysis: Sales used in the analysis are validated following the guidelines laid out in the Sales Verification Procedure. Multi-parcel and multi-building sales are generally excluded as not being representative of this market area. Mobile home and condominium sales are analyzed separately for the purpose of appraising these property types**. Listings of the individual sales used in the analysis for any parcel can be found by utilizing the *Parcel Search (A+)* link on the Assessor's website at** http://www.co.thurston.wa.us/Assessor/**.**

Number of Parcels in the Sales Sample: The population of residential vacant land and standard single family residences in the county over a 5 year period was approximately 15,631 parcels, adding sales of manufactured homes, condos and vacant land includes 18,922 total sales.



ALL RESIDENTIAL	Percentiles						
	5	10	25	50	75	90	95
Ratio	78.7	82.8	89.2	95.6	102.3	109.5	114.3

		Mean	Median	W Mean	Std Dev	AAD	PRD	COD
NonSalt Residential	15,739	.960	.957	.961	.096	.075	.998	.079
Salt Water Residential	252	.970	.967	.941	.141	.110	1.031	.113
Mobile Homes in Parks	1,077	.975	.948	.947	.349	.273	1.030	.288
Mobile Homes on Land	598	.898	.917	.897	.236	.172	1.001	.187
Condos	457	.958	.946	.931	.139	.107	1.028	.113
Residential Land	985	1.011	1.000	.966	.230	.178	1.046	.178

Conclusion and Recommendation: The assessment department has achieved its constitutional and statutory requirements to appraise, on a mass basis, all residential properties at market value. Additionally, we have met and surpassed the required ratios which represent good quality results per the standards published in the STANDARDS ON RATIO STUDIES 2013 by the International Association of Assessing Officers.

Since the values recommended in this report improve uniformity, assessment level, and equity, we recommend posting them for the 2018 Tax Roll.

PREMISE OF THE APPRAISAL

Supporting Documents Used in the Mass Appraisal

"A mass appraisal is the process of valuing a universe of properties as of a given date using standard methodology, employing common data, and allowing for statistical testing."[1]

A mass appraisal for ad valorem taxes is a complicated process involving large amounts of data, gathered and analyzed by teams of appraisers. We do not intend this document to be a self-contained documentation of the mass appraisal but to summarize our methods, data, and to guide the reader to other documents or files, upon which we relied. These documents may include the following:

- Individual property records maintained in a computer database
- Sales ratios and other statistical studies
- Market studies
- Model building documents
- Real estate sales database.
- Previous studies and reports filed in our office.
- Assessor's manuals for data collection analysis.
- Revaluation and sales verification manuals
- Property Tax Advisory Publications by the Washington State Dept. of Revenue.
- Title 84 RCW Property Tax Laws (Washington State Law)
- WAC 458 (Washington Administrative Code)
- Guidelines published by the International Association of Assessing Officers (IAAO)

The Appraisal Standards Board of the Appraisal Foundation biennially publishes *the Uniform Standards of Professional Appraisal Practice* (USPAP). This cycle is subject to the 2014-2015 edition and the recent Updates for the 2016-2017. These standards are written by appraisers to regulate their profession and are the minimum standards for the conduct of property appraisal in the United States. They cover real, personal, and business property. We rely upon these standards in the development and reporting of our assessed values.

[1] USPAP, Appraisal Standards Board of the Appraisal Foundation, p. 3

CLIENT AND INTENDED USERS

This report was prepared for Steven J. Drew, Thurston County Assessor.

The primary intended users are the governing board and levy authority for:

Thurston County
Timberland Regional Library
Medic One
Port of Olympia
PUD 1
Tanglewide Park and Rec
North Thurston SD 3
Olympia SD 111
Rainier SE 307
Rochester SD 401
Tenino SE 402
Tumwater SD 33
Yelm SD
Centralia as 401-L
Griffin SD 324
City of Bucoda
City of Lacey
City of Olympia
City of Rainier
City of Tumwater
City of Tenino
City of Yelm
Fire District 1
Fire District 2
Fire District 3
Fire District 4
Fire District 5
Fire District 6
Fire District 7
Fire District 8
Fire District 9
Fire District 11
Fire District 12
Fire District 13
Fire District 15
Fire District 16
Fire District 17
SE Thurston Regional Fire Authority
West Thurston Regional Fire Authority
Cemetery District 1
Cemetery District 2

Other intended users include the County Board of Equalization and the State Board of Tax Appeals.

ASSUMPTIONS AND LIMITING CONDITIONS

The Appraisal Summary Report, of which this statement is a part, is expressly subject to the following conditions:

This revaluation is a mass appraisal assignment resulting in conclusions of market value. No one should rely on this study for any purpose other than administration and distribution of ad valorem taxation. The opinion of value on any parcel may not be applicable for any use other than ad valorem taxation.

That the maps and drawings in this report are included to assist the reader in visualizing the property; however, no responsibility is assumed as to their exactness.

That the legal description, as given, is assumed correct. No survey or search of title of the property has been made for this report, and no responsibility for legal matters is assumed.

The report assumes good merchantable title and any liens or encumbrances that may exist have been disregarded.

The opinions and values shown in the report apply to the subject parcels only. The assessors made no attempt to relate the conclusions of this report to any other revaluations, past, present, or future.

The assumptions governing the use of multiple linear regression analysis have been met unless otherwise stated.

Unless otherwise stated in this report, the existence of hazardous substances, including without limitation asbestos, polychlorinated biphenyl, petroleum leakage, or agricultural chemicals, which may or may not be present on the property, or other environmental conditions, were not called to the attention of nor did the appraiser become aware of such during the appraiser's inspection. The appraiser has no knowledge of the existence of such materials on or in the property unless otherwise stated. The appraiser, however, is not qualified to test such substances or conditions. If the presence of such substances, such as asbestos, urea formaldehyde foam insulation, or other hazardous substances or environmental conditions, may affect the value of the property, the value estimates is predicated on the assumption that there is no such condition on or in the property or in such proximity thereto that it would cause a loss in value. No responsibility is assumed for any such conditions, or for any expertise or engineering knowledge required to discover them.

All properties are considered to be conveyed in fee simple with the full bundle, with the exception of separate leasehold accounts. Exceptions will be noted on their individual records.

Generally, the appraiser does not have the benefit of an interior inspection. As a result, it is assumed that the interior condition mimics the exterior. On those occasions in which an interior inspection is granted, the condition is reflective of the overall property. Those parcels which have had an interior inspection are noted on their individual records.

SPECIAL ASSUMPTIONS, LIMITING AND HYPOTHETICAL CONDITIONS

We assume that none of the subject land or improvement(s) is contaminated or that any contamination would affect the value except as shown in individual property records or otherwise stated.

Unless otherwise noted on the individual property record, we assume that the property is not adversely affected by neighboring properties or other external environmental factors.

We assume that the interior of residences and structures are the same as the exterior visual review.

We assume that the current condition and features of the property are the same as of the date of its last inspection.

It is assumed that the property is at its highest and best use as improved.

Because of budget restraints, we have not inspected all comparable sales. We have inspected the interiors of only a small percentage of the properties.

We believe that our screening process is adequate to capture arms-length property sales. Some arms-length transactions do not actually reflect their market value and were not used for either modeling or ratio studies per trimming guidelines of IAAO.

JURISDICTIONAL EXCEPTION

Washington exempts all or a portion of the market value on specific types of property including “open space,” agricultural, forest, home improvement, and some low-income housing.

PURPOSE AND INTENDED USE

The intended use of this appraisal is for administration of ad valorem taxation. After certification by the Assessor, these values will be used as the basis for assessment of real estate taxes payable in 2018. We do not intend the values to be used for or relied upon for any other purpose.

This report serves as a record of the revaluation which is subject to review and change by the County Board of Equalization, the Washington State Board of Tax Appeals, and the courts.

TRUE AND FAIR VALUE

The basis of all assessments is the true and fair value of property. True and fair value means market value (Spokane etc. R. Company v. Spokane County, 75 Wash. 72 (1913): Mason County, 62 Wn. 2d (1963); AGO 57-58, No. 1/8/57; AGO 65-66, No. 65, 12/31/65)

The true and fair value of a property in money for property tax valuation purposes is its "market value" or amount of money a buyer willing but not obligated to buy would pay for it to a seller willing but not obligated to sell. In arriving at a determination of such value, the assessing officer can consider only those factors which can within reason be said to affect the price in negotiations between a willing purchaser and a willing seller, and he must consider all of such factors. (AGO 65,66, No. 65, 12/31/65)

DATE OF APPRAISAL

Properties are appraised as of January 1, 2018.

This report was completed as of July 31, 2017

PROPERTY RIGHTS APPRAISED

This appraisal is of the fee simple interest in the real property. The fee simple estate is the absolute ownership unencumbered by any other interest or estate, subject only to the limitations imposed by the governmental powers of taxation, eminent domain, police power, and escheat.[2]

PERSONAL PROPERTY NOT INCLUDED IN THE APPRAISAL

No personal property was included in the value. Fixtures are generally accepted as real property. Business value is intangible personal property and it is not appraised.

MARKET AREA AND PROPERTIES APPRAISED

The subject of this mass appraisal report are residential properties (excluding mobile homes and condominiums), throughout Thurston County. Properties in region 4 were physically inspected and their physical features recorded as of the effective date of January 1, 2017. All other properties are assumed to have the same physical features as were noted during their last inspection.

Our property records contain photographs, sketches, legal descriptions and other characteristics of land and buildings on each property.

INSPECTED REGION BOUNDRY DESCRIPTION

The physical inspections occurred in Region 4 which includes the Cities or Tumwater and Olympia. The general boundaries include Black Lake to the west, South Bay Road to the east, Priest Point Park to the north and 93rd Avenue to the south. This region is further broken into 28 residential neighborhoods that are designed to reflect similar land and building characteristics and neighborhood amenities. The neighborhoods and their codes are shown on pages 63-65. They are all considered to be stable in terms of the life cycle of a neighborhood.

ZONING

Thurston County exercises jurisdiction over land use and community planning. The regulations for use and development can be found in its ordinances. We show property zoning as a land characteristic on our digital maps.

[2] *The Dictionary of Real Estate Appraisal. 3rd Ed.* Appraisal Institute, p.140

HIGHEST AND BEST USE

True and fair value -- Highest and best use. Unless specifically provided otherwise by statute, all property shall be valued on the basis of its highest and best use for assessment purposes. Highest and best use is the most profitable, likely use to which a property can be put. It is the use which will yield the highest return on the owner's investment. Any reasonable use to which the property may be put may be taken into consideration and if it is peculiarly adapted to some particular use, that fact may be taken into consideration. Uses that are within the realm of possibility, but not reasonably probable of occurrence, shall not be considered in valuing property at its highest and best use. [WAC 458-07-30 (3)]

The highest and best use concept is based upon traditional appraisal theory and reflects the attitudes of typical buyers and sellers. The market sets the highest and best use based on the theory of wealth maximization for the owner with consideration given to community goals.

To estimate highest and best use, four elements are considered:

1. Possible use. What uses of the site in question are physically possible?

2. Permissible legal use. What uses of the site are permitted by zoning and deed restrictions?

3. Feasible use. Which possible and permissible uses will produce a net return to the owner of the site?

4. Highest and best use. Among the feasible uses, the use which will produce the highest net return or the highest present worth?

The highest and best use of the land or site if vacant and available for use may be different from the highest and best use of the improved property. This is true when the improvement is not an appropriate use, but it contributes to the total property value.

For the purpose of this appraisal the highest and best use of all vacant and improved property is considered to be single family residential or related to a single family residential use.

SCOPE OF THE APPRAISAL

Under state law, the assessor receives a copy of each Real Estate Excise Tax Affidavit and is therefore privy to the sale price, date, and description of all real estate sales. Our staff compiles and verifies this data into our sales database as explained in our sales verification procedure.

Thurston County is on a six-year revaluation cycle. Every property is revalued annually. At least once each six years, each property is inspected and its data refreshed. The assessor collects property characteristic data as discussed in our Residential Data Standards Manual. Other than new construction, physical inspections were done in regions 4 and occurred during the end of 2016 and the first half of 2017. All neighborhood and regional maps are included and begin on page 50 of this report

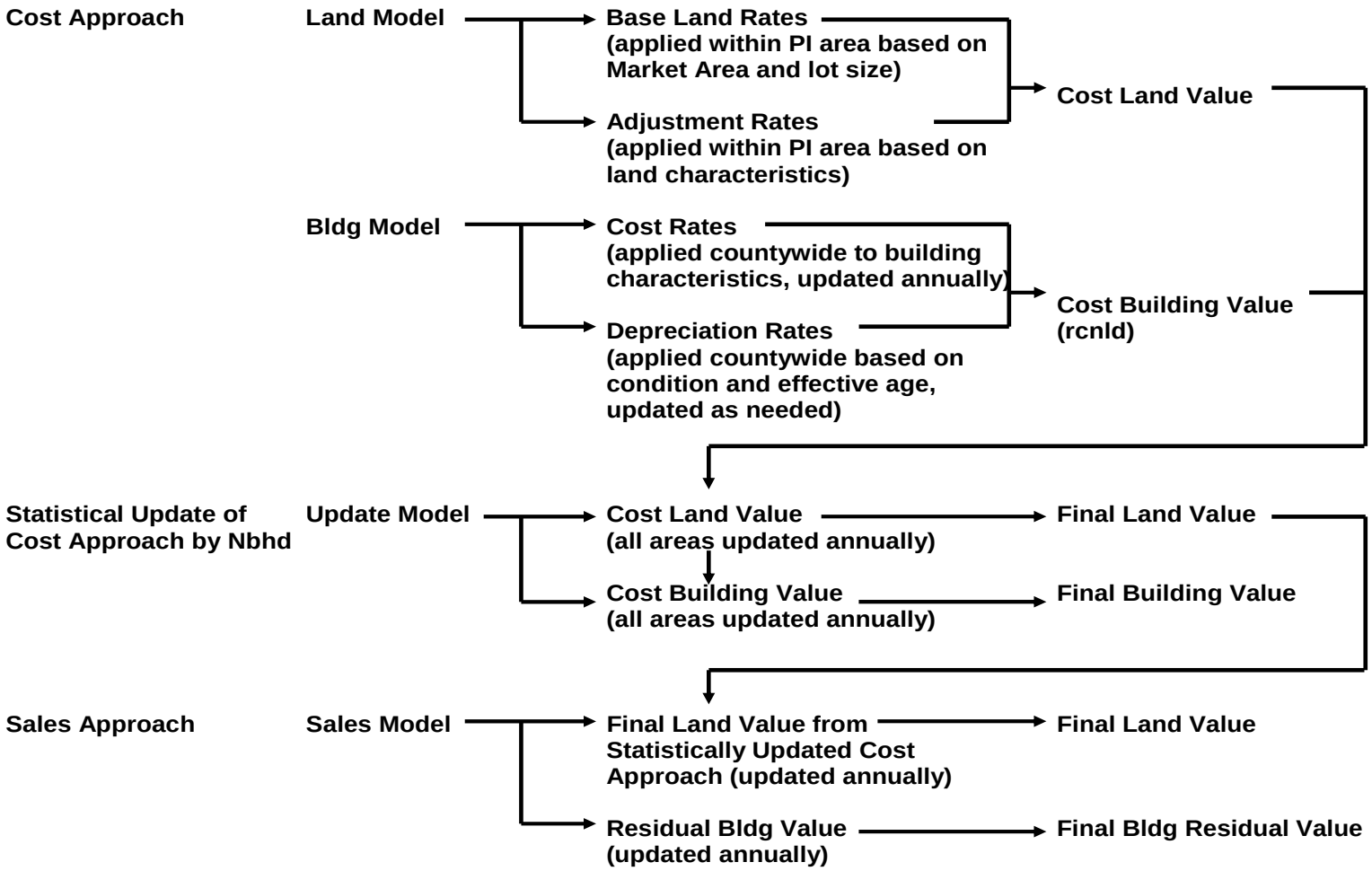
The appraisal considers the cost approaches to value with sales used to calibrate the model to a specific neighborhood. Neighborhood adjustments are widely used to adjust for time and location and are a normal and standard part of the cost approach to value. The Marshall Swift cost manual provides what they call current cost multipliers and local area multipliers to adjust for time and location. Because this is a national valuation service, we fine tune their cost rates even further to consider differences between neighborhoods and local market trends. Whether we make these adjustments to the raw land and cost rates or to the preliminary cost values, does not impact the mathematical calculation and does not affect the final result. It is more convenient to apply the time and

location adjustments to the preliminary cost values, because it makes the statistical updating of values from year to year much easier.

A market model (strict sales approach) has not been developed for 2017 due to time and budget limitations. The use of an income approach was not considered to be applicable because homes in this area are not typically purchased for their income potential.

The flow chart on page 12 describes the land model developed as part of the mass appraisal process and how it is used in the sales adjusted cost approach. The model is discussed in more detail starting on page 13.

Residential Valuation Process



COST APPROACH

Land Model Specification

- **A logarithmic model format is used in the development of base land rates and adjustment rates.**
- **Land Model Format:**

$LV = b_0 \text{ X } SQFT^{b1} \text{ X } LINVIEW^{b2} \text{ X } b_3^{LI3} \text{ X } b_4^{LI4} \text{ X } b_5^{LI5} \text{ X } . . .$

Where: All variables are scaled and continuous. Variables with actual scalar values were converted to logarithms, and binary observations are converted to inactive variables scales to site size to reduce systemic bias.

Land Model Calibration

- **Multiplicative model calibrated using linear MRA**
- **Logarithms are used to convert a multiplicative equation to form.**

Standard Multiplicative form: $SP = a * SQFT^b * c^{NBHD} * . . .$
Log Linear form: $LN(SP) = LN(a) + (b * LN(SQFT)) + (LN(c) * NBHD) + . . .$

- **Logarithmic equations have the same form as a standard linear equation:**

Linear equation: $Y = a + (b * X) + (c * Z)$

- **We can then calibrate using standard multiple regression analysis.**
- **The calibrated model is then converted back to its Standard Multiplicative form by applying the anti-log function.**

$EXP[LN(SP)] = EXP[LN(a) + (b * LN(SQFT))]$

Due to the limited number of sales available, 5 years of data was utilized. Two models were developed. Most of the properties in the county are based on square footage and acreages. With the exception of salt waterfront properties a model was developed utilizing the sale price of vacant land as the dependent variable. The major independent variables (as measured by the beta coefficient) were the square foot of land, region, time and other site specific variables. Sixty three candidate variables were presented to the model and a backward regression was utilized, with 36 variables being statistically significant.

For salt waterfront properties a forced regression model was utilized using 17 variables. The dependent variable was the natural log of the sale price, with the major independent variable being the natural log of the front footage as well as other control variables for region, market conditions (time) and site influences. Only vacant land sales were utilized as the dependent variable. The sales observations were a combination of vacant land sales, as well as extracted land values of sold improved properties utilizing the land residual technique. There were a total of 227 observations.

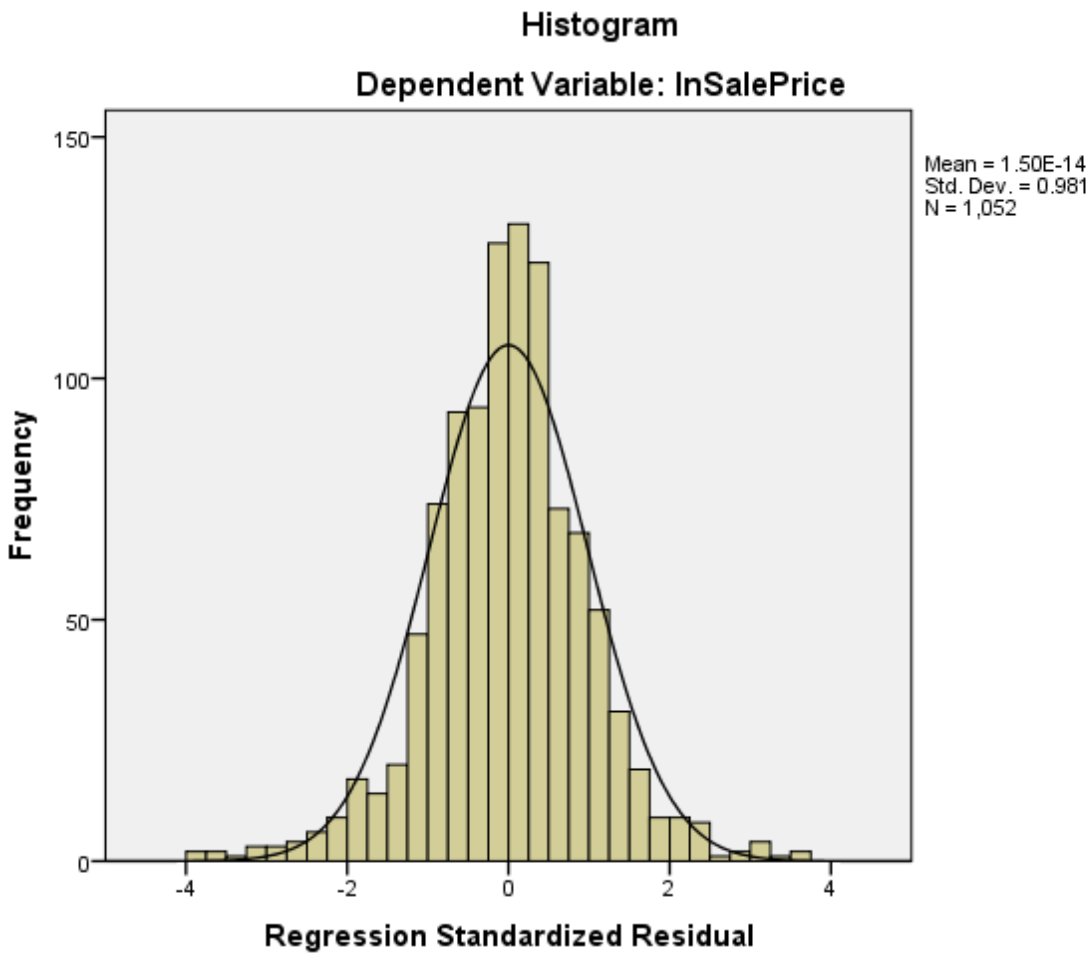
Each region was controlled for by using a variable for that region, time, and other control variables. The model at this point has been maximized at the regional level. However, stochastic errors have not yet been controlled for at the neighborhood level. An analysis of the residuals at the neighborhood will maximize the predictability of values as well as minimize any stochastic errors.

Multiple Regression Analysis Assumptions

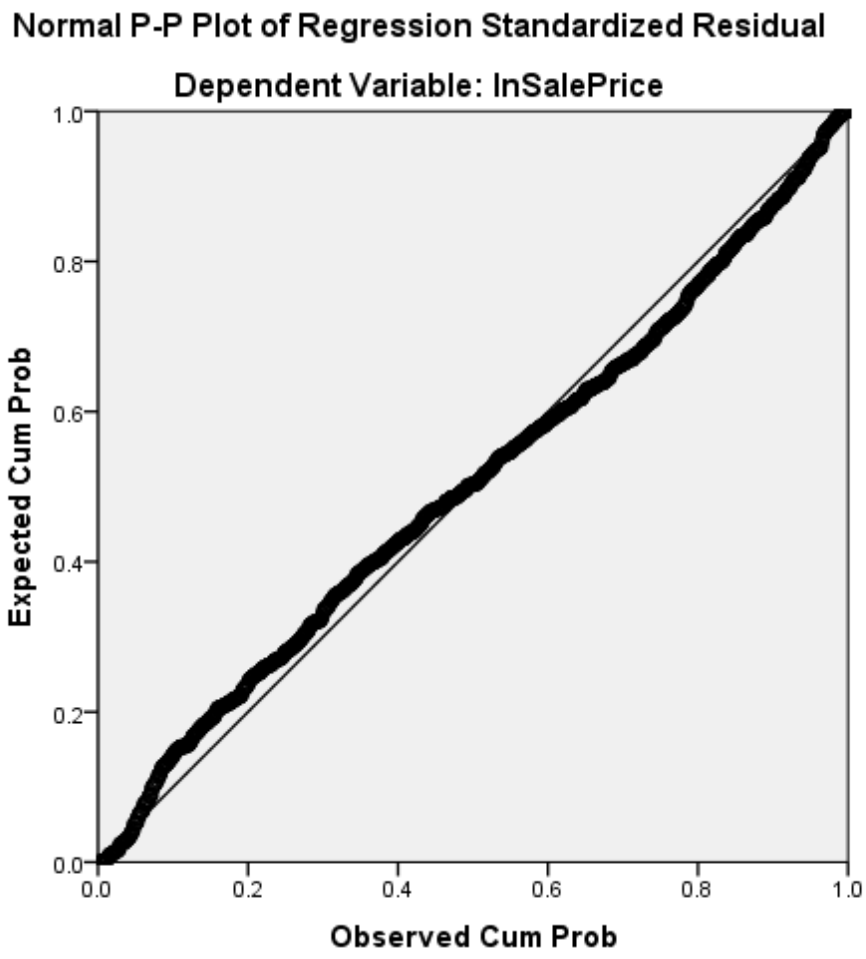
Multiple regression analysis is based on several assumptions regarding the data going into the model and the output from the calibration process. These assumptions are validated to determine the accuracy of the model and identify any limitations that may exist. Checks were conducted for specification errors, multicollinearity, autocorrelation (time), and heteroscedasticity. A detailed discussion of the MRA assumptions is included in the Appendix.

Validation of Land Models

Square Footage Model Normal Distribution of the Residual Errors

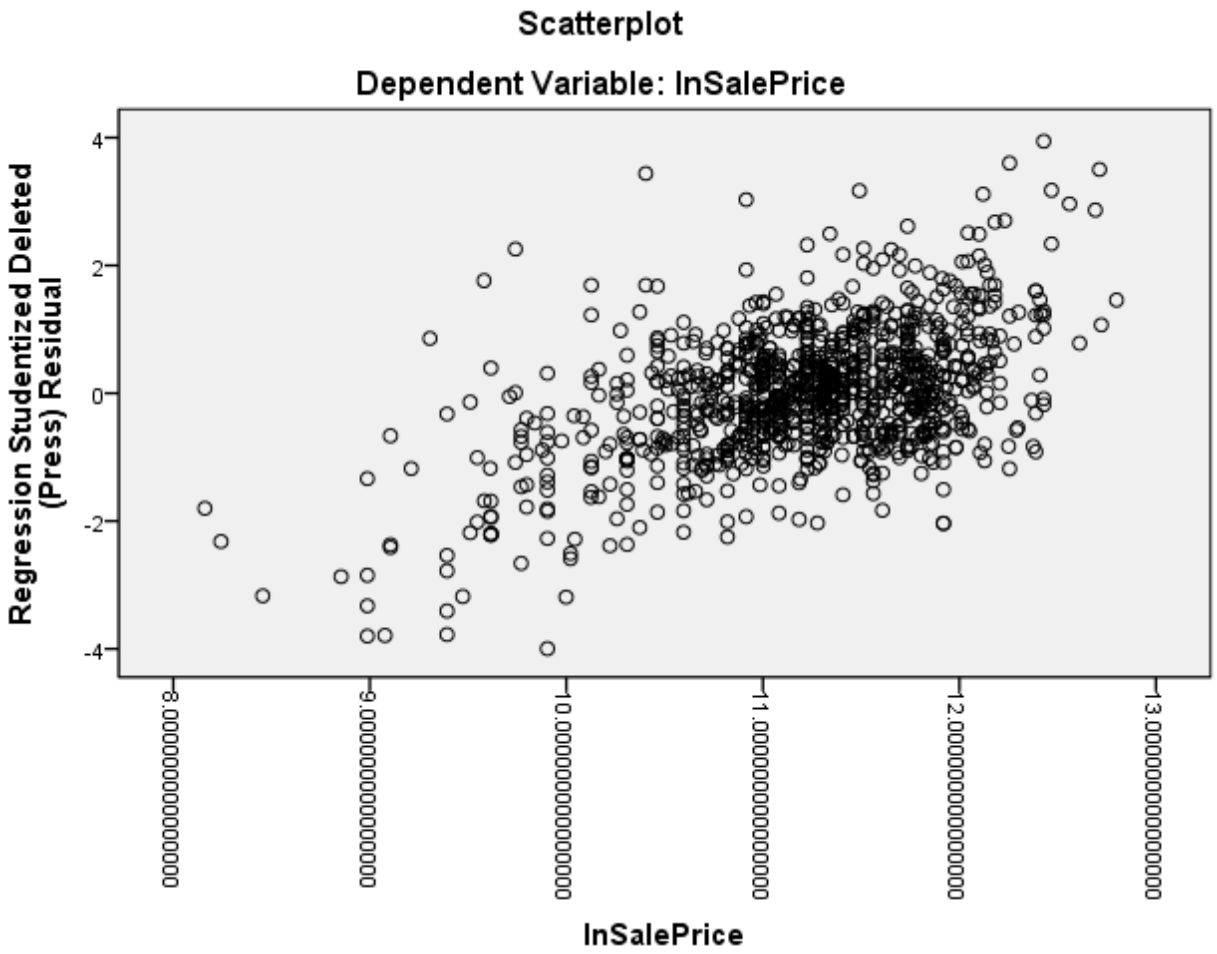


Total number of vacant land sales = 1052 (from 1/3/11 – 10/28/16 (trended to 1/1/16)



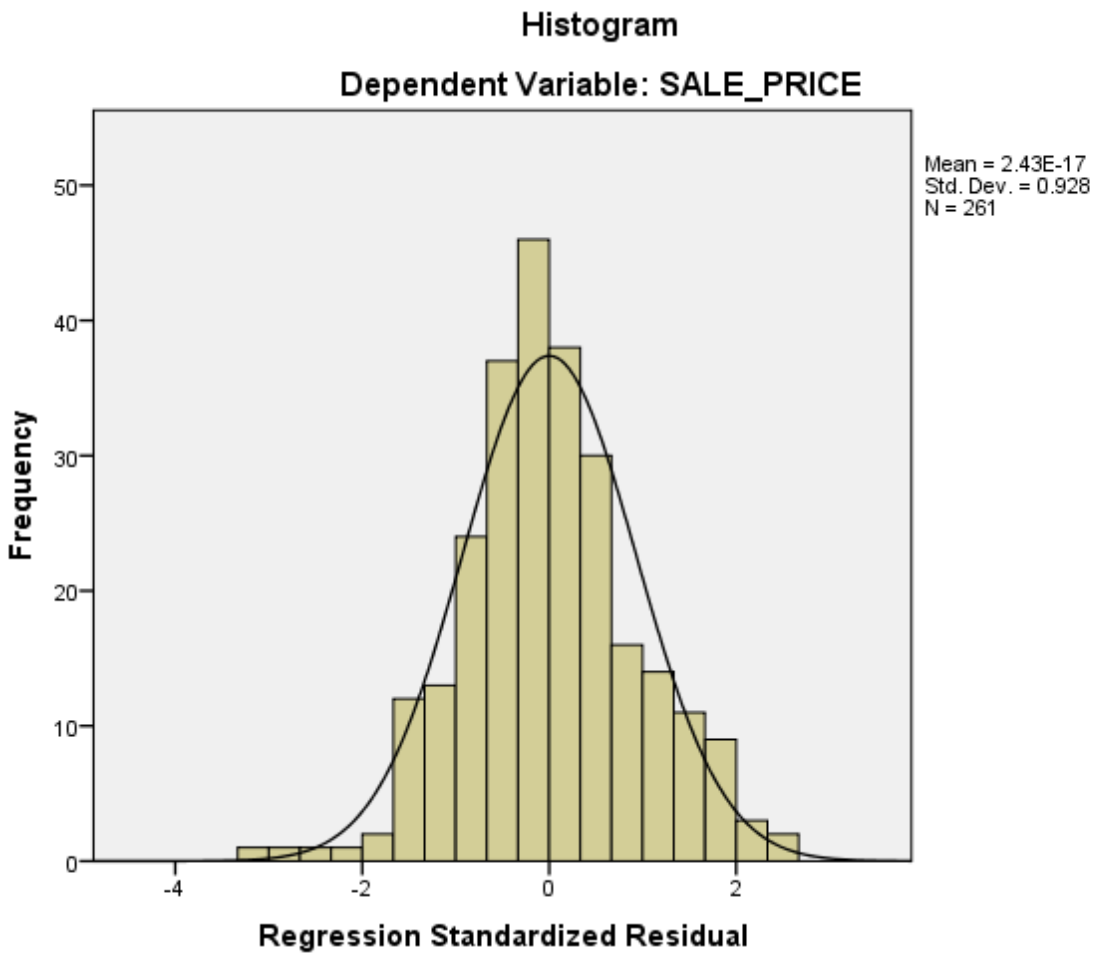
- The chart above demonstrates that the expected and observations trend well.

Scatterplot of Residual to Price as check for systemic bias

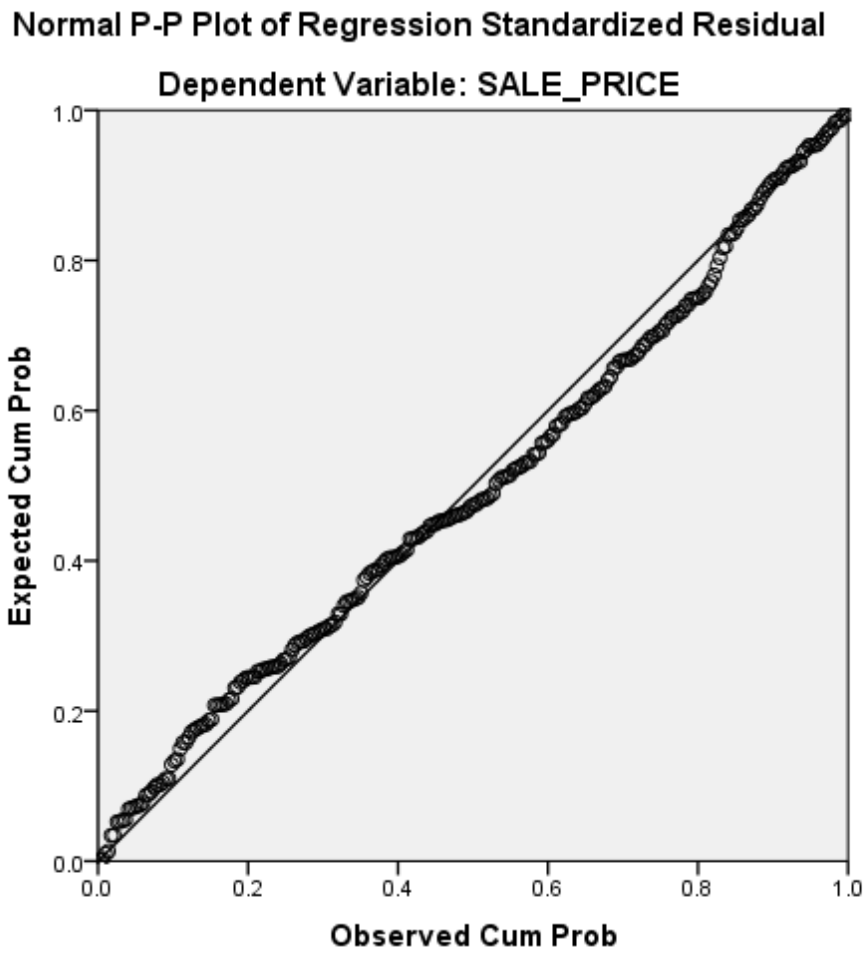


- The plot indicates that there is no systemic bias with respect to predicted value.

Front Footage Model Normal Distribution of the Residual Errors



Total number of sales = 227 (from 1/3/11 – 3/21/17 (trended to 1/1/17)



Example of Land Square Feet Table Base Area Regions 4 & 5

Site Square Feet	Value	Base / Sq Ft	Act Price / Sq Ft	Size Factor	Value Factor
2,500	36,769	5.03	14.71	0.200	2.926
5,000	46,315	5.03	9.26	0.400	1.843
7,500	53,010	5.03	7.07	0.600	1.406
10,000	58,340	5.03	5.83	0.800	1.160
12,500	62,840	5.03	5.03	1.000	1.000
15,000	66,774	5.03	4.45	1.200	0.885
17,500	70,291	5.03	4.02	1.400	0.799
20,000	73,487	5.03	3.67	1.600	0.731
22,500	76,426	5.03	3.40	1.800	0.676
25,000	79,155	5.03	3.17	2.000	0.630
27,500	81,708	5.03	2.97	2.200	0.591
30,000	84,110	5.03	2.80	2.400	0.558
32,500	86,382	5.03	2.66	2.600	0.529
35,000	88,540	5.03	2.53	2.800	0.503
37,500	90,598	5.03	2.42	3.000	0.481
40,000	92,566	5.03	2.31	3.200	0.460
42,500	94,454	5.03	2.22	3.400	0.442
45,000	96,269	5.03	2.14	3.600	0.426
47,500	98,018	5.03	2.06	3.800	0.410
50,000	99,707	5.03	1.99	4.000	0.397
52,500	101,340	5.03	1.93	4.200	0.384
55,000	102,922	5.03	1.87	4.400	0.372
57,500	104,457	5.03	1.82	4.600	0.361
60,000	105,948	5.03	1.77	4.800	0.351
62,500	107,398	5.03	1.72	5.000	0.342
65,000	108,809	5.03	1.67	5.200	0.333
67,500	110,186	5.03	1.63	5.400	0.325
70,000	111,528	5.03	1.59	5.600	0.317
72,500	112,839	5.03	1.56	5.800	0.310
75,000	114,120	5.03	1.52	6.000	0.303
77,500	115,373	5.03	1.49	6.200	0.296

Example of Acreage Table Base Regions 4 & 5

	Acres	Site Square Feet	Value	Base / Acre	Act Price / Acre	Size Factor	Value Factor
	1	43,560	95,232	32,551	95,232	0.200	2.926
	2	87,120	119,957	32,551	59,979	0.400	1.843
	3	130,680	137,298	32,551	45,766	0.600	1.406
	4	174,240	151,101	32,551	37,775	0.800	1.160
BASE	5	217,800	162,757	32,551	32,551	1.000	1.000
	6	261,360	172,945	32,551	28,824	1.200	0.885
	7	304,920	182,054	32,551	26,008	1.400	0.799
	8	348,480	190,332	32,551	23,791	1.600	0.731
	9	392,040	197,945	32,551	21,994	1.800	0.676
	10	435,600	205,014	32,551	20,501	2.000	0.630
	11	479,160	211,625	32,551	19,239	2.200	0.591
	12	522,720	217,846	32,551	18,154	2.400	0.558
	13	566,280	223,731	32,551	17,210	2.600	0.529
	14	609,840	229,321	32,551	16,380	2.800	0.503
	15	653,400	234,650	32,551	15,643	3.000	0.481
	16	696,960	239,748	32,551	14,984	3.200	0.460
	17	740,520	244,637	32,551	14,390	3.400	0.442
	18	784,080	249,338	32,551	13,852	3.600	0.426
	19	827,640	253,868	32,551	13,361	3.800	0.410
	20	871,200	258,241	32,551	12,912	4.000	0.397

Example of Land Influences

MEAN LAND ADJUSTMENT FACTORS

Flood Area	**20% Wetland**	**40% Wetland**	**60% Wetland**	**80% Wetland**	**100% Wetland**
.700	.900	.850	.750	.600	.300
Limited View	**Good View**	**V Good View**	**Excellent View**	**Fair Nbhd Appeal**	**Good Nbhd Appeal**
1.117	1.400	1.500	1.850	.850	1.350
Restrictions	**Shape**	**Steep**	**Unbuildable**	**Unuseable**	**No Electric Service**
.500	.670	.700	.300	.120	.380
Golf Course	**Lake Front Avg**	**Prelim Plat**	**No Road**	**No Site Improve**	**Res in Comm Zone**
1.900	2.500	4.000	.800	.500	2.353

The above are the conversion of the unbiased parameters. Although generally applied, specific features of an individual may results in deviations for these parameters. Some parcels may have a cascading effect of multiple influences. Although checks for multicollinearity were conducted in building a model, some parcels may require individualized adjustments.

Example of Saltwater Front Foot & Depth Tables

BASE Region 3					
	Front Feet	Standard Depth	Land Flag	Value Region 3	FF Rate Group
BASE>>>>>	50	350	1740	6820	3650
	75	350	1740	5063	3650
	100	350	1740	4099	3650
	150	**350**	**1740**	**3043**	**3650**
	200	350	1740	2463	3650
	250	350	1740	2091	3650
	300	350	1740	1829	3650
	350	350	1740	1633	3650
	400	350	1740	1480	3650

	Standard Front Foot	Lot Depth	Land Flag	Depth Value	Depth Adj Group
	150	100	1740	2,945	2,655
	150	200	1740	2,999	2,655
BASE>>>>>>	**150**	**350**	**1740**	**3043**	**2,655**
	150	500	1740	3,072	2,655
	150	650	1740	3,093	2,655
	150	800	1740	3,110	2,655
	150	950	1740	3,124	2,655
	150	1100	1740	3,136	2,655

SALT WATER SPECIFIC INFLUENCES

Mean Influence	Description
82	No Access
90	Moderate Access
95	Superior Access
90	Salt High
94.6	Salt Medium
103.6	Rec1st class
102	Rec2nd class
60	No View
75	Limited View
90	Good View
Base	Very Good View
103	Excellent View
128	Good Quality NBHD
Variable	Restrictions
Variable	Lagoon

Building Cost Specification

- **Model Format for RCNLD:**

$$BV = [(c_1 X Q_1) + (c_2 X Q_2) + (c_3 X Q_3) + \ldots] X \text{ Pct. Good}$$

Where: Building Components = $Q_1, Q_2, Q_3 \ldots$

Costs per unit = $c_1, c_2, c_3 \ldots$

2016 COST TABLE CALIBRATION

Introduction

Thurston County uses construction cost data from Marshall & Swift as the basis for our cost approach. While these rates include local area and current cost multipliers to produce a cost estimate that is more tailored to our market area, they do not produce the level of accuracy that is needed in the appraisal process. One way to calibrate the cost tables to the local market is to use actual construction costs obtained from local builders to compare to the replacement cost new calculated from the Marshall & Swift rates. Another alternative is to use sales of new construction to measure the actual cost new to compare to the RCN calculated from M&S. For residential property new construction was used to calculate a calibration factor. For commercial structures and detached structures there were no actual sales of new construction. For these structure types builder cost estimates were obtained and used to determine cost table calibration factor.

.

Residential Structures

- **Procedure**

  All new construction sales were queried for 2012 and 2016, and were adjustment for market conditions as of 1/1/2017.. A total of 4,108 sales of new homes were used in the analysis. A residual building cost was calculated by subtracting an estimate of the land value from the sale price. The current appraised value of the land after conducting a ratio study of land sales within the last five years with the appraised value. The mean ratio for that period of 101.5 well within IAAO standards.

-
- **Sales Analysis**

  The histogram and descriptive table on the next page demonstrates that the supplied cost table rates match our actual construction costs within our local market. This indicates that the Marshall & Swift building cost are good proxies for actual local building cost. Happily, the overall resulting COD

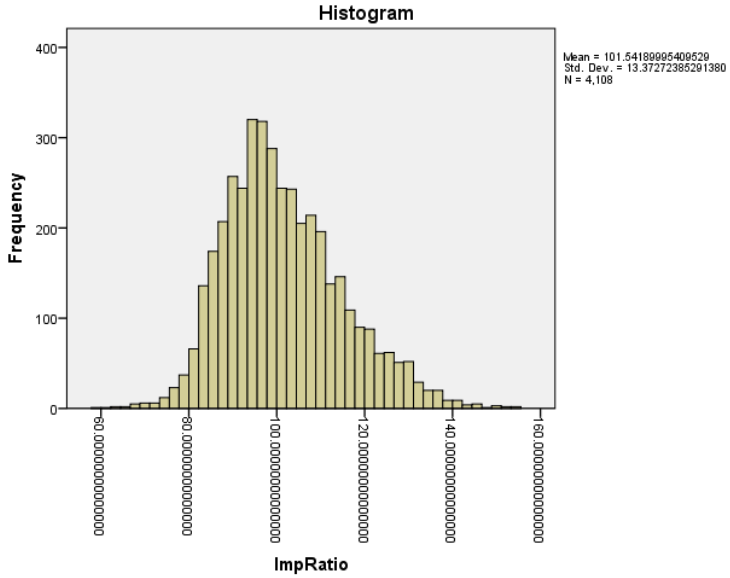
about the median is 8.8% below the 10% standard which is considered a quality result for new construction according to IAAO 2013 Standard on Ratio Studies.

- ## Conclusion

The cost index as supplied by Marshall & Swift is representative of our current cost in their present state on an aggregate scale. This market calibrated cost table then provides a starting point for the determination of value at the neighborhood level. Sales are further analyzed to determine final land and building adjustments that take into consideration locational differences between neighborhoods.

COST BASE RATE STATISTICS

		Statistic	Std. Error
Mean		101.5	0.2
95% Confidence Interval for Mean	Lower Bound	101.1	
	Upper Bound	102.0	
5% Trimmed Mean		101.0	
Median		99.6	
Std. Deviation		13.4	
Interquartile Range		17.7	
Skewness		.579	.038
Kurtosis		.315	.076



Construction Cost Tables

Marshall Swift cost rates, adjusted to the current year and local area, are used to determine the replacement cost of each residential improvement. Adjustments can also be made for various structure types and for other building components based on locally advertised building costs.

The complete set of rate tables is too lengthy to include here. However, an example of the rates for the main floor level of a residence by quality grade is shown below. The complete set of rate tables is stored within the Sigma CAMA System.

	SFLA	LOW	FAIR	AVG	GD	VGD	EXC	EXP
BASE-1STY-SS	600	75.06	79.49	89.01	100	120	160	230
BASE-1STY-SS	800	71.21	77.29	88.03	100	120	160	230
BASE-1STY-SS	1000	68.12	76.38	86.56	100	120	160	230
BASE-1STY-SS	1200	65.57	73.36	85.02	100	120	160	230
BASE-1STY-SS	1400	63.42	71.7	83.55	100	120	160	230
BASE-1STY-SS	1600	61.55	70.24	82.16	100	120	160	230
BASE-1STY-SS	1800	59.93	68.9	80.87	100	120	160	230
BASE-1STY-SS	2000	58.48	67.7	79.67	100	120	160	230
BASE-1STY-SS	2200	57.19	66.61	78.56	100	120	160	230
BASE-1STY-SS	2400	56.01	65.6	77.53	100	120	160	230
BASE-1STY-SS	2600	54.95	64.67	76.56	100	110	160	230
BASE-1STY-SS	2800	53.96	63.82	75.66	100	110	160	230
BASE-1STY-SS	3000	53.06	63.02	74.81	96.88	110	160	220
BASE-1STY-SS	3200	52.21	62.27	74.01	96.08	110	160	220
BASE-1STY-SS	3400	51.4	61.6	73.21	95.31	110	160	220
BASE-1STY-SS	3600	50.65	60.97	72.45	94.57	110	160	220
BASE-1STY-SS	4000	49.26	59.77	71.06	93.16	110	160	220
BASE-1STY-SS	4400	49.26	59.77	69.79	91.92	110	150	220
BASE-1STY-SS	4800	49.26	59.77	68.64	90.78	110	150	210
BASE-1STY-SS	5200	49.26	59.77	67.63	89.7	100	150	210

Depreciation Analysis

Effective Age

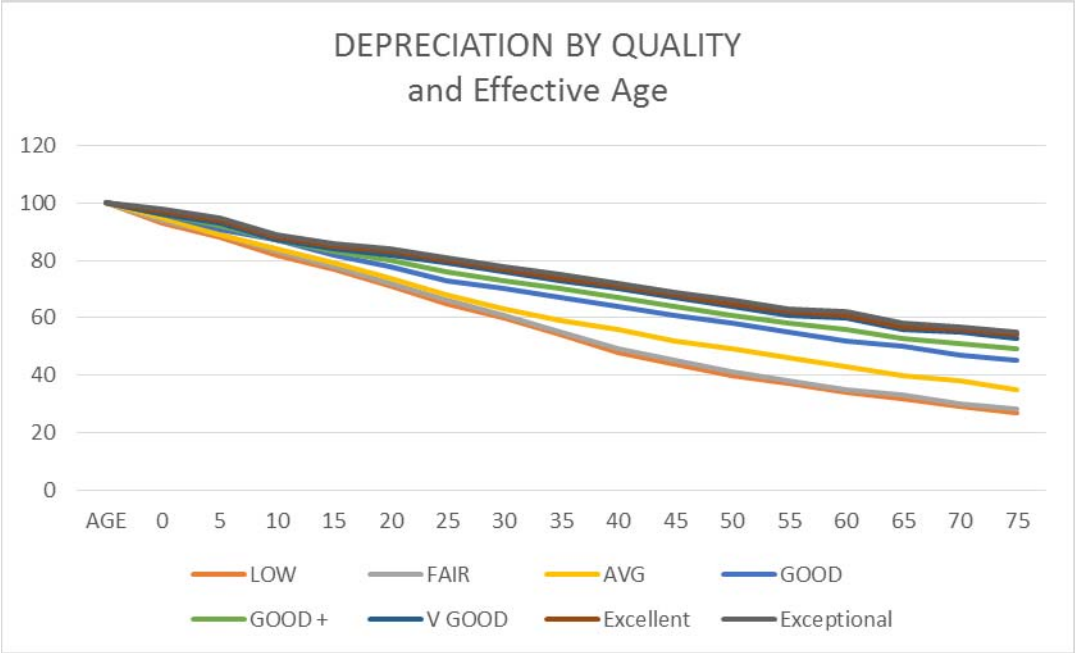
The effective age of a building is largely based on its overall condition. It is a measure of how old a building looks and not how old it actually is. As a result, any type of maintenance, repair, remodel, or renovation will tend to reduce the effective age. The more extensive the maintenance or repair work the more the effective age is reduced. This concept suggests that a very old building can be brought back to almost new condition, thereby reducing the effective age to a level that is typical of much newer construction.

Depreciation Rate Tables

Periodically, the depreciation tables are calibrated using residential sales representing all years of construction. The most recent estimates of the land values are subtracted from the sale prices to determine the residual building values. These values are compared to the replacement cost new to arrive at an estimate of the percent good, which is then correlated with the effective age of the building to produce a set of depreciation tables. An example table for a stick built house is show below. The depreciation rates are expressed as a percent good.

SELECTED DEPRECIATION PERCENT GOOD BY EFFECTIVE AGE								
AGE	LOW	FAIR	AVG	GOOD	GOOD +	V GOOD	Excellent	Exceptional
0	100	100	100	100	100	100	100	100
5	93	94	95	96	96	96	97	98
10	88	89	89	91	92	93	94	95
15	82	83	84	87	87	87	88	89
20	77	78	79	82	83	84	85	86
25	71	72	74	78	80	82	83	84
30	65	66	68	73	76	79	80	81
35	60	61	63	70	73	76	77	78
40	54	55	59	67	70	73	74	75
45	48	49	56	64	67	70	71	72
50	44	45	52	61	64	67	68	69
55	40	41	49	58	61	64	65	66
60	37	38	46	55	58	61	62	63
65	34	35	43	52	56	60	61	62
70	32	33	40	50	53	56	57	58
75	29	30	38	47	51	55	56	57
80	27	28	35	45	49	53	54	55

The graph below shows the relationship between the percent good by quality and effective age.



Condition

Because many properties are in better or worse condition than what is typical for their age, we need a method to adjust the depreciation rate accordingly. There are two ways to accomplish this. One is to adjust the effective age and the other is to adjust the condition rating to raise or lower the amount of depreciation that is applied.

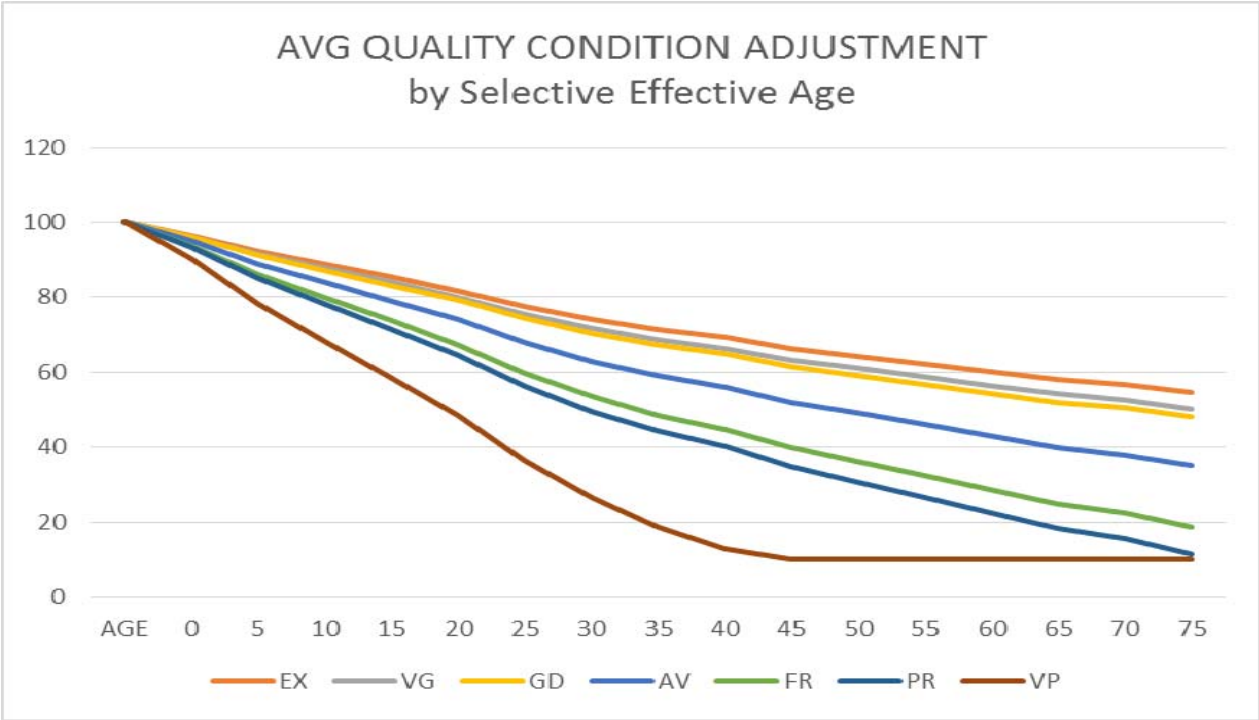
Adjusting the effective age would involve a fairly complex set of instructions and calculations for different situations that may be encountered. Minor remodels, major renovations, and building additions would require different adjustment techniques. Even with these procedures in place, there would be substantial appraiser judgment involved that would open the door for inconsistencies in the way effective age is determined and depreciation is applied.

A better method is to establish guidelines for determining the condition rating to apply to each property. In general, if an improvement to a parcel of land is typical for its age and has received average maintenance, it would be considered to be in average condition. If the improvement has had less than average maintenance, it will be in less than average condition. If the improvement has received better than average maintenance, it will be in better than average condition.

Generally, the appraiser does not have the benefit of an interior inspection. As a result, it is assumed that the interior inspection is the same as the exterior. On those occasions in which an interior inspection is granted, the condition is reflective of the overall property. Those parcels which have had an interior inspection are noted on their individual records.

The graph of the following page is an example of average quality with the different condition ratings has on the percent good curve. It summarizes the relationship between effective age, building condition, and the rate of depreciation. The CAMA system calculates depreciation by the following formula:

Phy-Pct_Good = 100 – (Cond-Factor x (100 - Pct_Gd_Table))



Neighborhood Adjustment Model Specification

The equation for the neighborhood adjustment has an additive model format but without the constant term.

$V = b_1(LV) + b_2(BV)$ + systemic and random error

- Where: b_1 and b_2 are based on a combination of regression analysis and appraiser judgment
    1. Systemic errors would be bias introduced by neighborhood influence
    2. Random sampling error and also a result of market imperfections and difference in consumer taste

Neighborhood Adjustment Calibration

Initially regression coefficients are developed to apply to both land (b_1) and building (b_2) values within each neighborhood. A preliminary adjustment to the neighborhood land values is determined first by considering only available vacant land sales within the region.

After making the initial adjustment to the land value, the coefficient for the building value (rcnld) can be determined. This again produces a preliminary adjustment or starting point for determining the final neighborhood building trend. The residuals produced by the regionalize model will indicate a systemic differences between neighborhoods. These residuals become the basis for developing a neighborhood factor. These factors are scalar values, as opposed to qualitative estimates often employed by fee appraisers and can either be reintroduced in an MRA model. These factors are analogous to a positivist economist market model, it provides a statistically valid measurable solution based upon observable data. These models are not normative, they do not attempt to answer why. A similar methodology is employed in the cost approach. In this mass appraisal methodology a group of sales is normalized on a neighborhood level to determine the best factor to meet the statutory requirement and minimize variance.

Specifically, each neighborhood within the region is analyzed to consider its unique characteristics, amenities, and market conditions. This final adjustment to the neighborhood land and building values is largely based on the appraiser's analysis of individual sales ratios guided by the region wide sales analysis. An iterative process of adjusting the initial coefficients is applied to each neighborhood to reach the desired level of assessment, PRD, and COD. The Assessor's target level of assessment for 2017 is 96%. This level was chosen to reflect that the majority of residences are not 'market ready' compared to the properties that sold at 100% of their market value. There were 15,809 sales used to do develop these neighborhood ratios.

As an example, final adjustments for neighborhood "11O1"along with the ratio statistics are shown on the next page.

- **Final Neighborhood adjustments for 11O1:**
  - b_1 = 0.982 land value adjustment and
  - b_2 = 1.172 building value adjustment
  -

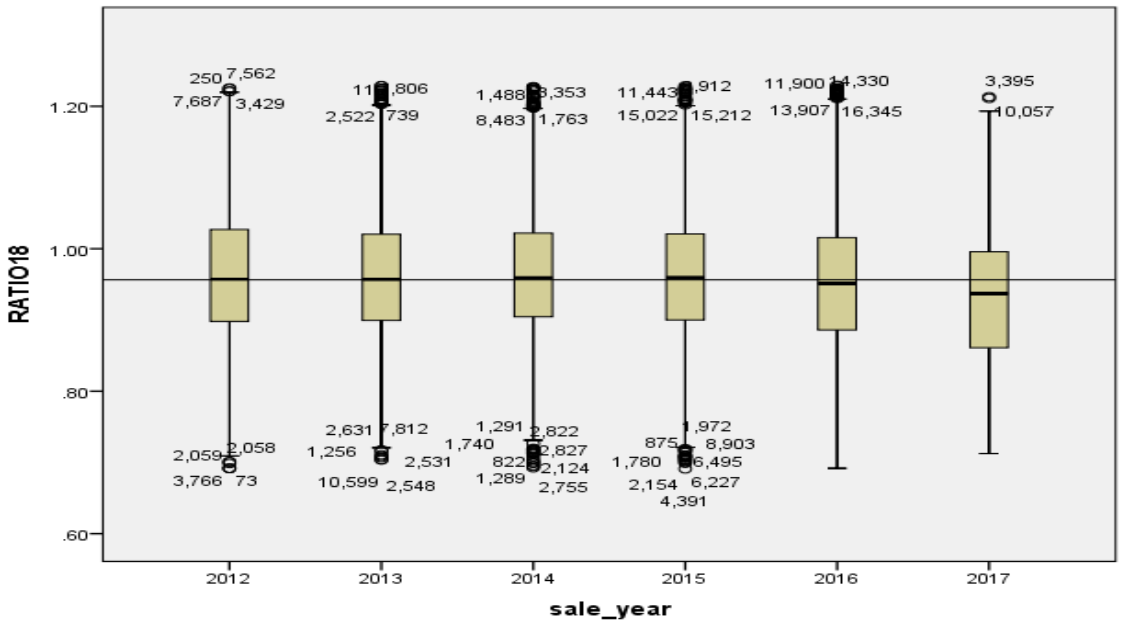
NBHD 11O1		
MEASURE	**VALUE**	**IAAO STD**
COUNT	75	N/A
MEAN	97	90 to 110
MEDIAN	95.5	91 to 110
W. MEAN	97.2	92 to 110
STD DEV	10.8	N/A
AVG DEV	8.5	>5 and < 15
PRD	0.999	0.98 to 1.03
COD	8.52	>5 and <15

Standards Source: Standards on Ratio Studies, 2013, International Association of Assessing Officers

The sales ratio analysis for each neighborhood in the county can be reviewed beginning on page 55.

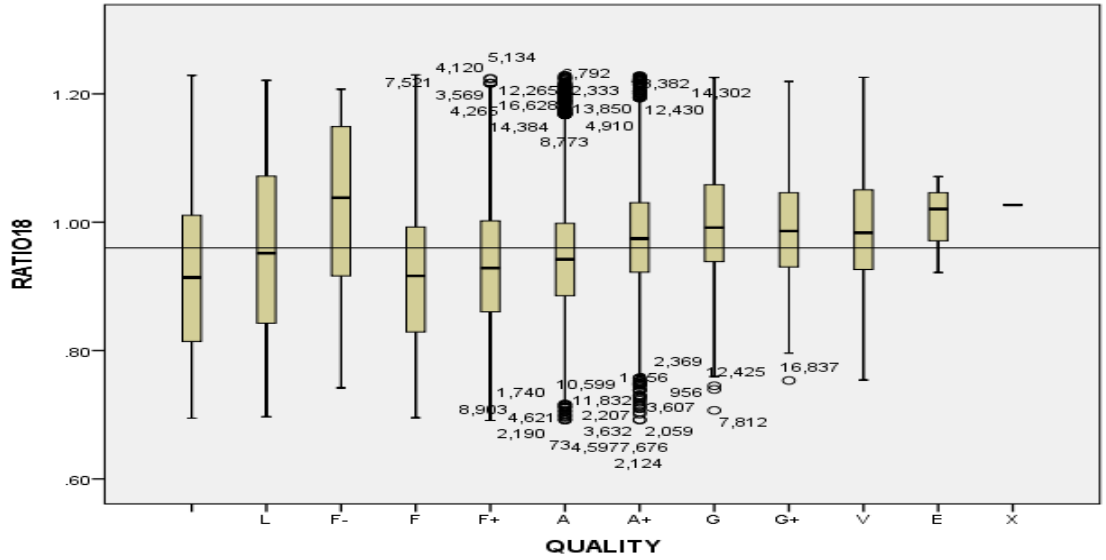
Residential Adjustment Model Validation

Neighborhood trends were calibrated using 15,909 sales that took place between 1/3/2012 to 02/17/2017. Because multiyear sales are utilized a check for consistency of that estimate is required. In other words, the mean and median ratios for each year should be in the range of 90 to 110% and be consistent across all years. To achieve this, the comparable sales can be time adjusted to the current year and unbiased estimates achieved. The boxplot below provides graphical verification this has been achieved. For information on time trending of sales, refer to the *Market/Time Adjustment* document in the Appendix.



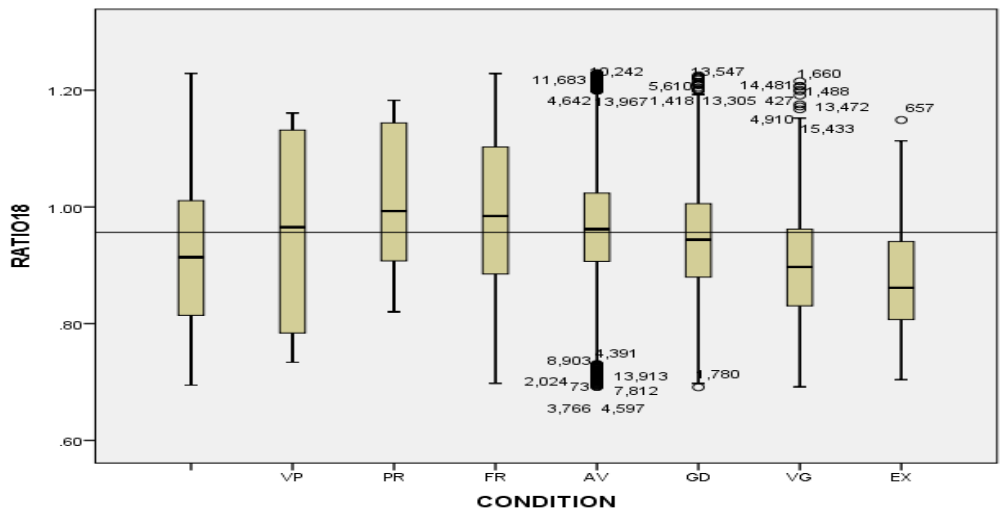
Assessment Uniformity by Quality Grade

After total square feet of gross living area, quality and size are major value drivers. The median level between quality grades is fairly consist at about the 95% level and the interquartile ranges are fairly consistent. The county is in the process of consolidating and creating better consistency between quality levels. While compliant, continuous improvement is expected. However, the data does indicate a propensity to slightly over value excellent quality homes.



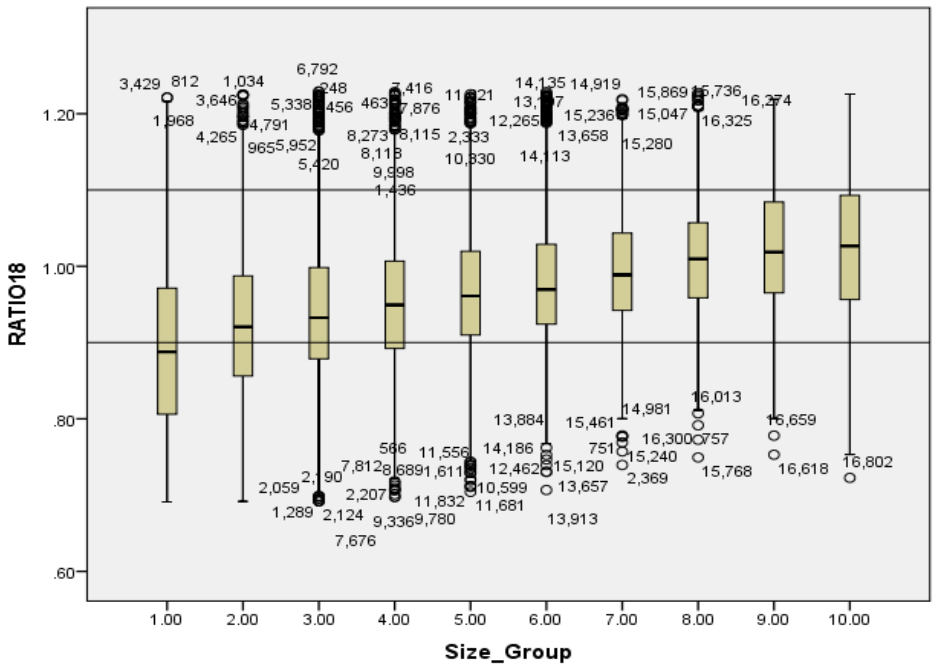
Assessment Uniformity by Condition

With respect to condition, there is no indication of systemic bias. The values for VP conditions are slightly higher than the general trend for all other conditions. It may be due to the low value of these properties, so a slight miss will overstate the difference. All other medians are within a tight pattern and hover around 96%



Assessment Uniformity by Size Group

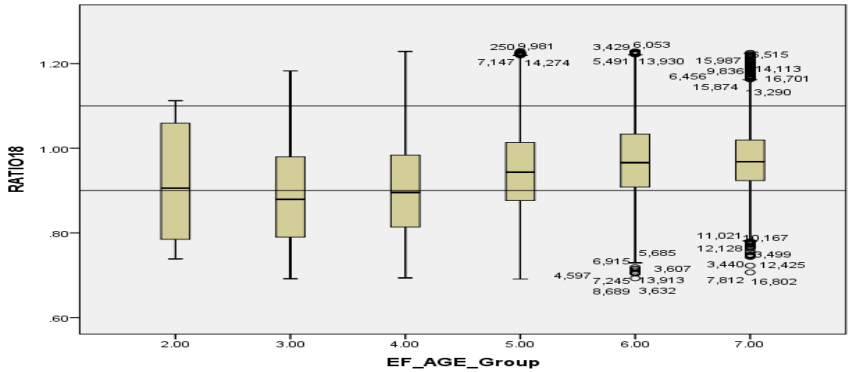
The ratios with respect to size are all within a tight compliance level. There does appear to be a very slight increase as the ratio and homes increase in size, but the change in minimal. It is expected that the regrading process which started this year will correct this slight trend. Median home size is 1,843 square feet, Mean 1,927 square feet, and 50% of homes are from 1,480 to 2,293 square feet.

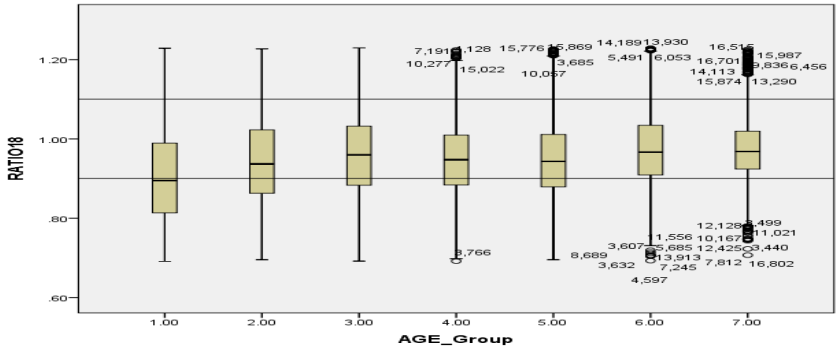


0_LT 1000
1_1000 to1299
2_1300 to 1599
3_1600 to 1899
4_1900 to 2200
5_2201 to 2499
6_2500 to 2799
7_2800 to 3099
8_3100 to 3400
9_GT 3400

Assessment Uniformity by Actual and Effective Age

Thurston County utilizes the effective age to calculate depreciation. However, this should also be reviewed in conjunction with actual age. We are within IAAO guidelines with respect to either methodology. There is a slight indication that we are slightly more conservative on older properties, although it certainly is well within allowable tolerances. Group 1 is < 1941, Group 2 is 1941 to 1963, Group 3 is 1964 to 1971, Group 4 is 1972 to 1982, Group 5 is 1983 to 2000, Group 6 is 2001 to 2009, and Group 7 is 2010 and newer.





RECONCILIATION AND CONCLUSION

Considering the quantity and quality of data and the reliability of the various models as shown in the performance tests above, we have concluded that the Sales Adjusted Cost Approach produces an accurate estimate of market value. There is no evidence of a systemic bias between or within the sample. Also, the median ratio between the commercial subclass and residential subclass is within recommended guidelines by the International Association of Assessing Officers. This would indicate there is no tax shift due to inequality or inequity among property owners.

APPENDIX

Multiple Regression Analysis Assumptions

Complete and Accurate Data:

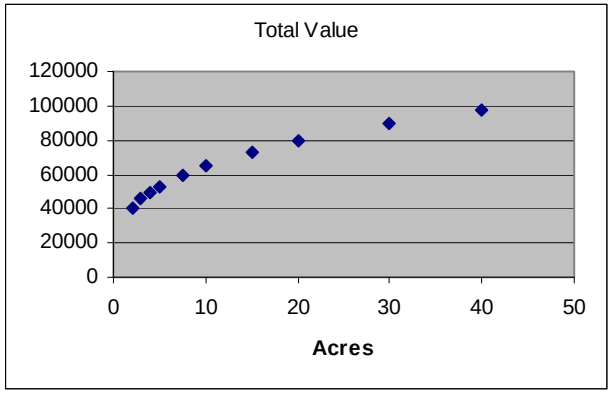
- Data definitions and standards have been developed to ensure our data is as complete and accurate as possible.
- A procedure has been established to ensure sales are properly verified.
- Annual training is conducted to remind appraisers of the standards that have been developed.

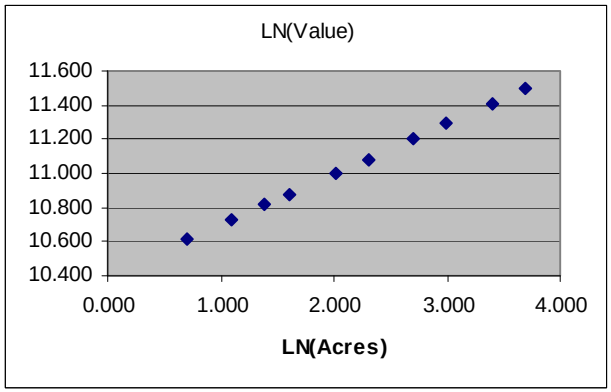
Representativeness:

- It is assumed that the sale sample adequately represents variables in the model.
- Violation of this assumption may affect the accuracy of the model in predicting the value of properties that are under-represented. For example, if there are no sales of "Excellent" view, the model would make no distinction from the typical "Average" view and an "Excellent" view. Using scalar or linearized variables in the model has mitigated this potential problem.

Linearity:

- It is assumed that the marginal contribution of a variable is constant over the range of values for the variable. Each additional unit of size or quantity adds equally to the value.
- The assumption is violated when economies of scale or other non-linear relationships are present.
- Developing a multiplicative land model has helped to create linear relationships between the dependent variable and independent variables.
- For example, using the natural logarithm of the lot size (acres) addresses the decreasing marginal utility of adding additional units of land. See example below.





Additivity:

- It is assumed that the marginal contribution of one independent variable is not affected by the changes in other variables.

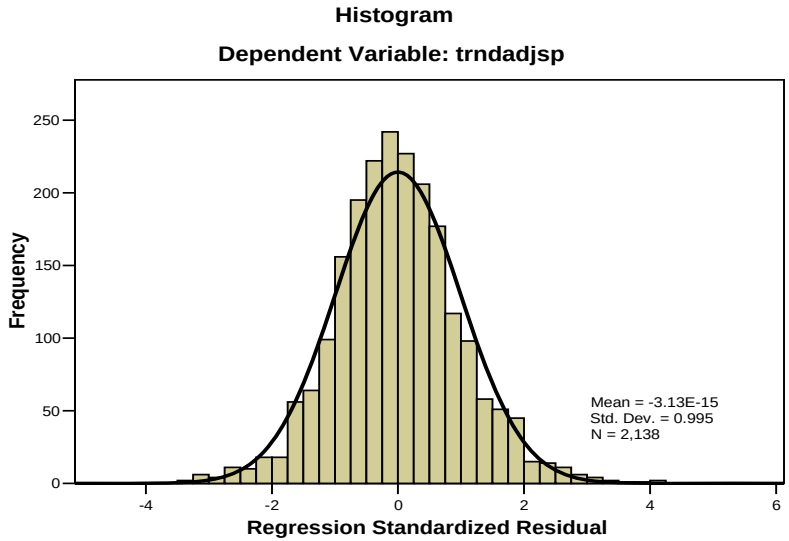
- The assumption is violated when one impendent variable interacts with another.
- This assumption generally does not hold for land models
    - Land characteristics are often interactive. For example, the adjustment for view may be influenced by the size or topography of the land parcel.
- A multiplicative model helps to address this issue by converting the format to log-linear terms.

No Correlation between Independent Variables:

- It is assumed that there is no correlation between independent variables.
- This assumption is addressed by reviewing the correlation matrix and by either eliminating one of the correlated variables or combining the highly correlated variables.

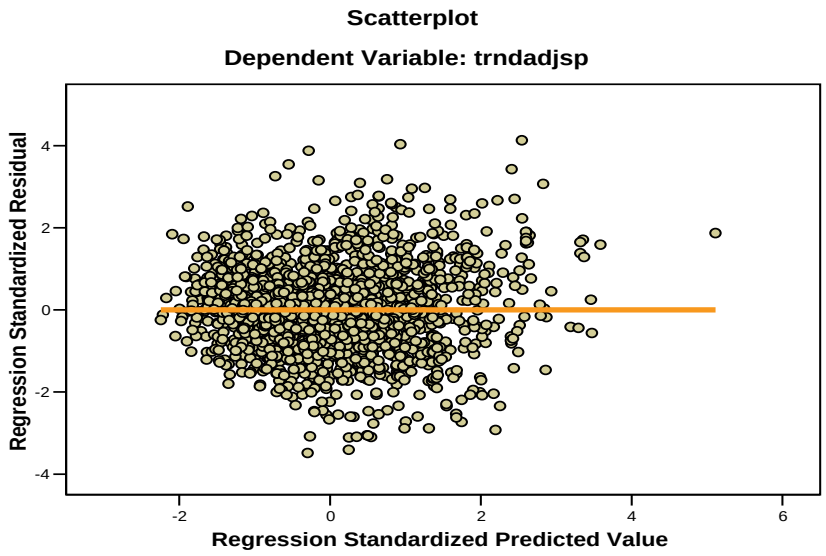
Normal Distribution of Residual Errors:

- Violation of this assumption affects the interpretation of the SEE, COV, and t-statistics.
- With large samples and proper screening of the sales, this assumption is typically not a problem.
- The assumption is verified by examining a histogram of residual errors. See example below.



Constant Variance of the Error Term (homoscedasticity):

- The residual errors should be consistent as prices increase.
- Violation of this assumption implies the residual errors are not evenly distributed (heteroscedasticity).
- As a result the model will chase high priced sales that may not be representative of the market.
- Sales have been properly screened to ensure accuracy of the data, and outliers have been removed to reduce the likelihood of this problem.
- Expressing the sale price (dependent variable) in per square foot or per acre terms has also helped to minimize this potential problem.
- Verified by examining a scatter diagram comparing residual errors to corresponding predicted values. See scatter diagram below as an example. The horizontal line-of-best-fit indicates that the residual errors are evenly distributed among the predicted values.



MARKET / TIME ADJUSTMENT AND MODEL SUMMARIES

For any statistical estimate to be valid, it must be representative of the population. In theory, under ideal circumstances, the sample should be an adequate size and randomized. However, in the real world, convenience samples are utilized. A convenience sample is one where the units that are selected for inclusion in the sample are, in this instance, the best available sales. Although these samples lack randomness, there is no other methodology available but to use actual sales. If the sample is large enough to represent the population value, then estimates can be developed which should reflect true market action.

So how does one increase the sample size? One method would be to expand the area, however, since real estate is highly dependent upon location that methodology would result in failure. The only other option is to extend the time frame (sale date range) in which to select observations. This methodology is quite accurate when properly controlled. The following explains the rational for this decision and the results.

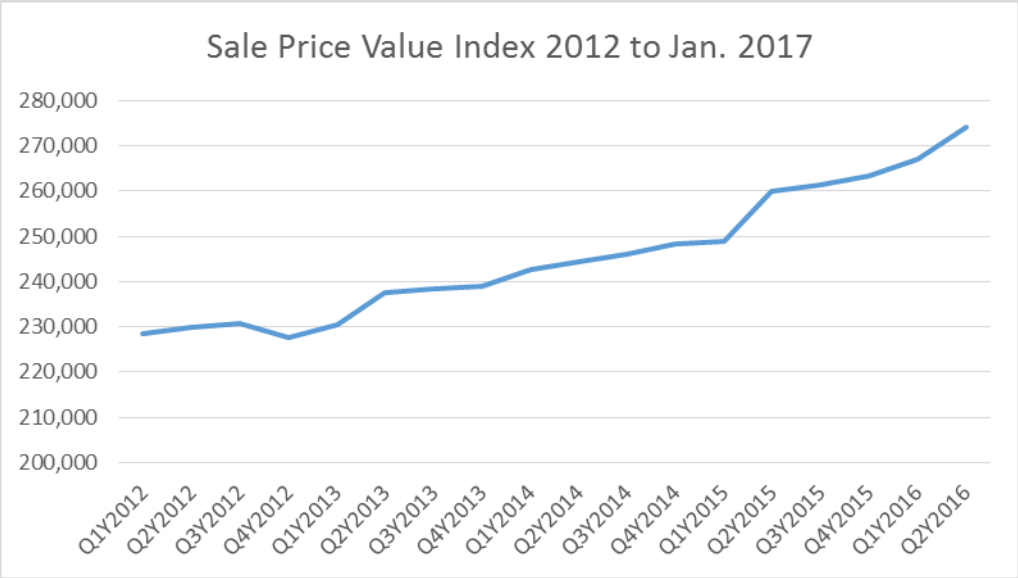
Values in all economic markets change over the course of time. The changes in values can occur as rapidly as second by second as in securities trading, or have slower movement which occurs over months, quarters, or even years as is more typical in real estate. The reader is cautioned to remember that it is not time itself which accounts for the change, but changes in supply and demand factors. These changes can be due to abstract things such as public sentiment and taste, to physical features such as weather conditions and natural aging of a depreciating asset, and to changes in economic conditions to name just a few.

Real estate prices are subject to many factors and when analyzed in sequence can exhibit predictable patterns. These patterns are generally seasonal and cyclical. For residential properties these values tend to peak in late spring/early summer and bottom out around mid-November to early-February. However, these patterns do not perfectly repeat so there can be differences in the magnitudes in common seasons. Besides the seasonal influences, cyclical influences also occur. These can be due to a sudden exogenous shock, such as the World Trade Center Attack and the beginning of the War on Terror, or more likely due to economic upheavals such as the Great Recession.

For residential real estate, when other variables are controlled for such as size, quality, condition, age, and site value. Time patterns can be seen and their influence determined. This is standardized research methodology that is used in academic, medical, social, and economic studies.

These time variables were determined by using 15,153 observations which occurred from January 3, 2012 to February 17, 2017. From that sample, only 17 were considered to be outliers. To minimize the impact of a random outlier as well as to create an efficient model, time adjustments were categorized on a quarterly basis.

Thurston County's residential values exhibit a strong pattern. Historic analysis revealed that the residential market "bounced" along the bottom during 2012, but has subsequently exhibits an upward trend since. This can be seen graphically below.



Mean Value and Index Ratio Table

TIME	INDEX PRICE	FACTOR
Q1Y2012	228,528	1.223
Q2Y2012	229,995	1.215
Q3Y2012	230,609	1.212
Q4Y2012	227,597	1.228
Q1Y2013	230,579	1.212
Q2Y2013	237,566	1.176
Q3Y2013	238,409	1.172
Q4Y2013	239,003	1.169
Q1Y2014	242,696	1.151
Q2Y2014	244,427	1.143
Q3Y2014	246,165	1.135
Q4Y2014	248,316	1.125
Q1Y2015	248,900	1.122
Q2Y2015	259,975	1.075
Q3Y2015	261,311	1.069
Q4Y2015	263,281	1.061
Q1Y2016	266,894	1.047
Q2Y2016	274,016	1.020
Q3-Q4Y2016	279,496	1.000

At this point the reader is wondering, how we know if those numbers are accurate? The proof can be determined by four features. Does the model have predictive ability, do the variables used "explain" the variance in values, is the model structurally correct, and when analyzed in isolation is there an indication of systematic bias?

The predictive ability of a model is determined by utilizing an Analysis of Variance (ANOVA) technique with an F-test. The regression utilized 90 variables with 15,136 observations used. The F-test value was 1,255.5 which is highly significant ($p<.000$). This would indicate that the model has highly predictive ability as a whole.

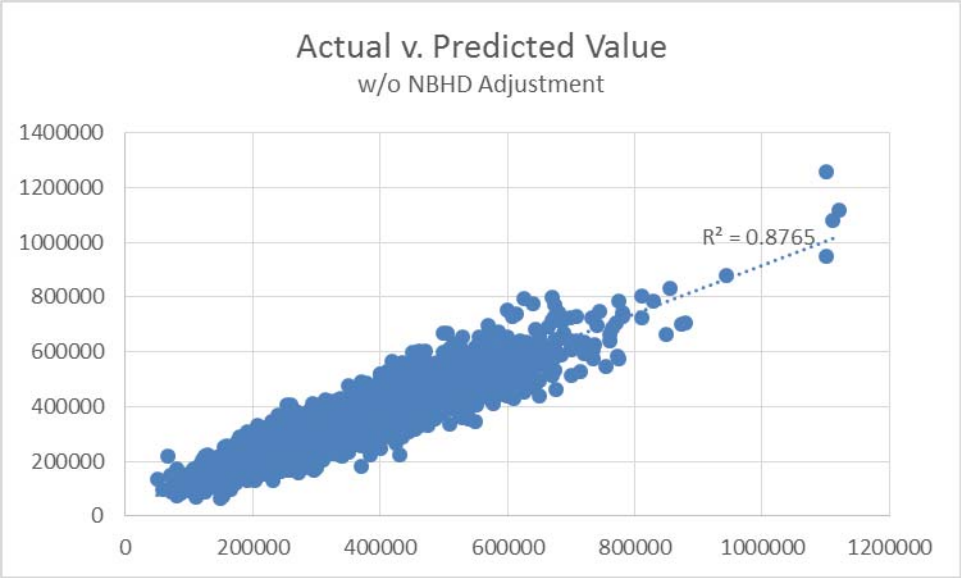
The next step is to determine if the chosen variables (including market/time) explain the dependent variable, in this case its value. This is accomplished by determining the Coefficient of Determination (R^2) and the Adjusted Coefficient of Determination (adj. R^2). The Raw R square results in a value of .877. One way to imagine this is that 88% of the variance is accounted for by the variables, even without specific neighborhood influences considered.

A common concern is the "usefulness" of the number of variables used. In other words, does the increase in the number of variables result in a general improvement of the model? The method to estimate this is by the adjusted R square. In this case the model still renders good results with a value of .876 or effectively, that these chosen variables explain 88% of the variance.

Of utmost importance, is the model correctly structured or is there a systemic bias. The most critical and rudimentary check is whether the model is misspecified. A misspecification results when the coefficients' value is beyond what would be a reasonable estimate or the directionality of the variable is opposite of what is expected by theory and established practice: for example, if the square footage adjustment is a minus $90.00 per square foot, or the value was $34,000 per square foot. Of the 90 variables utilized in the model, none are misspecified.

When two independent variables which affect the dependent variables similarly and to a high degree, it produces another possibility of systematic bias called multicollinearity. For example, total rooms and square feet both refer to size, both are highly correlated to each other and both affect home prices in nearly the same way. If both are introduced into the same model, their parameter values would be incorrect and quite likely would bias all other estimates as well. The most common check to avoid such a result would be to run a correlation matrix between all independent variables and assure that no correlation exceeded +/- 0.60. This was achieved in the model, so there is no indication of multicollinearity.

While we do not need the assumption of homoscedasticity for a model to create unbiased estimators, it is critical to the predictability of the model and the resulting standard error of the estimate. The ideal is to have the errors of the estimate to be consistent along the value range. When this occurs the model exhibits homoscedasticity, when it does not it is said to be heteroscedasticity. When Heteroscedasticity is present, as the values move away from the mean, the error rate increases. While there are several tests for this, the easiest review is to plot the estimates for the actual value. We have achieved a homoscedastic distribution if the error is consistent along the value range. This can be seen in the graph below.



Another critical feature of systemic bias is whether there is autocorrelation present in the model. Autocorrelation is a check for time related bias. A common check is the Durbin-Watson Statistic. This value ranges from 0 to 4, with 2 meaning there is no autocorrelation or, if you will, time bias. A value of 0 indicates positive autocorrelation. This is the most common time error when present. It means the directionality of the residual is followed by the same directionally of the previous observation. If either seasonal or cyclical influences were not accounted for in the model the pattern would look serpentine. A value of 4 would indicate negative autocorrelation. This would result in each observation's residual moving in the exact opposite of the previous observed direction. The residuals would exhibit a staccato pattern of rapid up and down movements. The model produced a value of 1.905 meaning there is no time bias that has not been accounted for by the variables.

The results indicate that the model is systematically unbiased and the time adjustments accurately reflect the market conditions.

Model Summary[t]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
19	.936[s]	.877	.876	33473.391	1.905

Model		df	F	Sig.
19	Regression	90	1,255.5	.000[t]
	Residual	15,861		
	Total	15,951		

SQUARE FOOT LAND MODEL SUMMARY

This model is a hybrid model with the dependent variable being the natural log of the sales price. The methodology utilized a backward regression methodology. The independent variables are a combination of size, region, site influences and time splines. 39 variables were statistically significant to predict value. The reference group are land sales in region 5.

Model Summary[ah]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
33	.865[ag]	0.748	0.738	0.347	1.962

ANOVA[a]

Model		df	F	Sig.
33	Regression	39	77.033	.000[ah]
	Residual	1012		
	Total	1051		

SALT WATERFRONT LAND MODEL SUMMARY

This model uses a forced regression technique with the independent variable being the residual land value. The independent variables are a combination of size, region, site influences and time splines. 36 variables were statistically significant to predict value. The reference group are land sales for this single region is for very good view, medium bank properties.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Durbin-Watson
1	.954[a]	.910	.895	79463.969	2.110

ANOVA[b]

Model		df	F	Sig.
1	Regression	36	62.912	.000[a]
	Residual	224		
	Total	260		

a. Dependent Variable: SALE_PRICE

NEIGHBORHOOD RATIO STATISTICS

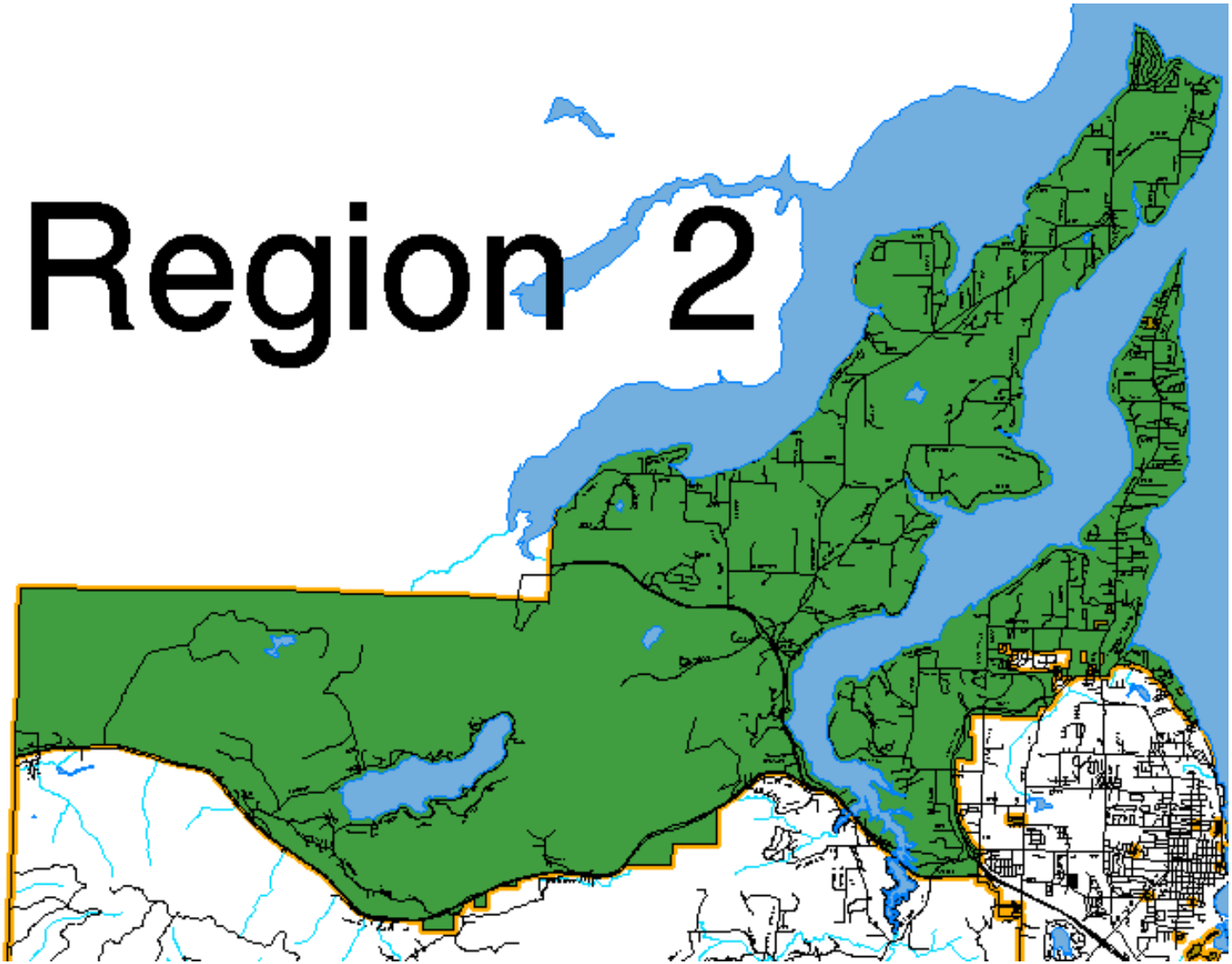
Group	Mean	Median	W Mean	Std Dev	AAD	PRD	COD
03U1	.975	.963	.962	.095	.070	1.014	.072
06E2	.943	.949	.943	.121	.095	1.000	.100
06U1	.997	.960	.968	.144	.108	1.030	.112
06U2	.945	.939	.960	.092	.072	.985	.077
07E2	.963	.956	.965	.096	.076	.998	.079
08B2	.944	.967	.943	.102	.081	1.001	.083
08H1	.970	.960	.974	.097	.082	.996	.085
08L1	.948	.947	.941	.106	.086	1.008	.090
08N1	.938	.963	.936	.106	.089	1.001	.092
09P1	.966	.953	.971	.110	.091	.994	.096
09S1	.942	.950	.946	.121	.098	.996	.103
09W1	.957	.956	.968	.096	.079	.989	.083
09YS	.977	.947	.947	.112	.076	1.032	.080
10G2	.959	.957	.956	.103	.084	1.003	.088
10I1	.955	.968	.964	.104	.083	.991	.086
10O1	.956	.957	.958	.111	.084	.998	.088
10P1	.965	.932	.970	.116	.088	.995	.094
10P2	.969	.974	.977	.104	.084	.992	.086
11E1	.954	.958	.958	.090	.072	.995	.075
11F1	.953	.956	.957	.103	.083	.996	.087
11K1	.961	.964	.956	.077	.060	1.006	.062
11L1	.973	.960	.972	.097	.082	1.001	.085
11O1	.970	.955	.972	.108	.081	.999	.085
11U1	.971	.956	.980	.130	.103	.991	.108
11VS	.942	.965	.925	.112	.091	1.018	.094
11XS	.975	.978	.938	.131	.101	1.039	.103
12O1	.980	.965	.989	.042	.027	.991	.028
12P1	.960	.956	.963	.080	.060	.997	.063
12Q1	.955	.955	.958	.136	.111	.997	.116
12S2	.961	.960	.967	.090	.067	.994	.069
12U1	.971	.963	.992	.119	.097	.978	.101
12U5	.972	.955	.977	.089	.066	.995	.069
12V3	.970	.952	.976	.087	.067	.994	.071
12W2	.975	.958	.987	.079	.063	.987	.066
12Z1	.982	.961	.985	.125	.099	.997	.103
12ZS	.967	.984	.956	.085	.063	1.012	.064
13K1	.940	.955	.942	.100	.079	.998	.082
13R1	.958	.959	.961	.083	.064	.996	.067
13R2	.956	.959	.963	.116	.098	.993	.102
13T1	.967	.960	.965	.095	.074	1.002	.077
13U1	.947	.933	.950	.126	.109	.997	.117
13V1	.932	.946	.926	.080	.065	1.007	.069
13W1	.970	.958	.983	.114	.085	.987	.089
13W3	.944	.954	.953	.129	.105	.991	.110
13W4	.966	.959	.959	.087	.068	1.007	.071
13X1	.959	.962	.952	.094	.068	1.007	.071
13Y1	.965	.959	.974	.117	.087	.991	.090
13YS	.962	.965	.940	.145	.112	1.024	.116
13Z1	.964	.954	.958	.107	.087	1.006	.092
13ZS	.976	.964	.962	.143	.113	1.014	.117

Group	Mean	Median	W Mean	Std Dev	AAD	PRD	COD
14H1	.966	.950	.977	.139	.116	.990	.122
14N1	.911	.902	.919	.099	.086	.992	.095
14P1	.948	.951	.954	.110	.088	.993	.092
14Q1	.962	.965	.964	.118	.098	.998	.102
14S2	.943	.941	.936	.130	.108	1.007	.115
14T1	.943	.933	.945	.126	.103	.998	.111
14U2	.953	.944	.944	.114	.090	1.010	.095
15K1	.957	.962	.964	.115	.092	.993	.096
15R2	.962	.957	.962	.112	.090	1.000	.094
15S1	.942	.924	.942	.114	.093	1.000	.100
15T1	.913	.900	.904	.130	.105	1.010	.117
15T2	.929	.917	.930	.105	.084	1.000	.092
15U1	.941	.942	.944	.117	.096	.997	.102
15U2	.956	.957	.954	.103	.079	1.002	.082
15X1	.958	.949	.958	.078	.064	1.000	.068
15XS	.976	.968	.947	.162	.119	1.031	.123
16B1	.917	.963	.863	.148	.124	1.063	.129
16F1	.958	.963	.955	.090	.072	1.002	.075
16P1	.970	.961	.972	.080	.063	.998	.066
16Q1	.955	.955	.961	.098	.079	.994	.083
16Q2	.972	.961	.969	.078	.063	1.003	.065
16R1	.960	.961	.966	.100	.082	.994	.086
16S1	.932	.926	.932	.116	.094	1.000	.102
16S2	.922	.911	.932	.130	.111	.989	.122
16T1	.951	.934	.953	.160	.124	.997	.133
16W1	.933	.936	.940	.118	.095	.993	.102
17C1	.926	.917	.912	.132	.112	1.015	.123
17G1	.949	.956	.947	.097	.076	1.002	.080
17L1	.947	.964	.951	.126	.103	.996	.107
17N1	.958	.956	.965	.084	.066	.993	.069
17Q1	.971	.962	.971	.090	.070	.999	.073
17R1	.944	.976	.962	.123	.097	.981	.099
17S1	.965	.958	.965	.107	.086	1.001	.090
17S2	.962	.957	.962	.068	.048	1.000	.050
17T1	.950	.960	.942	.121	.100	1.009	.105
17U1	.978	.960	.980	.097	.076	.998	.079
17U2	.977	.955	.982	.107	.087	.995	.091
17Y1	.967	.943	.972	.109	.087	.994	.092
17Z1	.967	.956	.975	.111	.089	.992	.094
17ZS	.988	.968	.950	.123	.089	1.040	.092
18L1	.958	.960	.956	.100	.075	1.002	.078
18N1	.975	.972	.975	.084	.066	1.000	.067
18P1	.967	.963	.961	.086	.068	1.006	.070
18Q1	.957	.958	.959	.093	.075	.998	.079
18R1	.950	.954	.950	.065	.048	1.000	.051
18S1	.964	.959	.963	.088	.070	1.002	.073
18U2	.953	.959	.953	.050	.034	1.000	.035
18W1	.970	.969	.963	.120	.107	1.007	.110

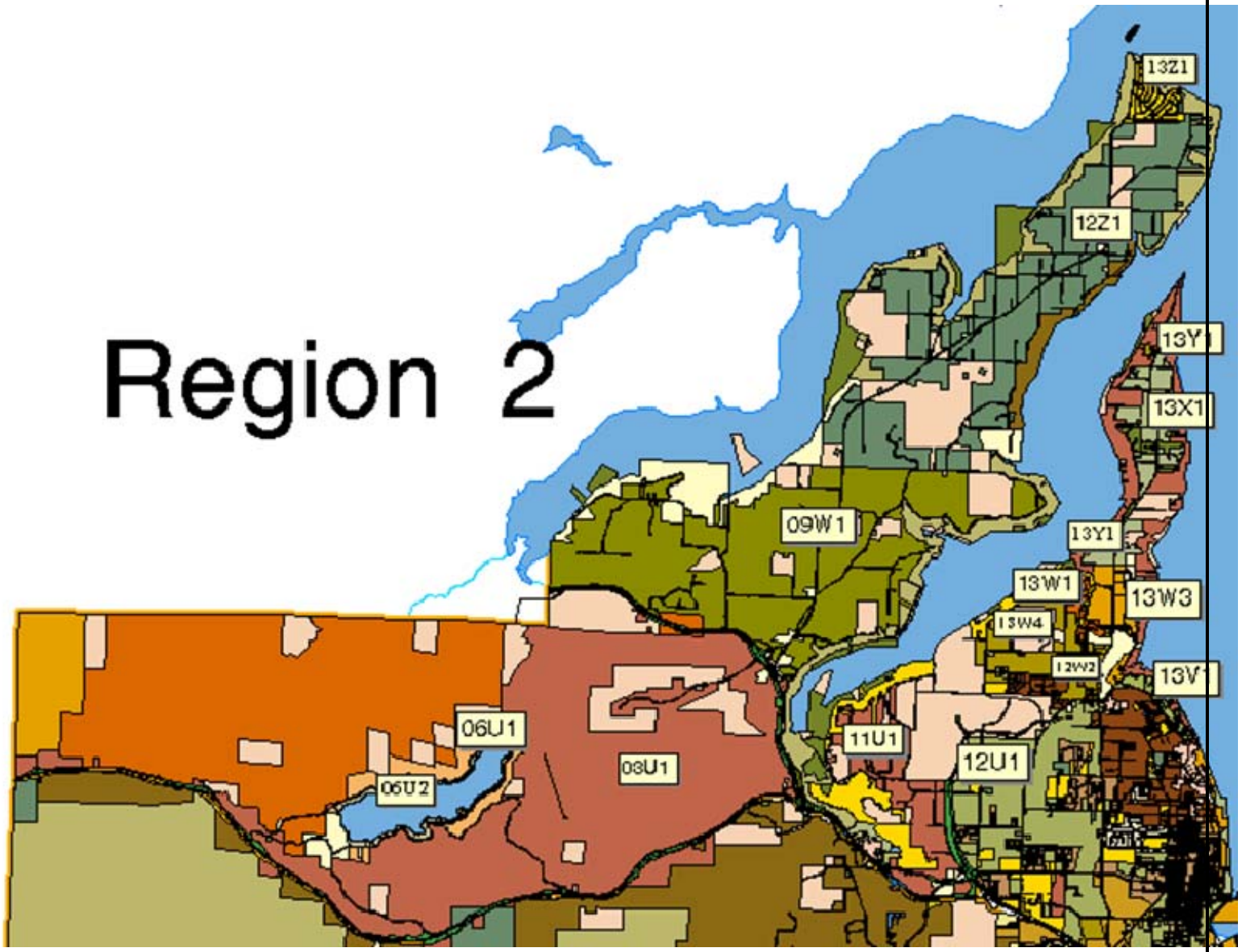
Group	Mean	Median	W Mean	Std Dev	AAD	PRD	COD
18YS	.947	.876	.900	.173	.144	1.052	.164
19H1	.933	.942	.943	.117	.094	.989	.100
19P1	.962	.958	.963	.083	.065	.999	.068
19P2	.965	.969	.964	.096	.079	1.001	.082
19Q1	.962	.958	.962	.075	.055	1.001	.057
19Q2	.974	.961	.971	.070	.056	1.003	.059
19Q3	.966	.960	.963	.063	.046	1.004	.048
19R2	.955	.962	.960	.086	.069	.994	.072
19R3	.971	.963	.970	.077	.060	1.001	.062
19R4	.965	.961	.964	.108	.092	1.001	.096
19W1	.978	.955	.976	.107	.089	1.002	.093
19Z1	.961	.944	.970	.148	.123	.990	.130
20P2	.980	.966	.975	.080	.059	1.005	.061
20P3	.967	.959	.969	.072	.054	.998	.057
20Q1	.989	.967	.996	.104	.084	.994	.086
20R1	.970	.958	.969	.093	.075	1.001	.078
20S1	.966	.958	.963	.085	.068	1.003	.071
20U1	.972	.953	.966	.102	.082	1.006	.086
20V1	.958	.955	.951	.094	.071	1.007	.075
20V2	.966	.956	.968	.067	.045	.998	.047
20W1	.973	.964	.966	.108	.072	1.008	.075
20W2	.977	.942	.976	.093	.071	1.001	.076
20ZS	.979	.967	.936	.158	.124	1.046	.128
21H2	1.002	.959	1.009	.117	.089	.994	.093
21O1	.968	.960	.966	.085	.066	1.002	.068
21Q3	.948	.961	.960	.088	.074	.988	.077
21R1	.944	.949	.937	.095	.074	1.007	.078
21R2	.954	.962	.951	.061	.046	1.002	.048
21S1	.960	.957	.961	.070	.056	.999	.059
21T1	.971	.963	.967	.085	.069	1.004	.071
21T2	.978	.961	.975	.087	.068	1.003	.071
21T4	.974	.959	.973	.098	.073	1.000	.076
21W2	.965	.962	.960	.075	.059	1.005	.061
21W3	.965	.957	.966	.063	.048	.998	.050
22N1	.961	.962	.963	.087	.065	.998	.067
22Q1	.994	.954	.996	.087	.065	.998	.068
22Q2	.971	.962	.973	.088	.069	.999	.072
22S1	.967	.959	.970	.077	.060	.997	.063
22T1	.971	.962	.966	.091	.071	1.006	.073
22T2	.971	.960	.970	.091	.074	1.001	.077
22T3	.970	.959	.968	.068	.055	1.002	.057
22V1	.965	.958	.967	.092	.077	.998	.080
22W1	.956	.959	.959	.064	.052	.996	.054
22W3	.960	.959	.961	.074	.059	1.000	.061
22W4	.946	.956	.950	.063	.054	.995	.056
23T1	.944	.958	.935	.048	.040	1.009	.042
23T2	.959	.959	.943	.102	.072	1.017	.075
23U1	.969	.961	.968	.055	.044	1.001	.046
23W1	.981	.960	.984	.109	.086	.998	.090

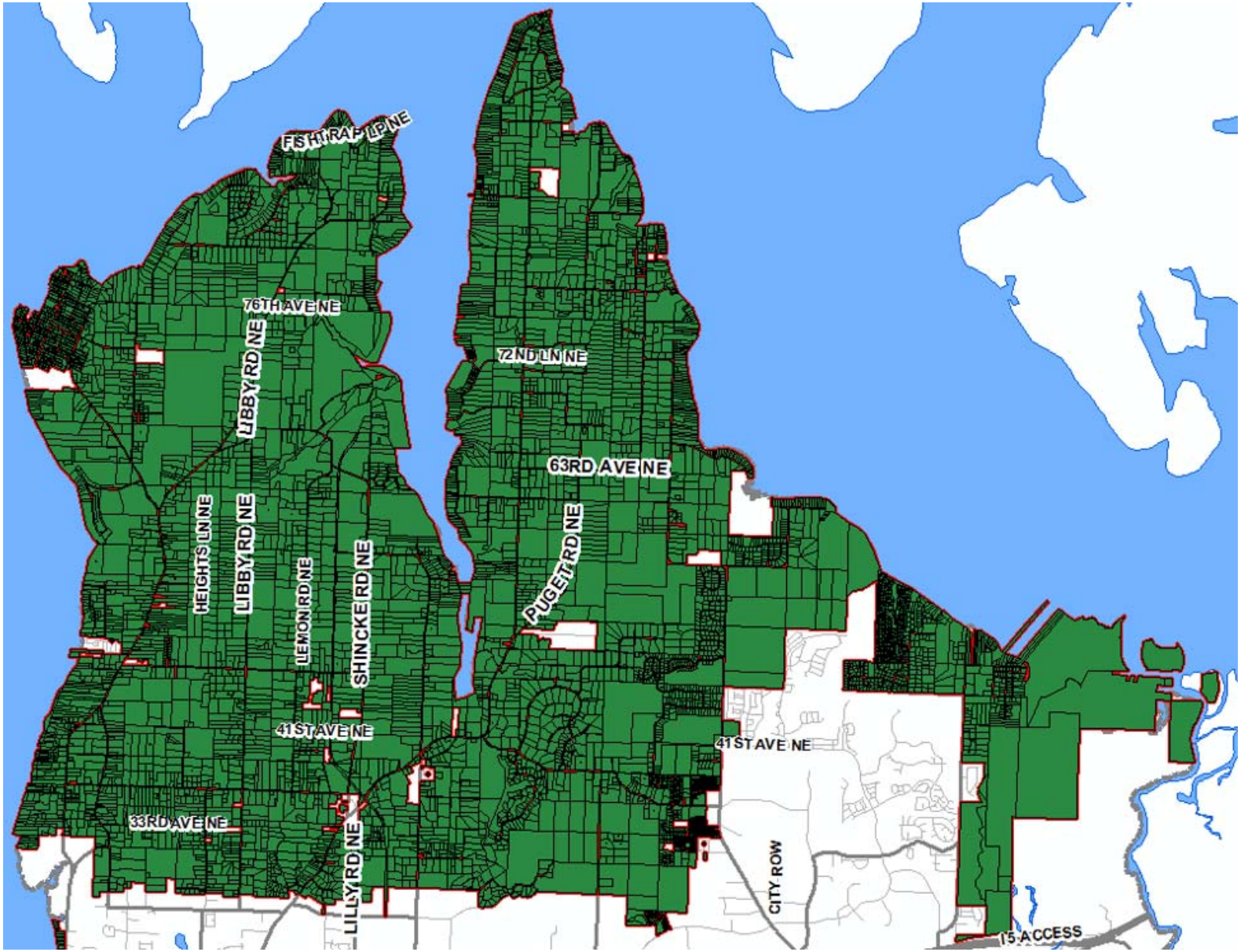
Group	Mean	Median	W Mean	Std Dev	AAD	PRD	COD
24I1	.960	.961	.963	.100	.080	.997	.083
24P1	.958	.954	.952	.071	.052	1.006	.055
24Q1	.960	.958	.963	.094	.075	.997	.079
24Q2	.962	.949	.968	.107	.083	.994	.087
25I1	.940	.955	.934	.119	.098	1.006	.103
25I2	.982	.959	.983	.102	.085	.999	.088
25J1	.966	.949	.965	.106	.083	1.000	.088
25S1	.935	.962	.926	.125	.085	1.009	.088
27H1	.955	.958	.956	.111	.090	.999	.094
27J1	.946	.958	.938	.143	.112	1.008	.117
28F1	.963	.962	.959	.120	.095	1.004	.098
28M1	.981	.962	.972	.120	.087	1.010	.090
28M2	.940	.954	.949	.094	.075	.990	.079
28M3	.936	.957	.943	.091	.070	.992	.073
28N1	.945	.933	.948	.071	.055	.997	.059
29I1	.964	.953	.963	.110	.087	1.001	.092
29K1	.954	.956	.968	.125	.102	.985	.107
29M1	.957	.958	.963	.097	.072	.995	.075
29M2	.958	.950	.962	.114	.094	.996	.099
29N1	.970	.953	.973	.121	.096	.996	.100
30G1	.929	.949	.959	.147	.124	.969	.130
30G2	.962	.951	.969	.122	.098	.992	.103
30N1	.933	.957	.923	.133	.103	1.011	.108
31K1	.953	.951	.954	.125	.096	.998	.101
32E1	.913	.906	.915	.104	.072	.998	.079
32I1	.953	.952	.961	.100	.082	.992	.086
34F1	.960	.962	.955	.135	.111	1.005	.116
35E1	.965	.954	.957	.125	.102	1.008	.107

Region 02 Map

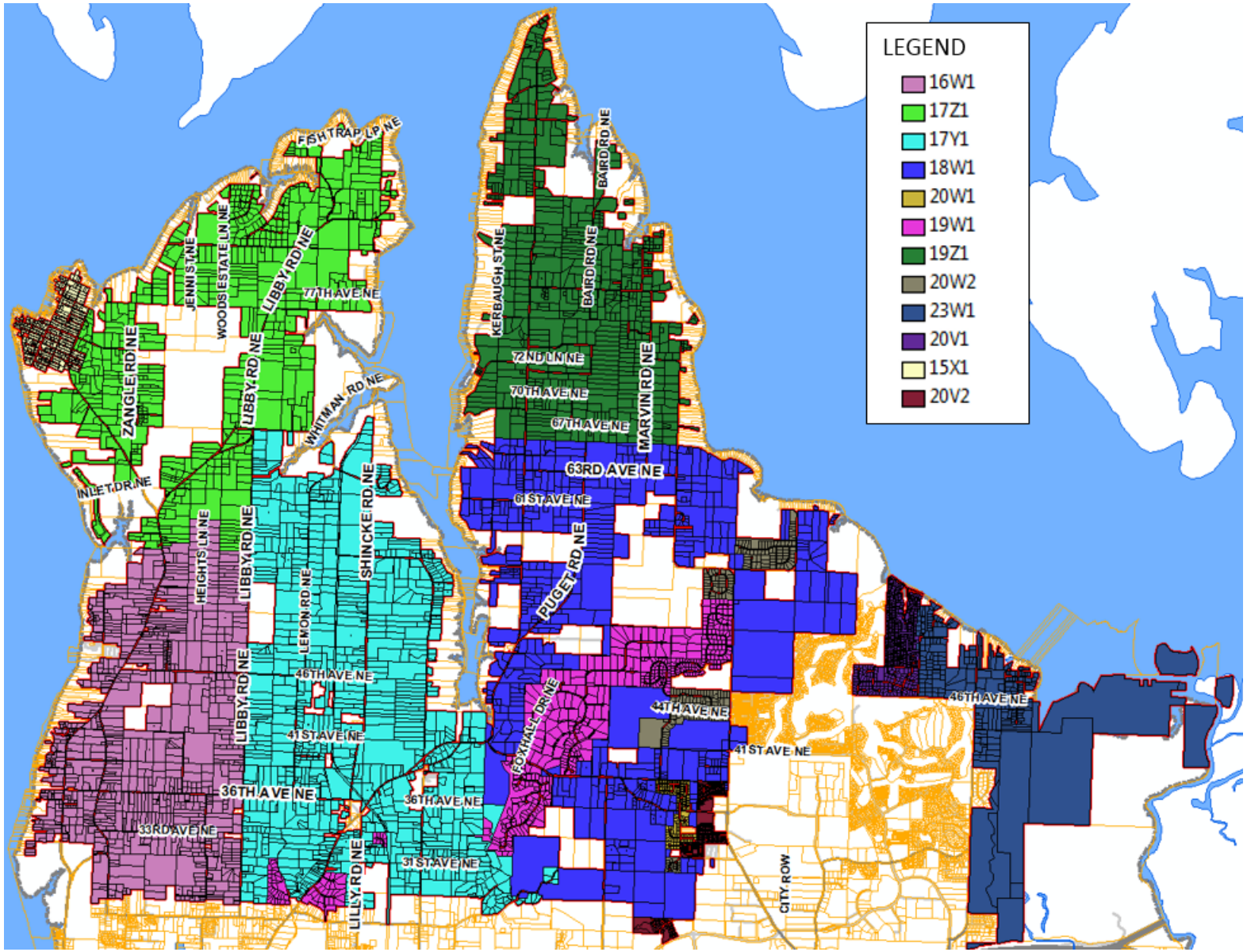


Region 02 Neighborhood Map

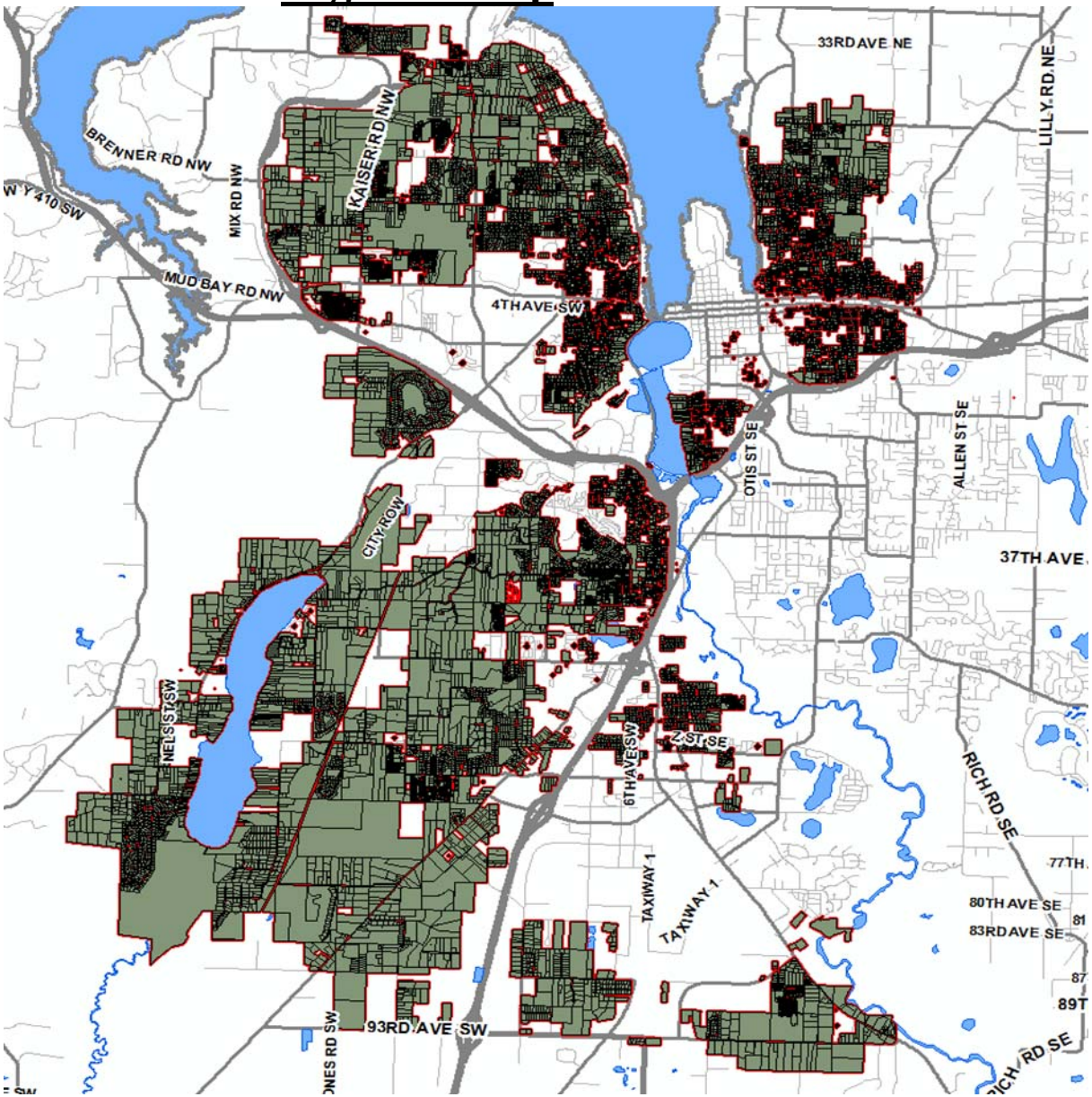


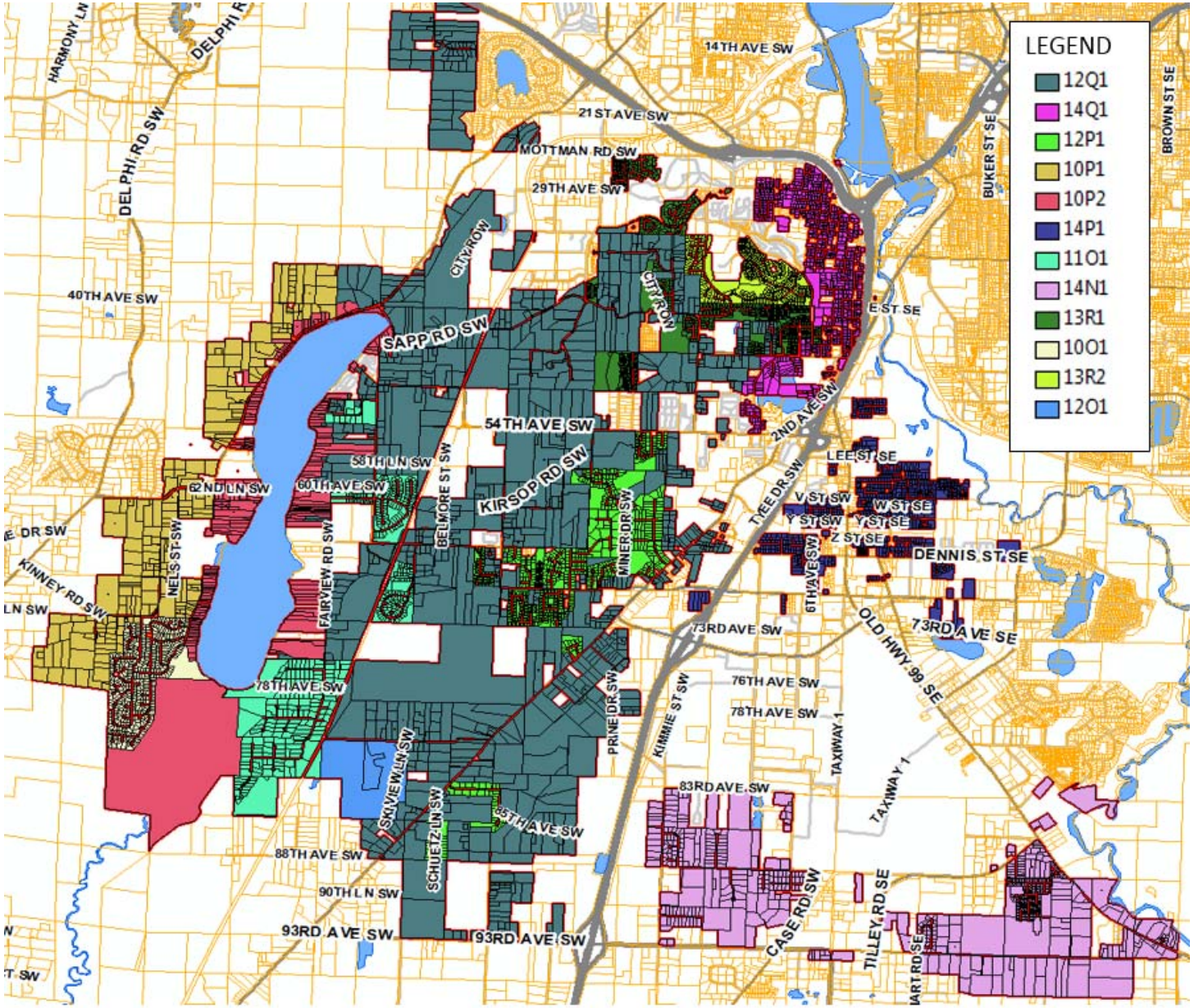

FISHTRAP LP NE
76TH AVE NE
LIBBY RD NE
72ND LN NE
63RD AVE NE
HEIGHTS LN NE
LIBBY RD NE
LEMON RD NE
SHINCKE RD NE
PUGET RD NE
41ST AVE NE
41ST AVE NE
33RD AVE NE
LILLY RD NE
CITY ROW
I5 ACCESS

Region 03 Neighborhood Map

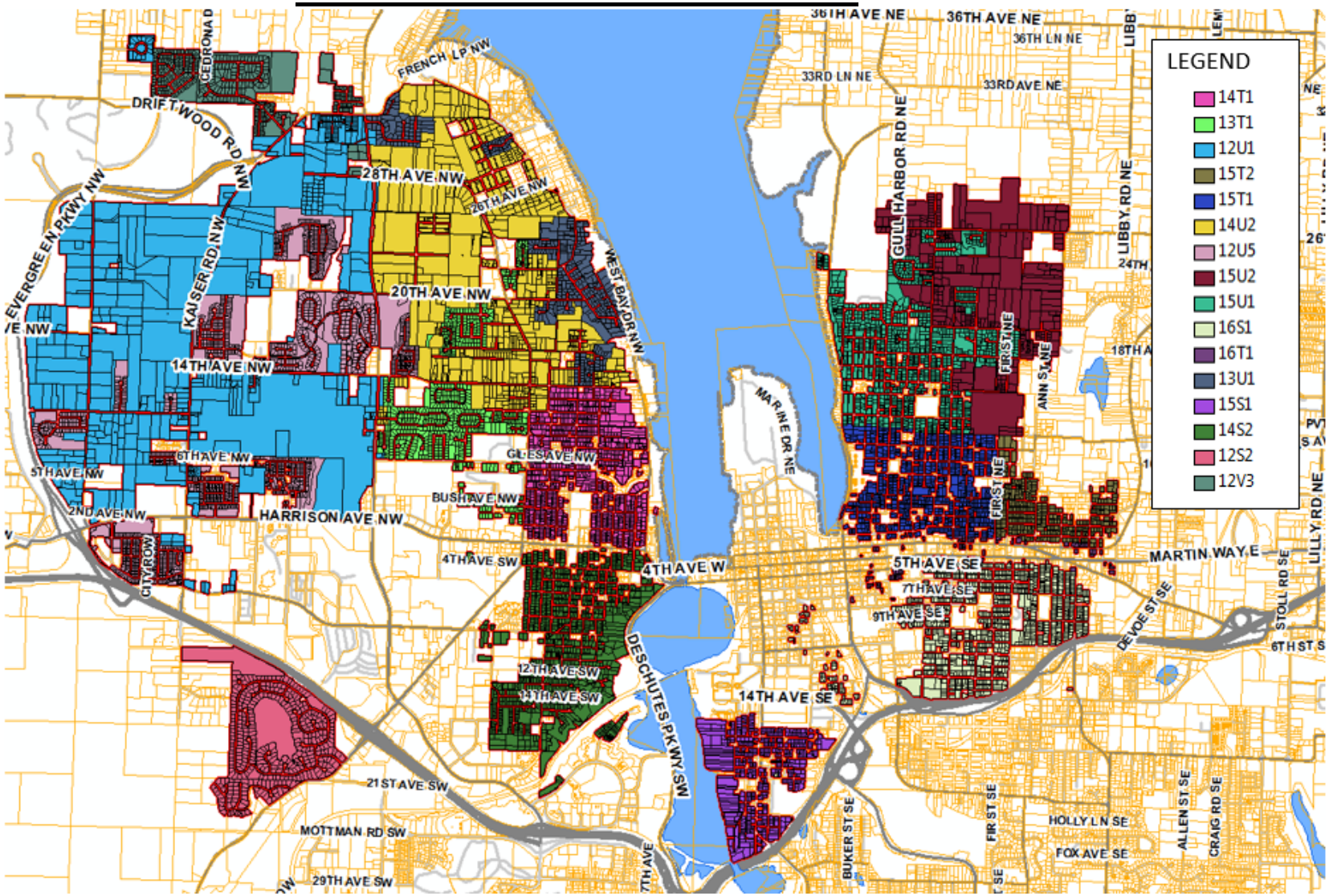


Region 04 Map

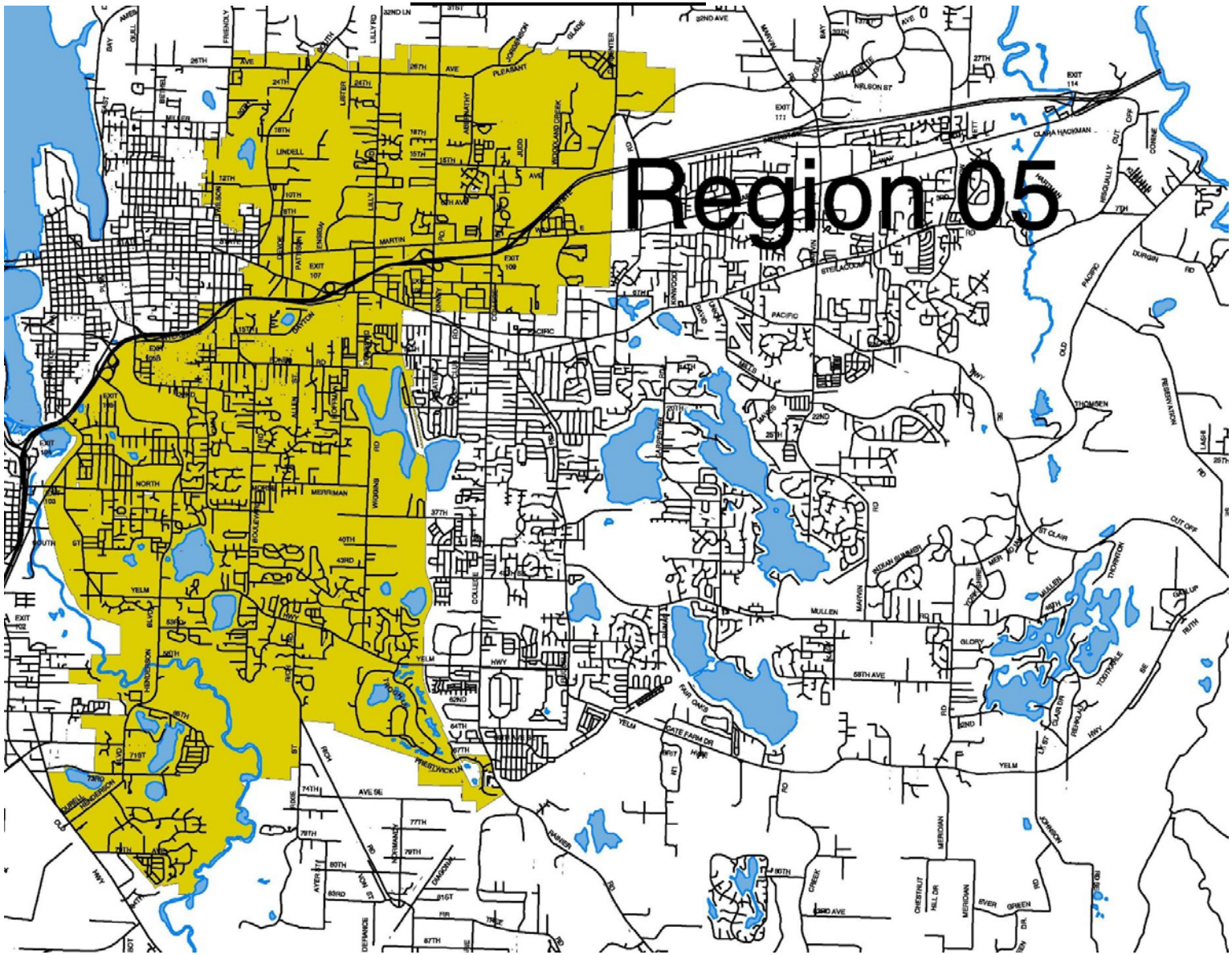



LEGEND
12Q1
14Q1
12P1
10P1
10P2
14P1
11O1
14N1
13R1
10O1
13R2
12O1
HARMONY LN
DELPHI RD SW
14TH AVE SW
21ST AVE SW
MOTTMAN RD SW
29TH AVE SW
BUKER ST SE
BROWN ST SE
CITY ROW
40TH AVE SW
SAPP RD SW
E ST SE
54TH AVE SW
2ND AVE SW
LEE ST SE
58TH LN SW
62ND LN SW
60TH AVE SW
BELMORE ST SW
KIRSOP RD SW
MINER DR SW
TREE DR SW
V ST SW
W ST SE
Y ST SW
Y ST SE
Z ST SE
DENNIS ST SE
KINNEY RD SW
NELS ST SW
FAIRVIEW RD SW
6TH AVE SW
73RD AVE SW
OLD HWY 99 SE
73RD AVE SE
78TH AVE SW
76TH AVE SW
78TH AVE SW
PRINE DR SW
KIMMIE ST SW
TAXIWAY 1
TAXIWAY 1
SKYVIEW LN SW
83RD AVE SW
85TH AVE SW
88TH AVE SW
SCHUETZ LN SW
90TH LN SW
93RD AVE SW
93RD AVE SW
CASE RD SW
TILLEY RD SE

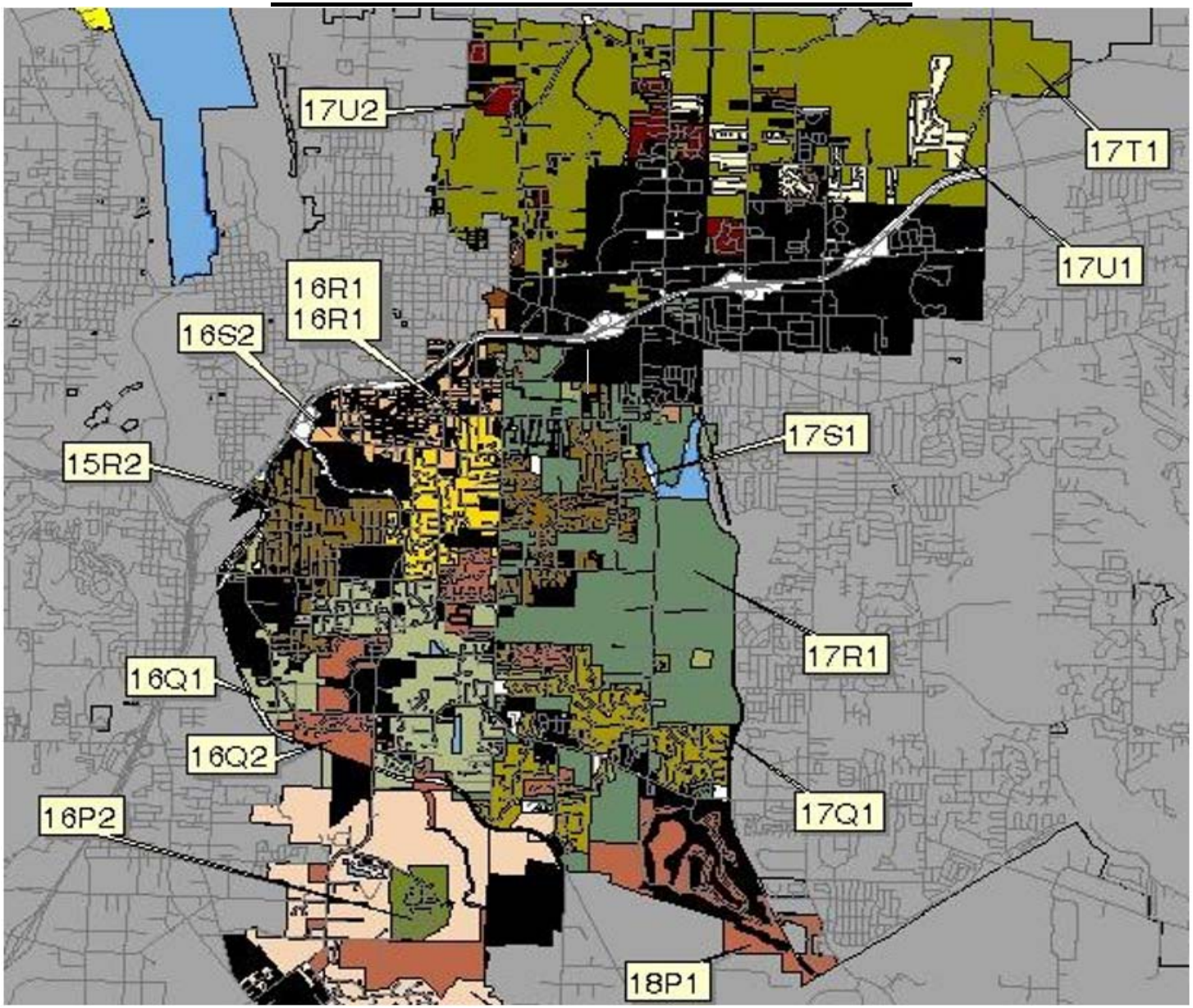
REGION 04 - NORTH CENTRAL



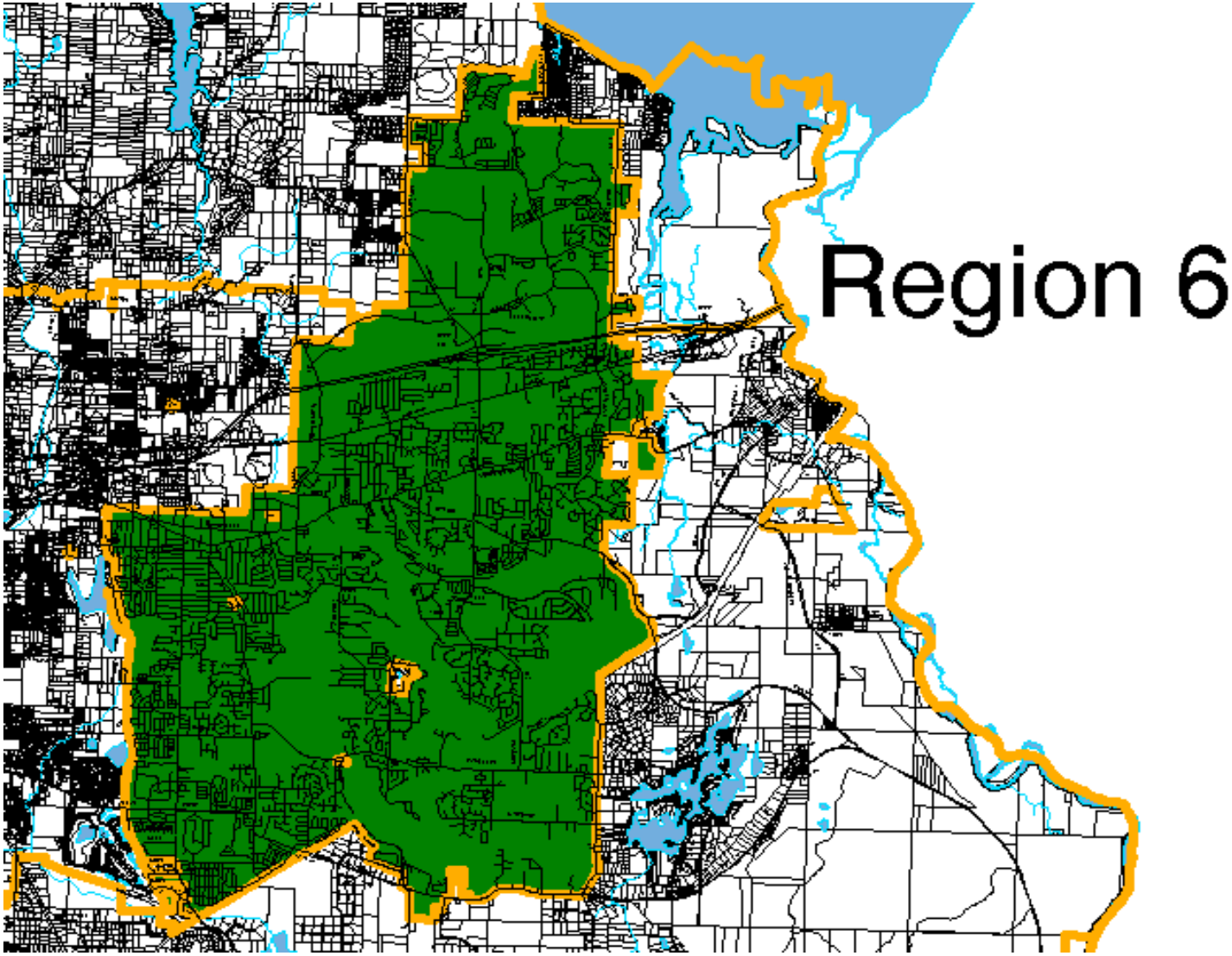
REGION 05 MAP



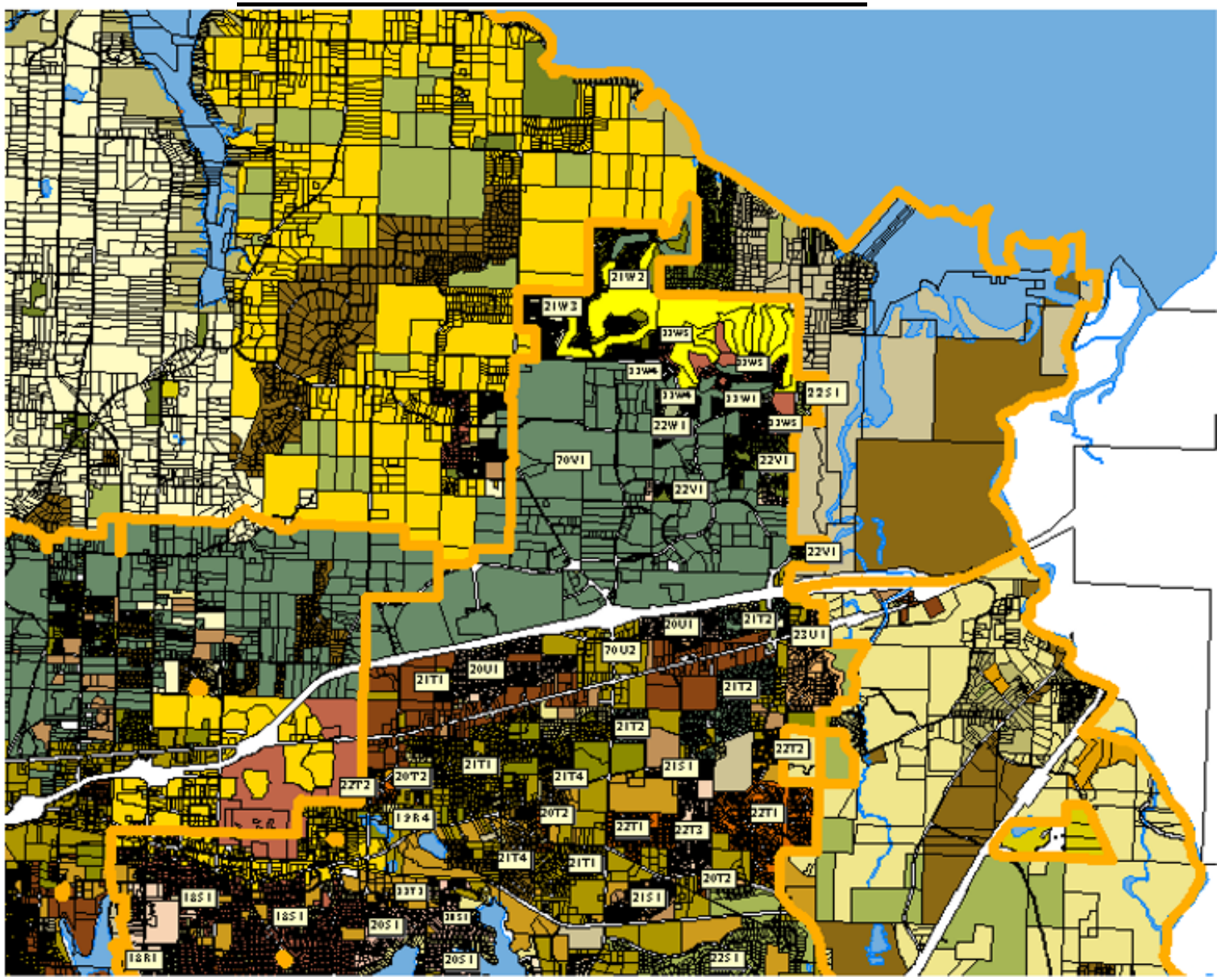
REGION 05 NEIGHBORHOOD MAP



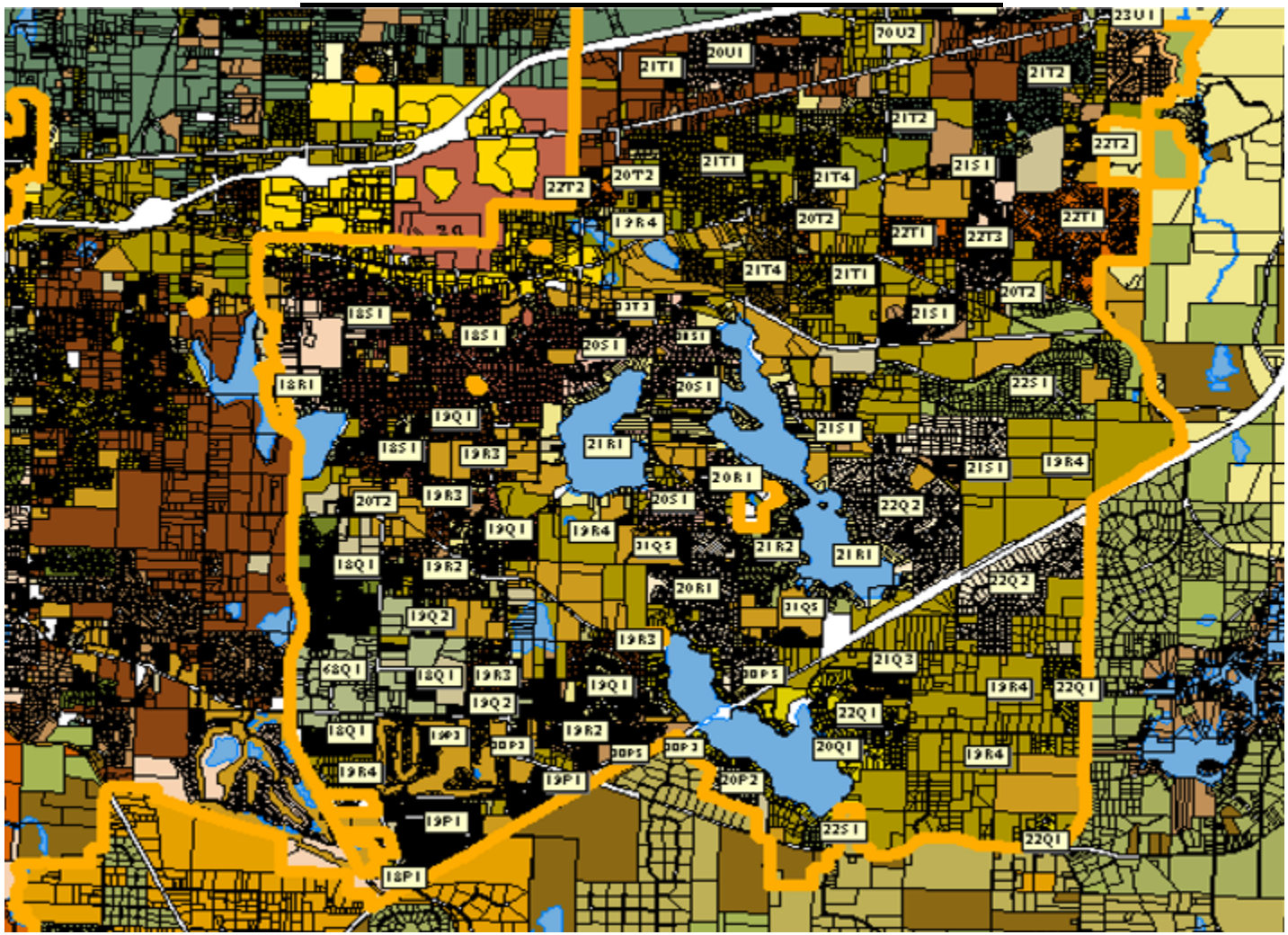
REGION 06 MAP



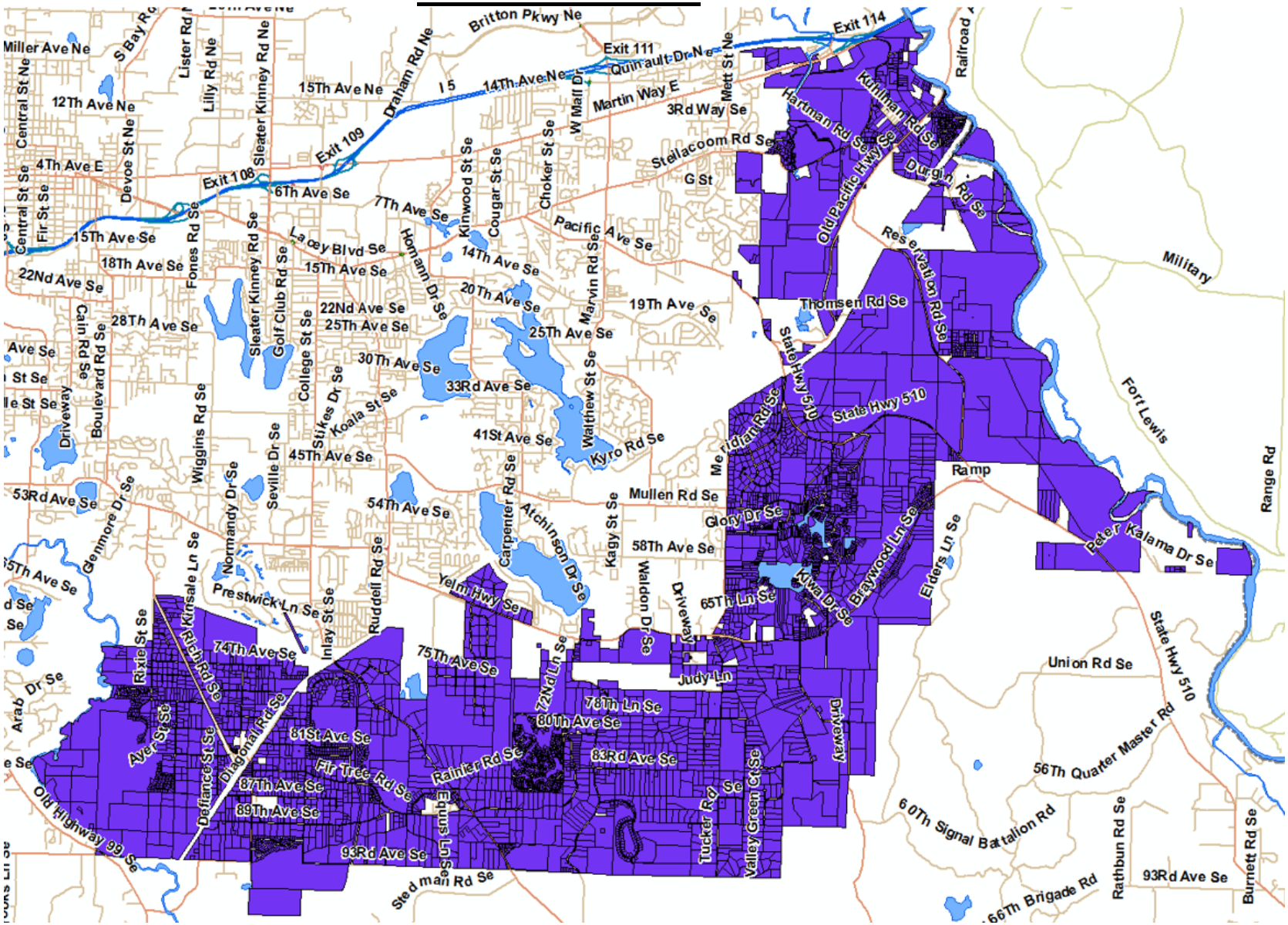
REGION 06 NEIGHBORHOOD MAP



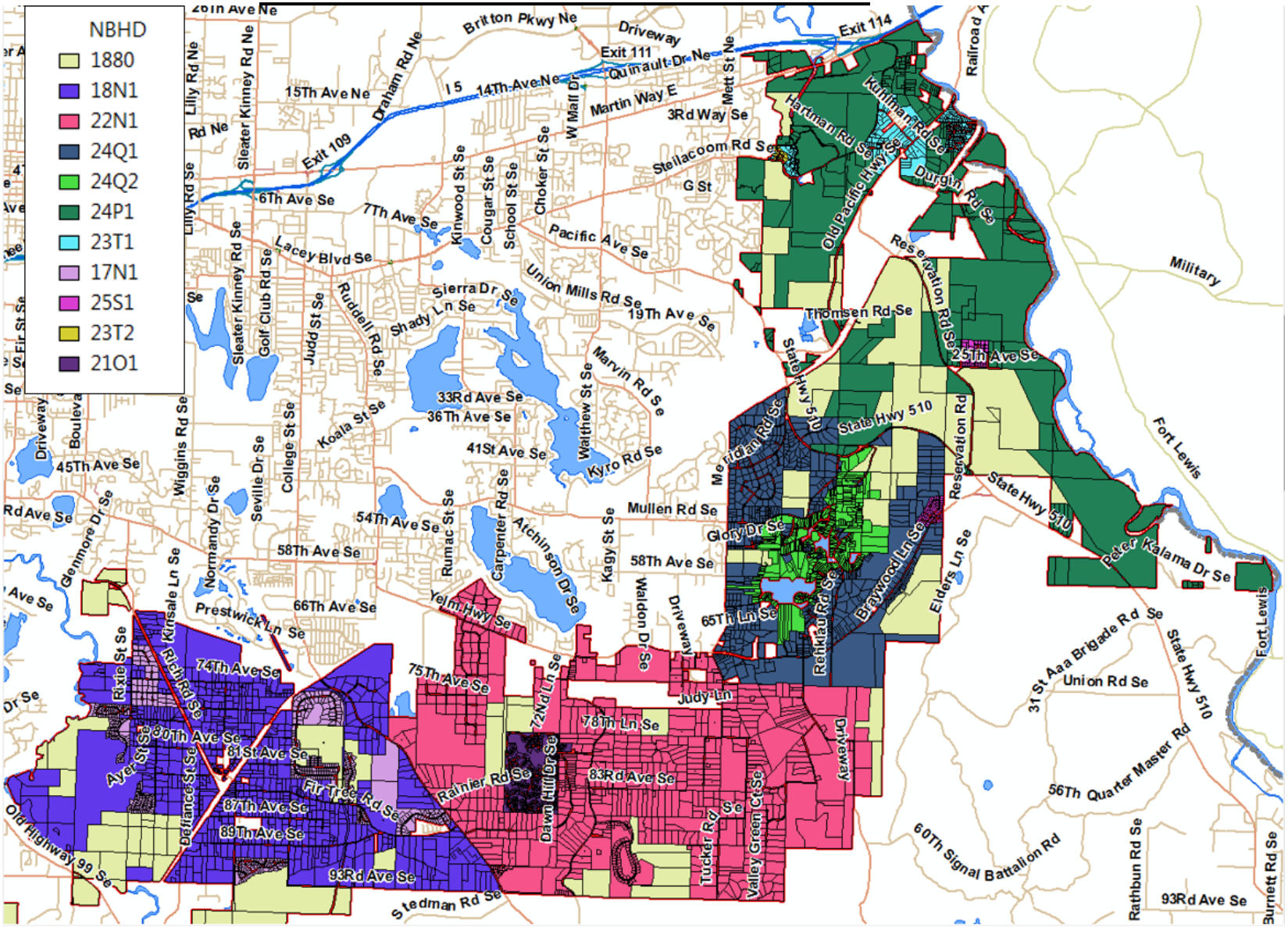
REGION 06 NEIGHBORHOOD MAP



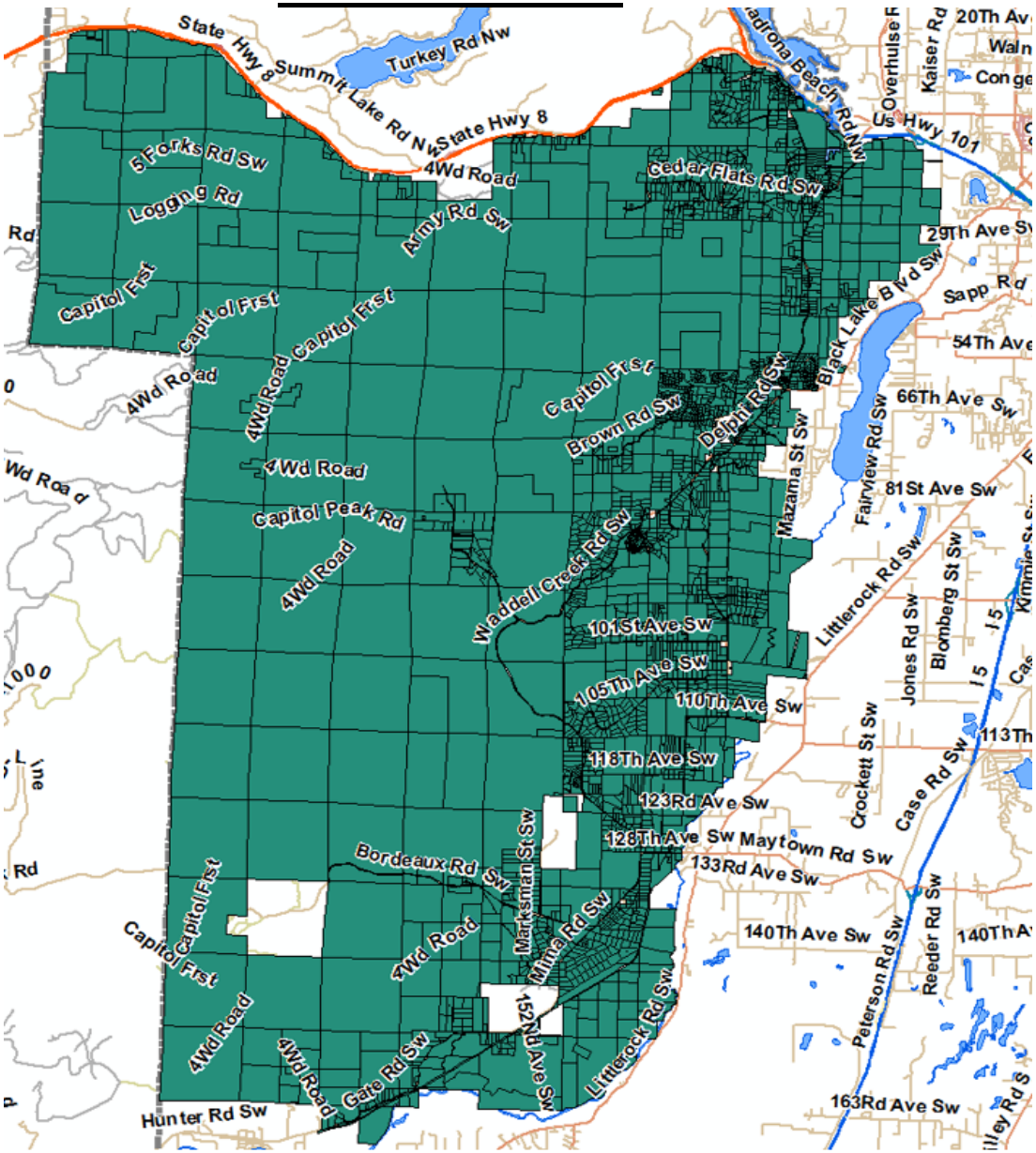
REGION 07 MAP



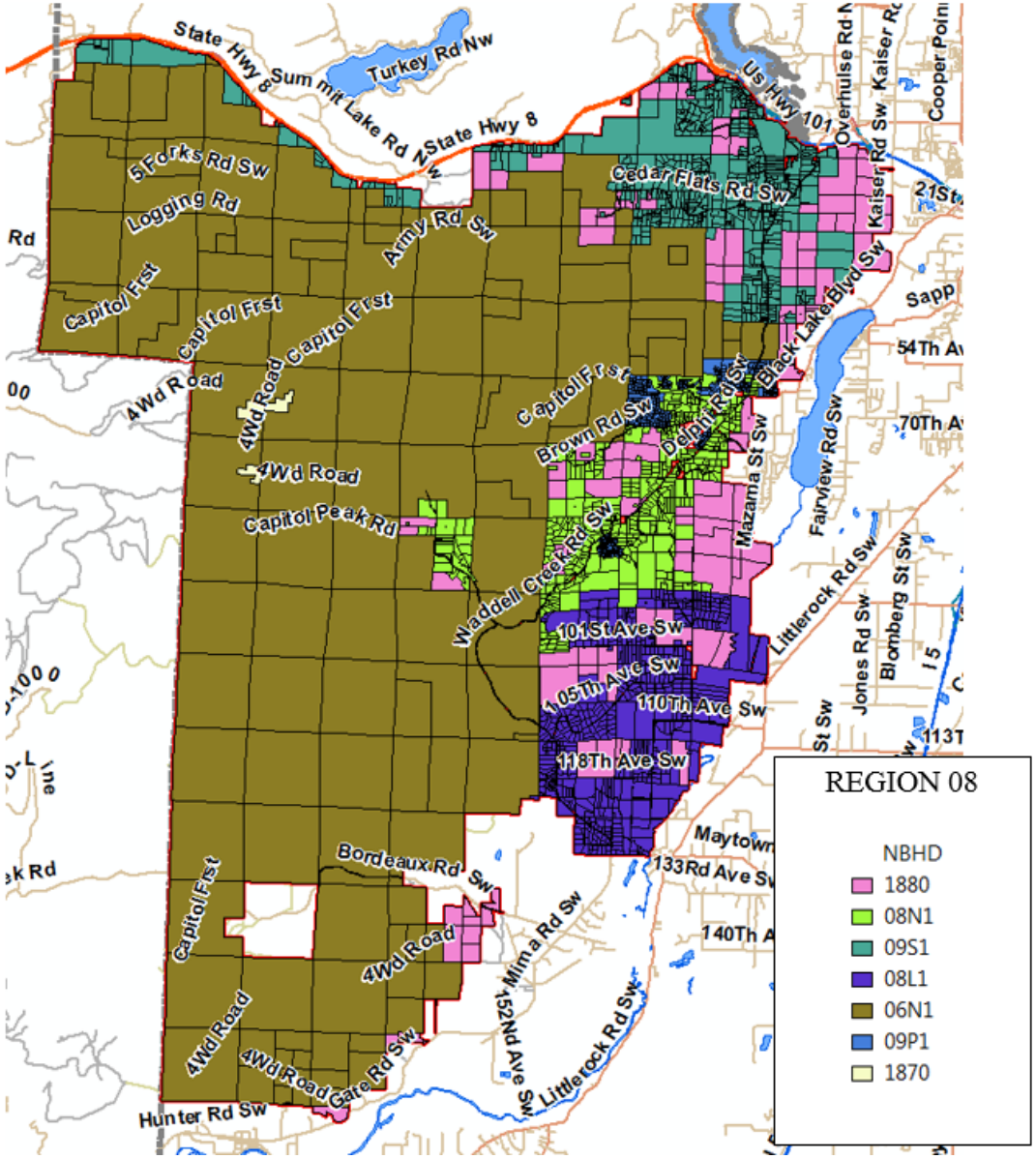
REGION 07 NEIGHBORHOOD MAP



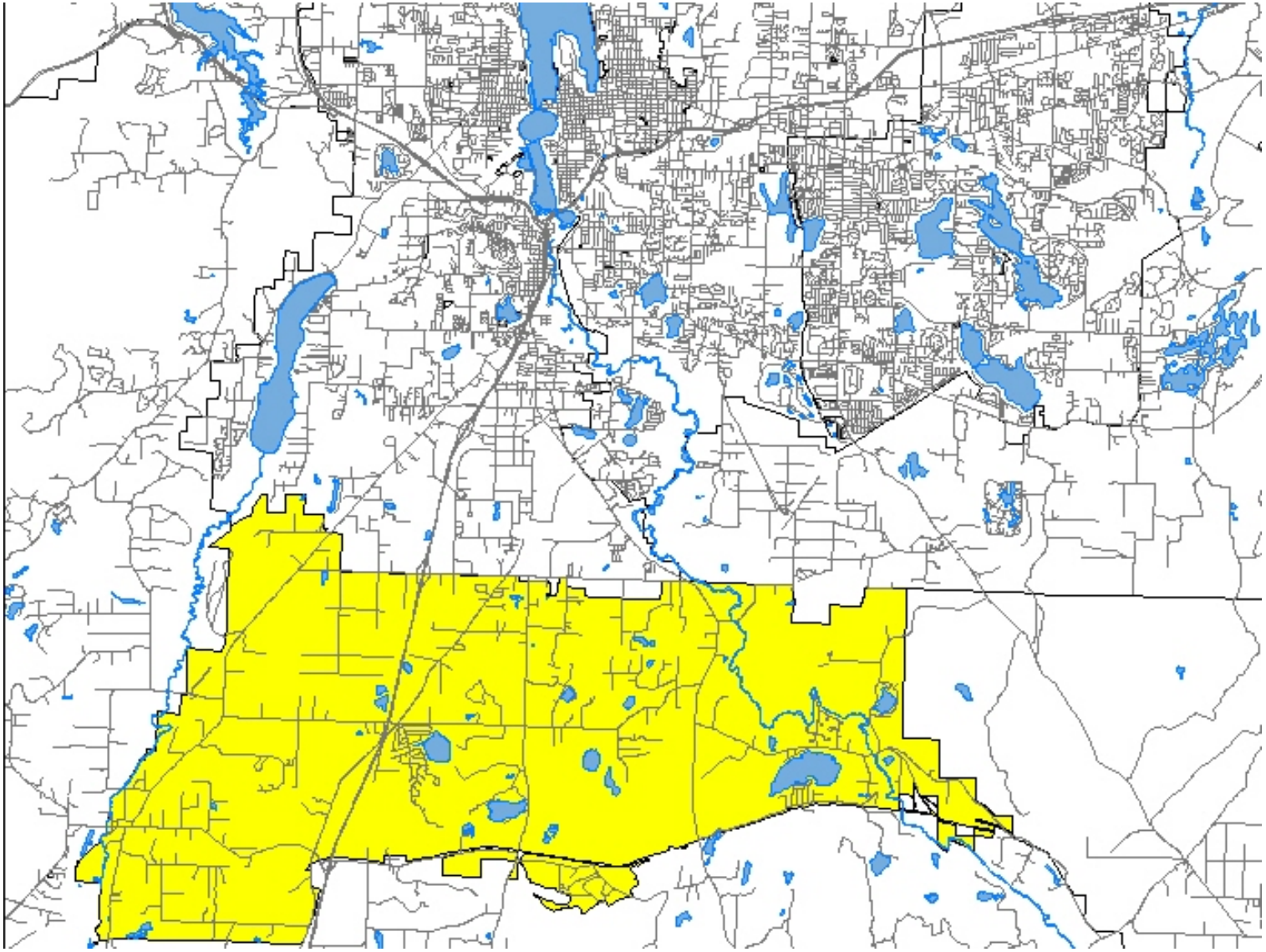
REGION 08 MAP



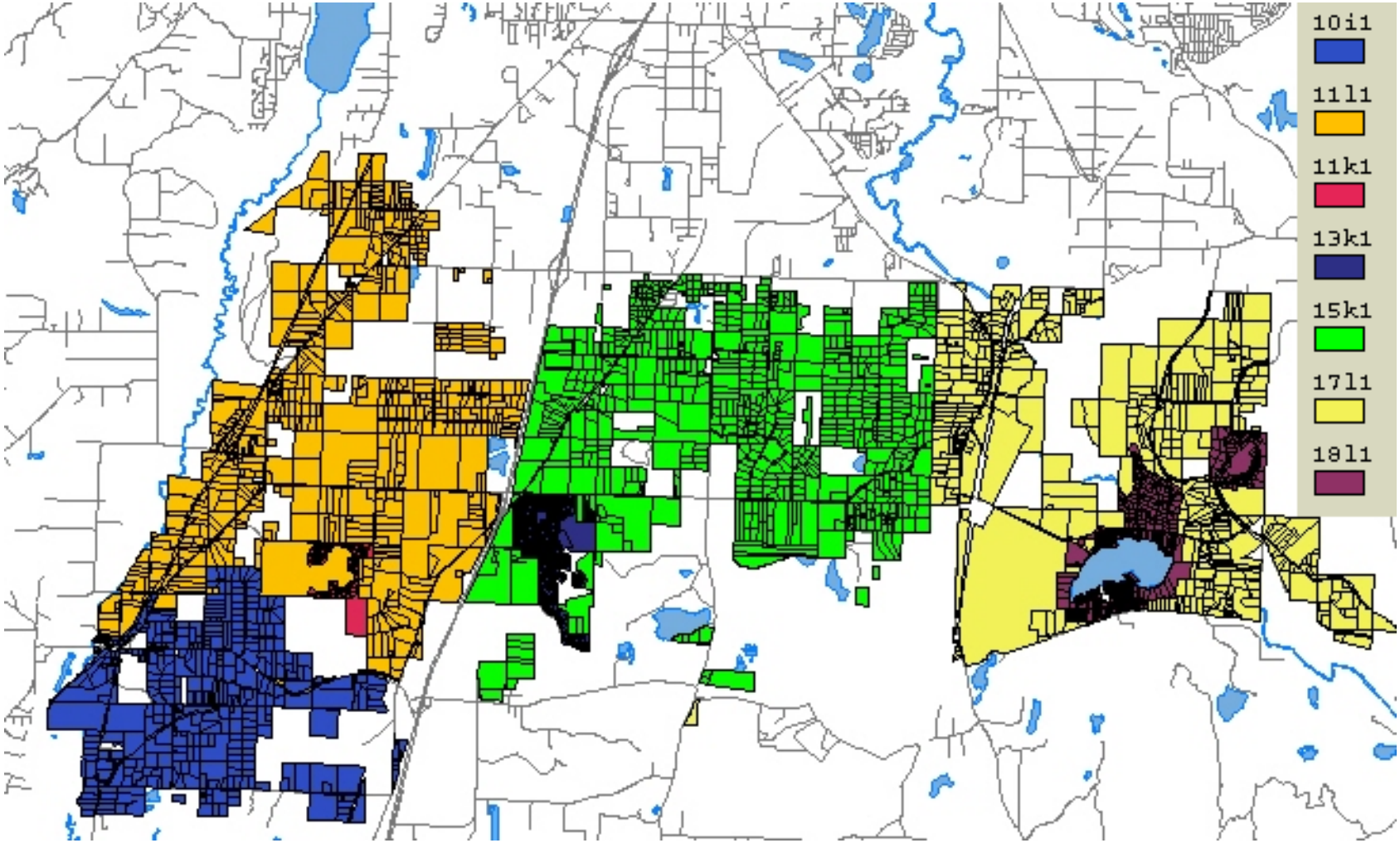
REGION 08 NEIGHBORHOOD MAP



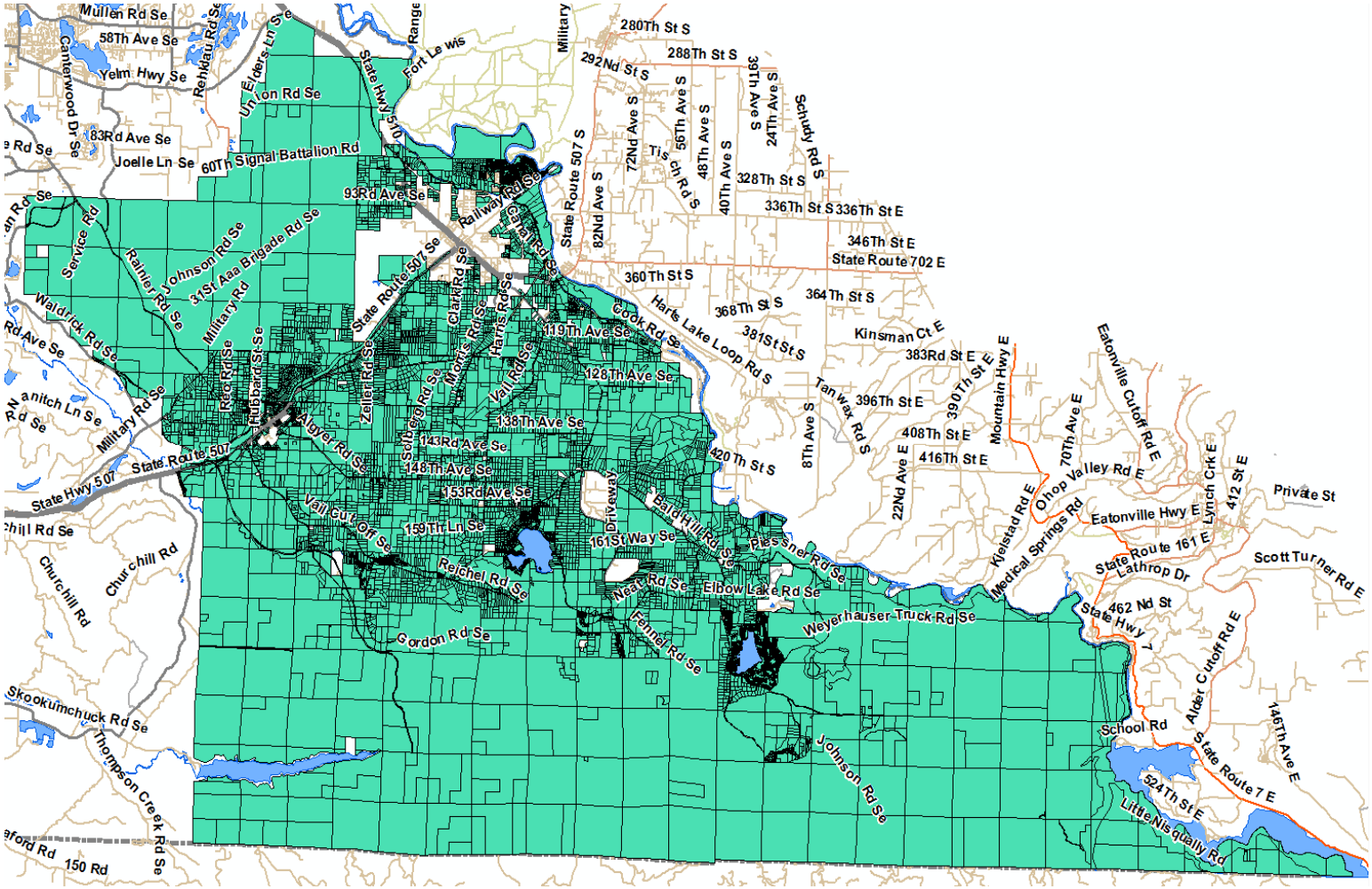
REGION 09 MAP



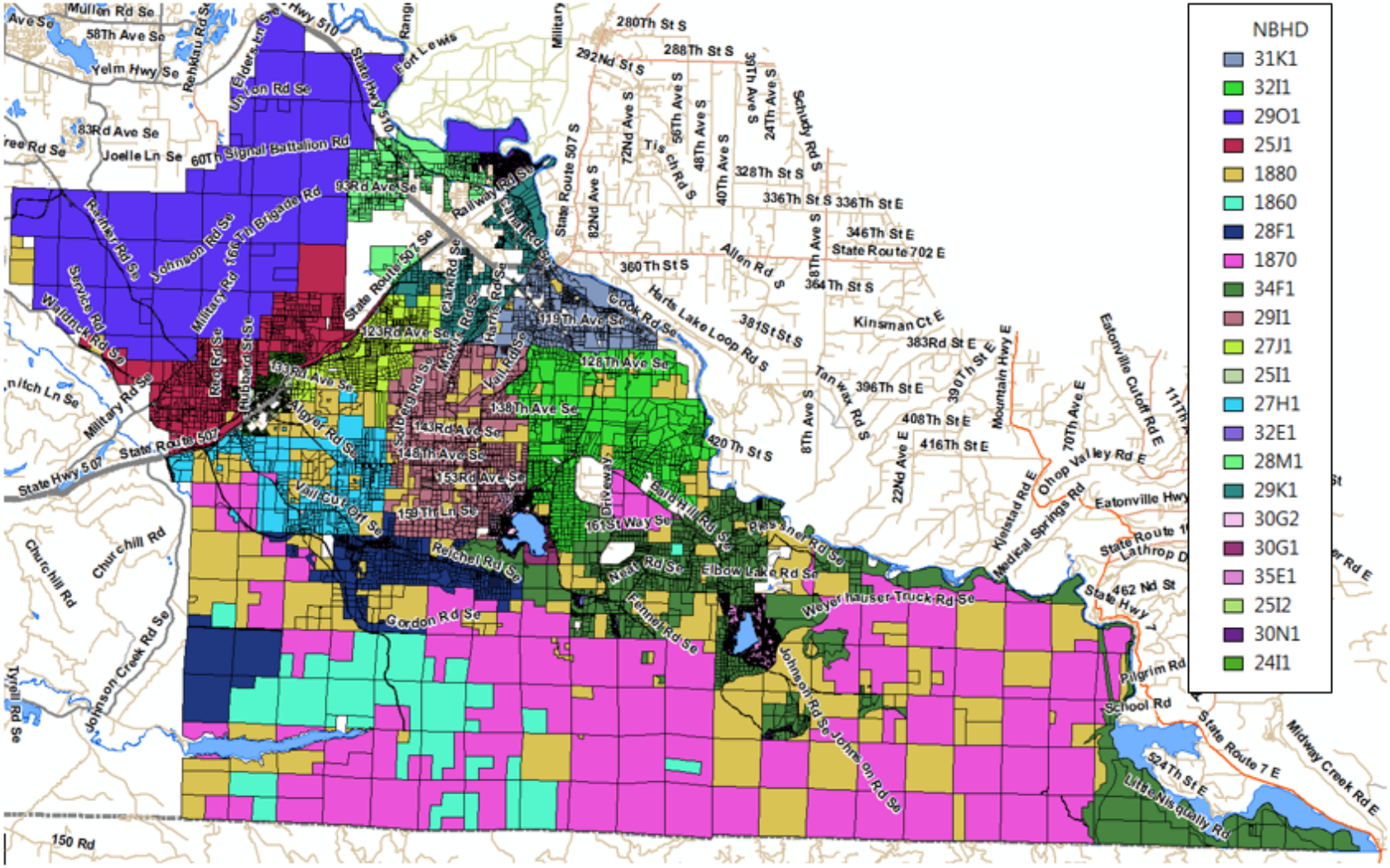
REGION 09 NEIGHBORHOOD MAP



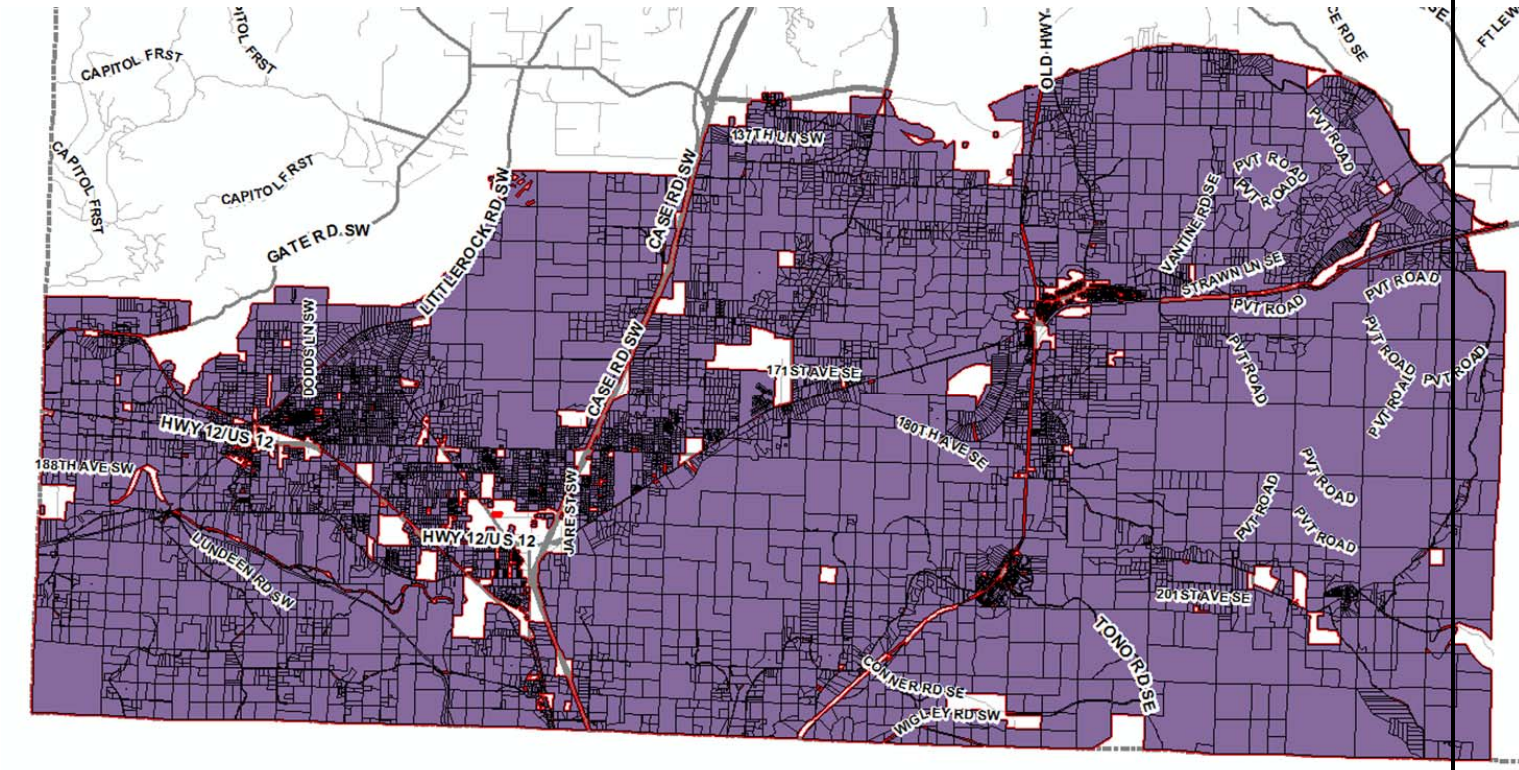
REGION 10 MAP



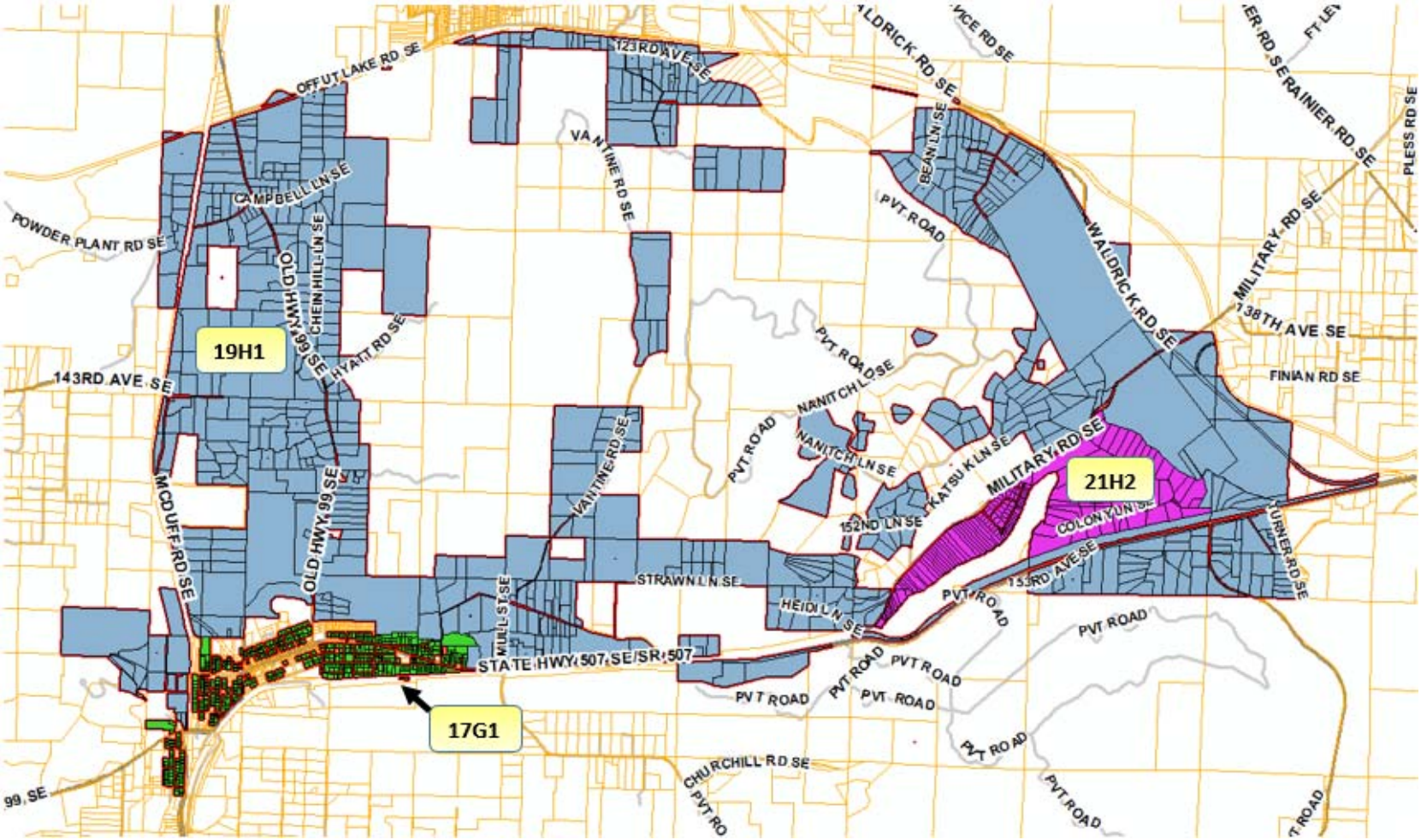
REGION 10 NEIGHOBORHOOD MAP



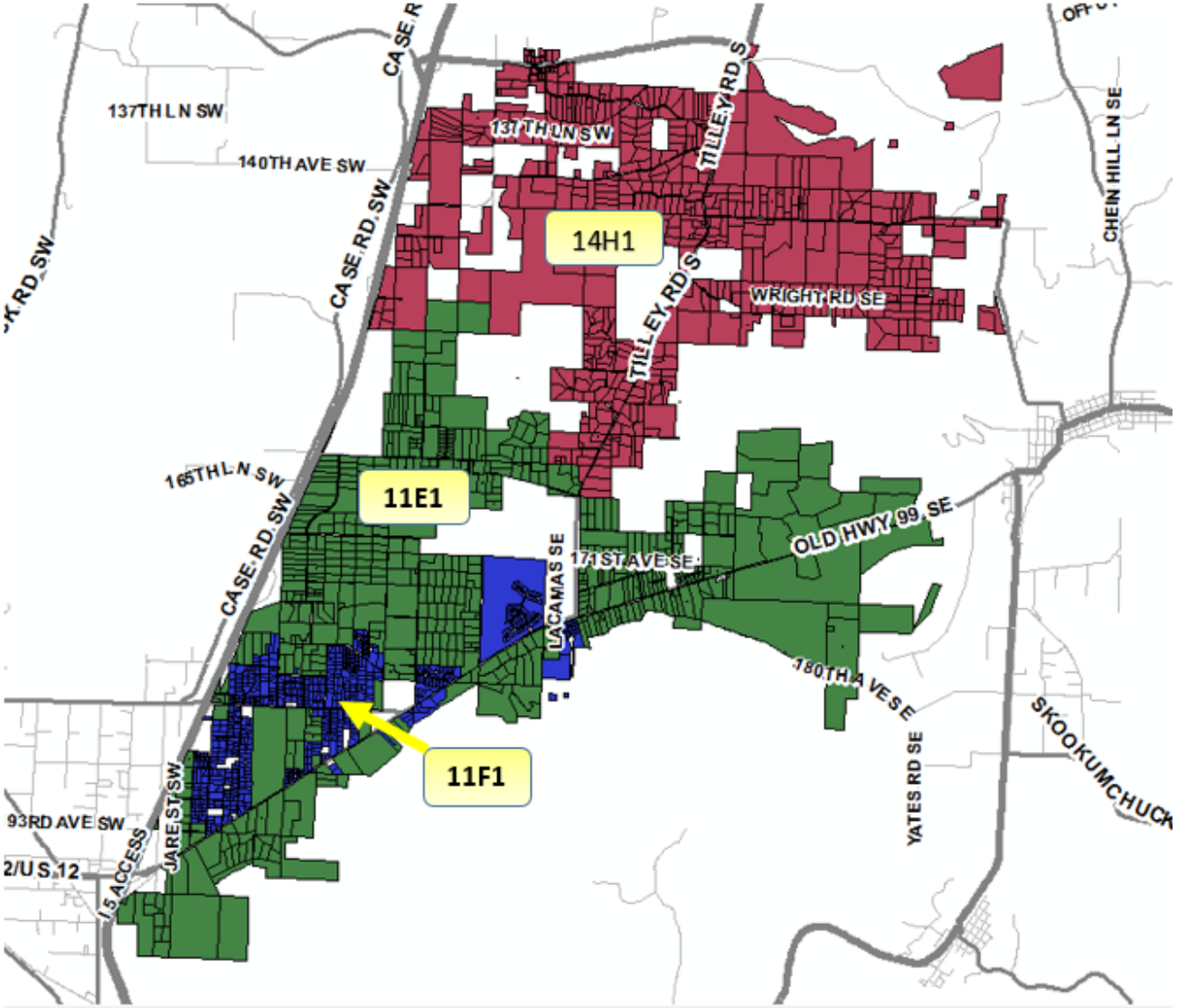
REGION 11 MAP



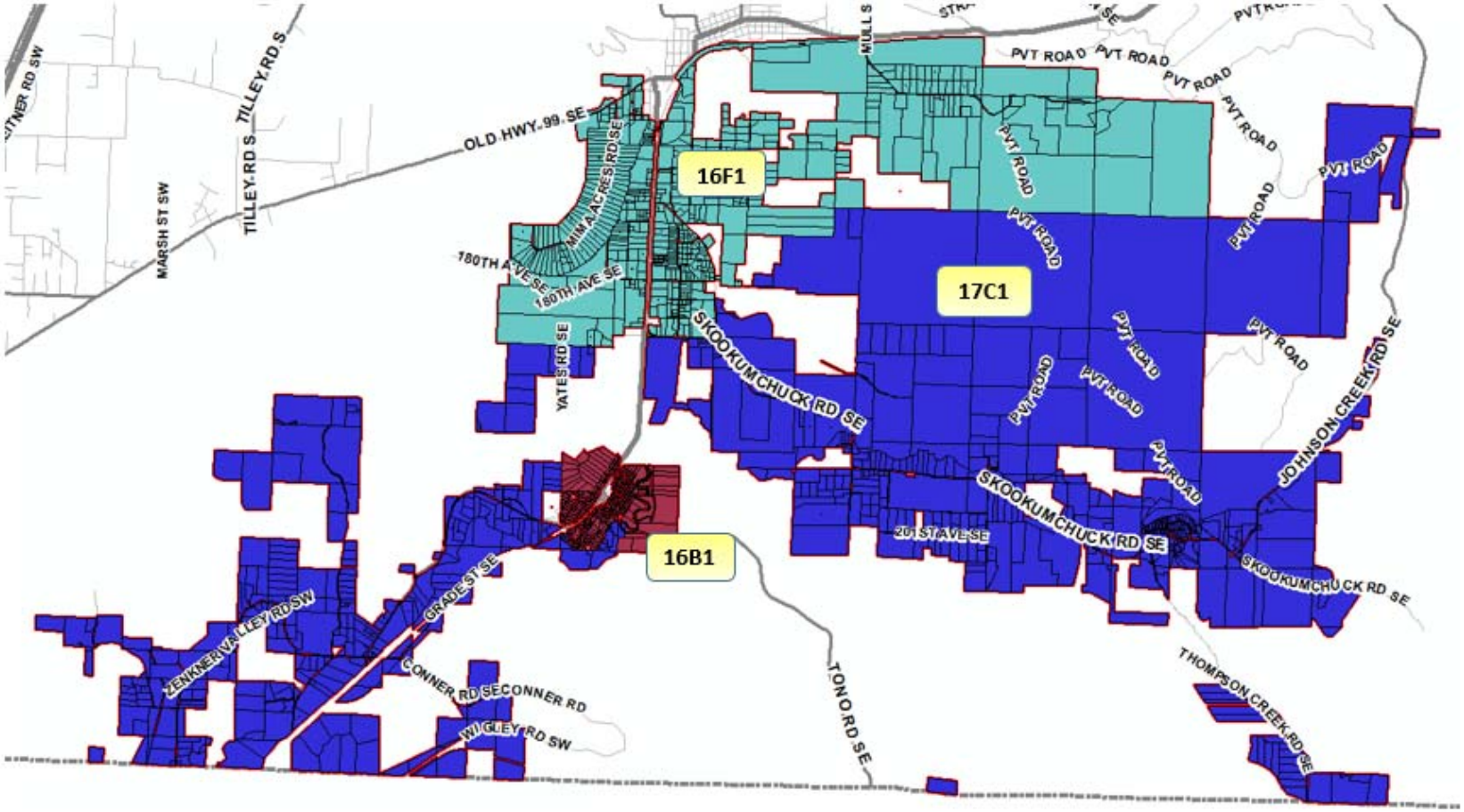
REGION 11 EAST CENTRAL NEIGHBORHOODS



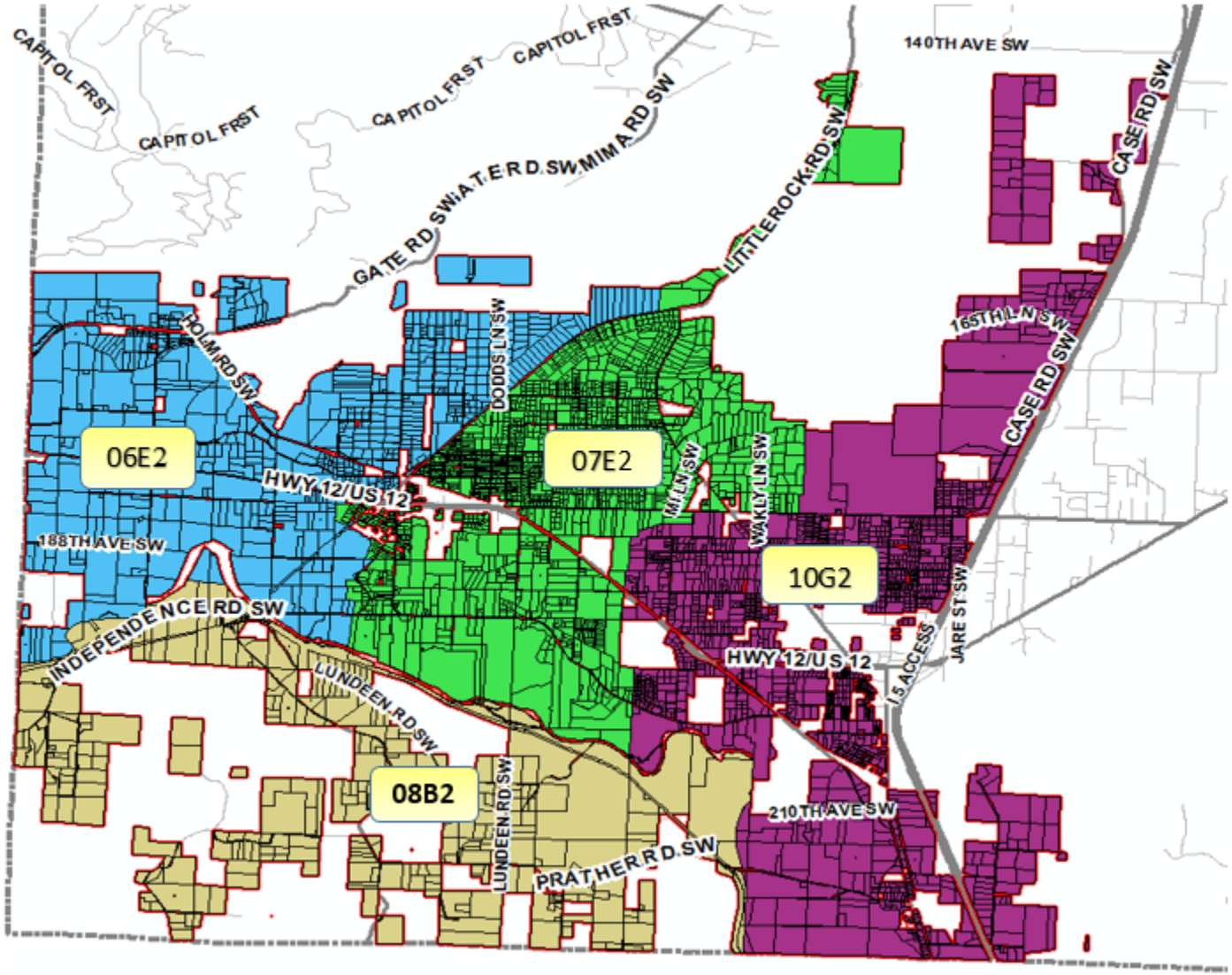
REGION 11 SE CENTRAL



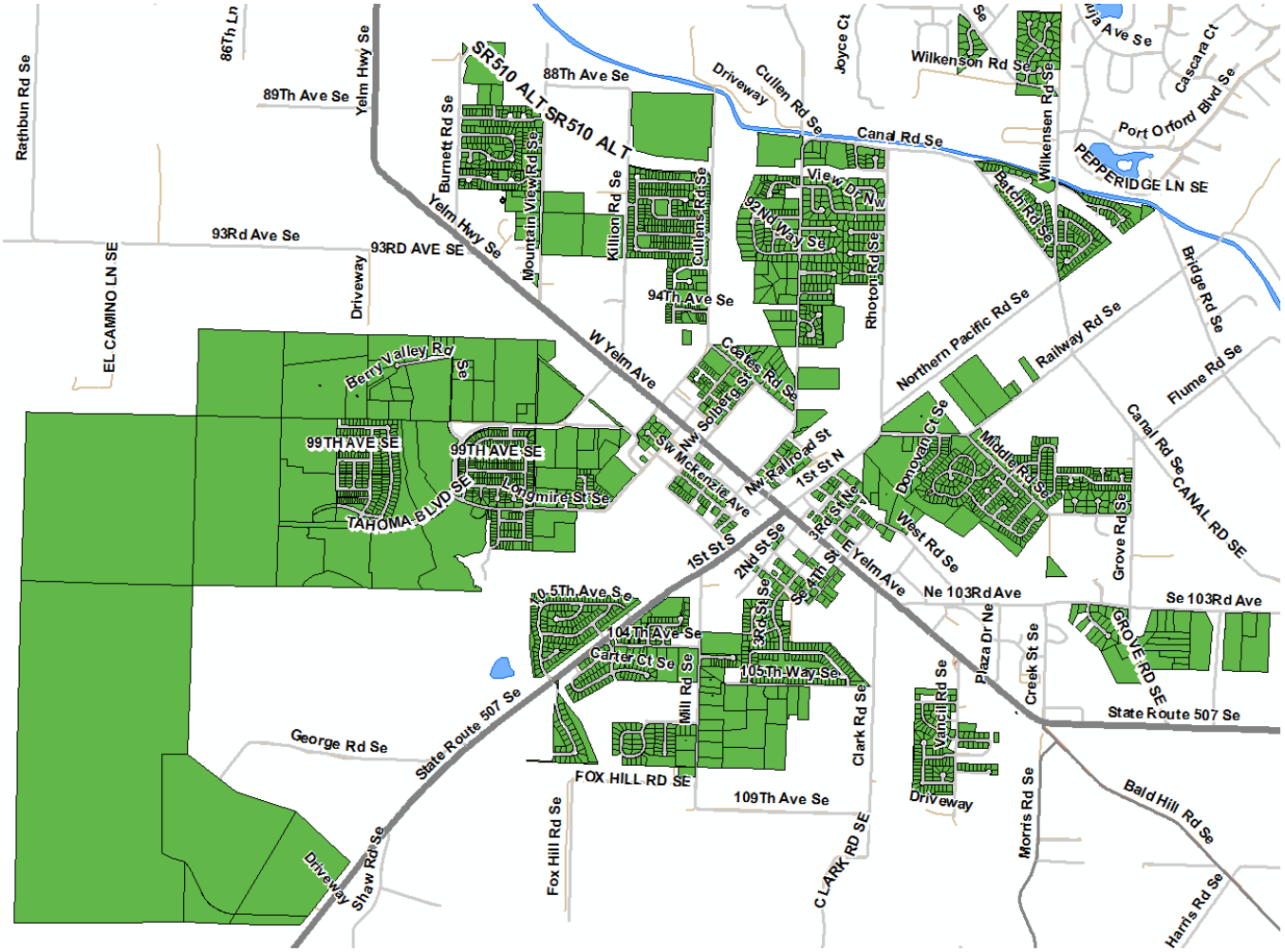
REGION 11 SOUTH CENTRAL



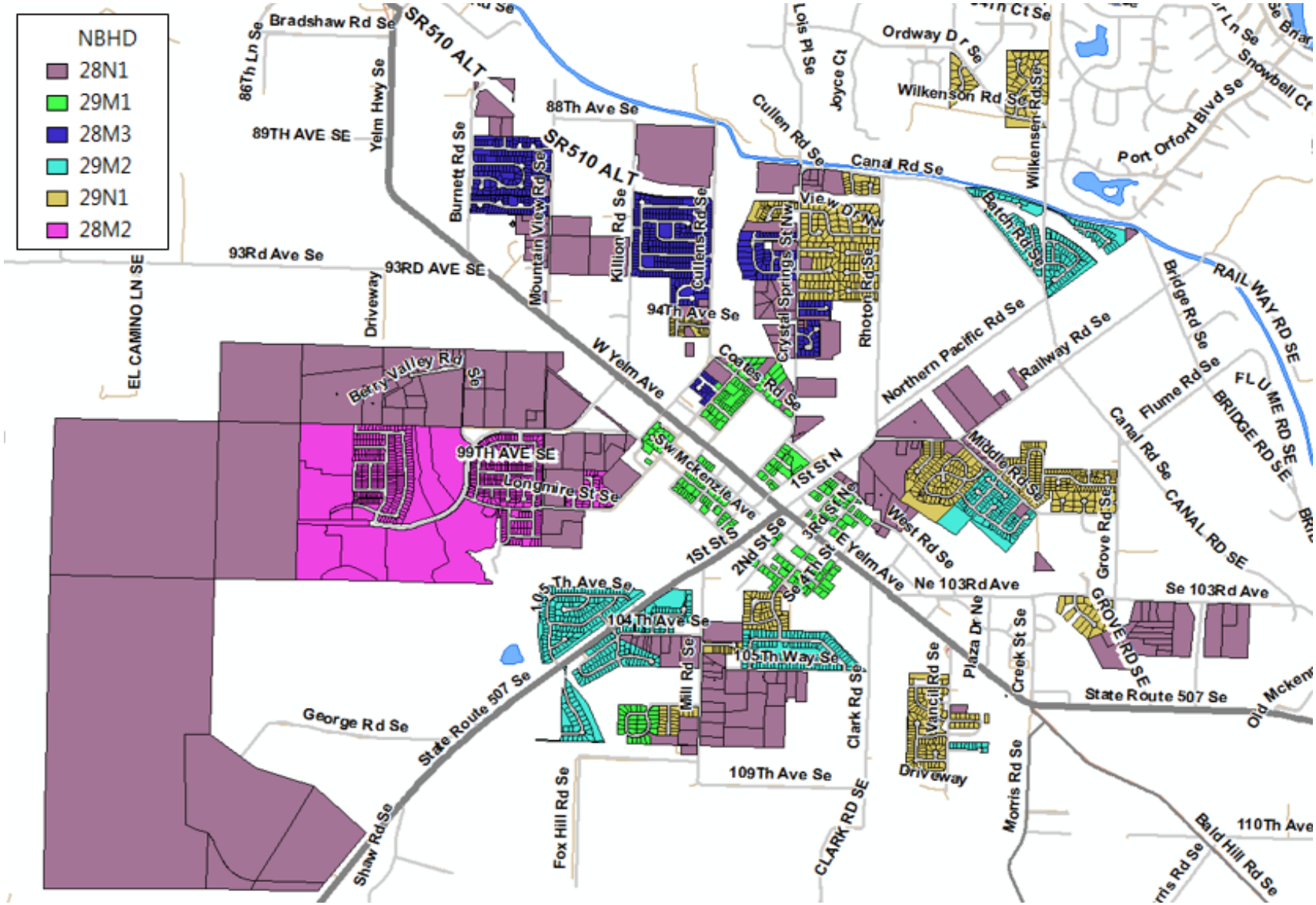
REGION 11 SOUTHWEST NEIGHBORHOODS



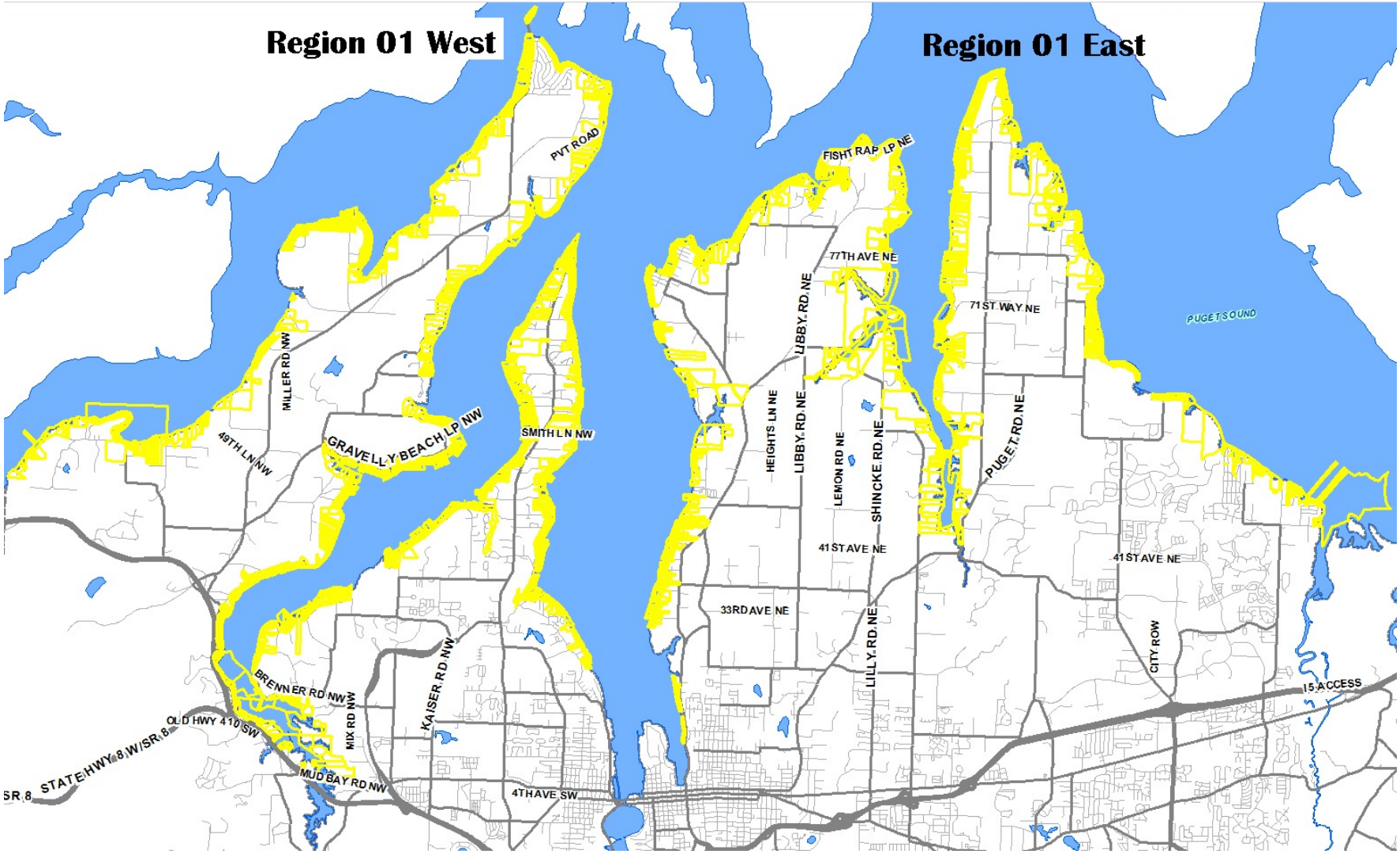
REGION 14 MAP



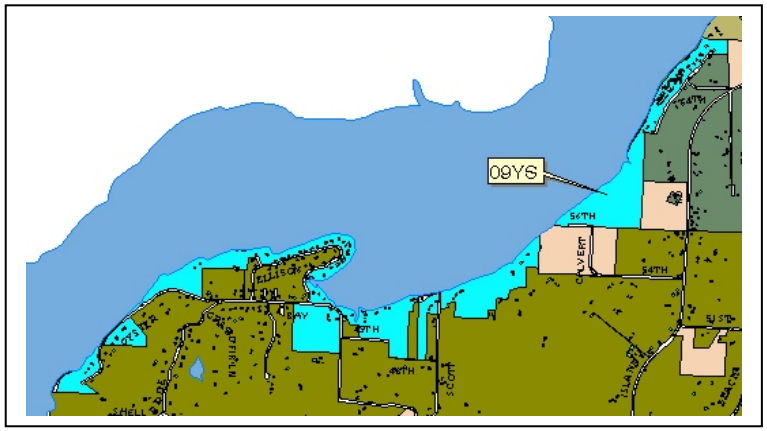
REGION 14 NEIGHBORHOOD MAP

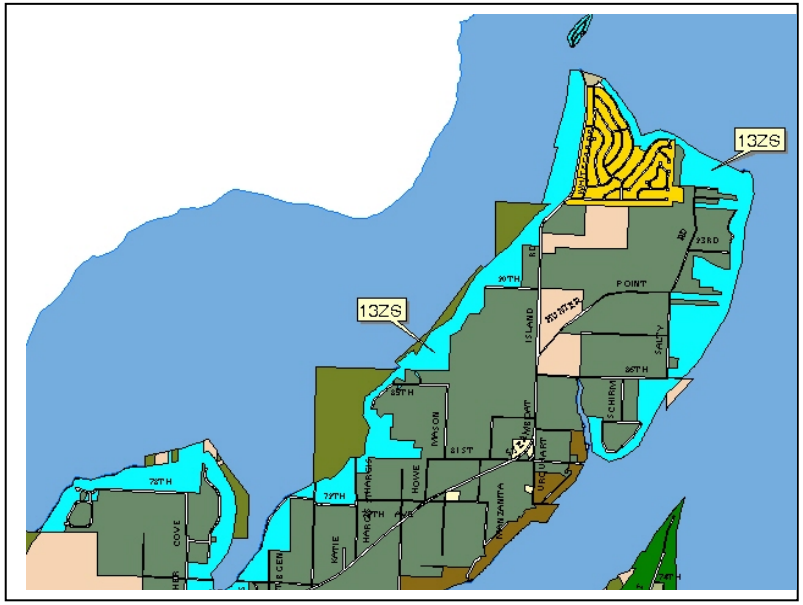


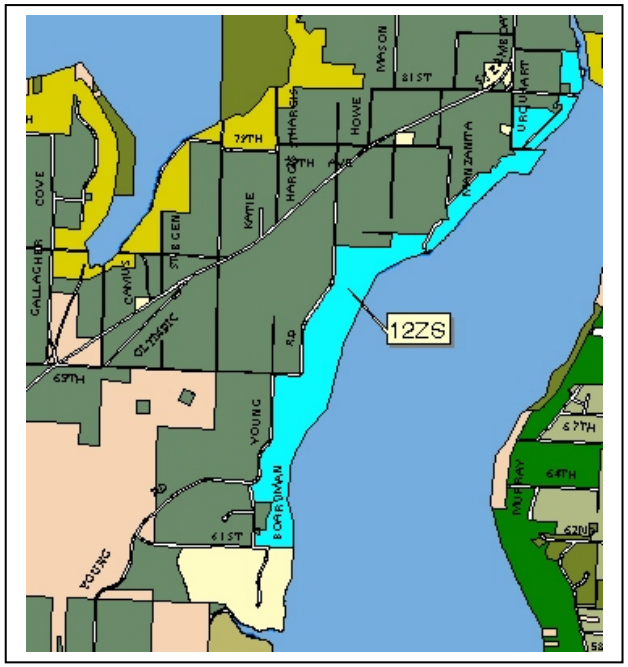
SALTWATER REGIONS 01



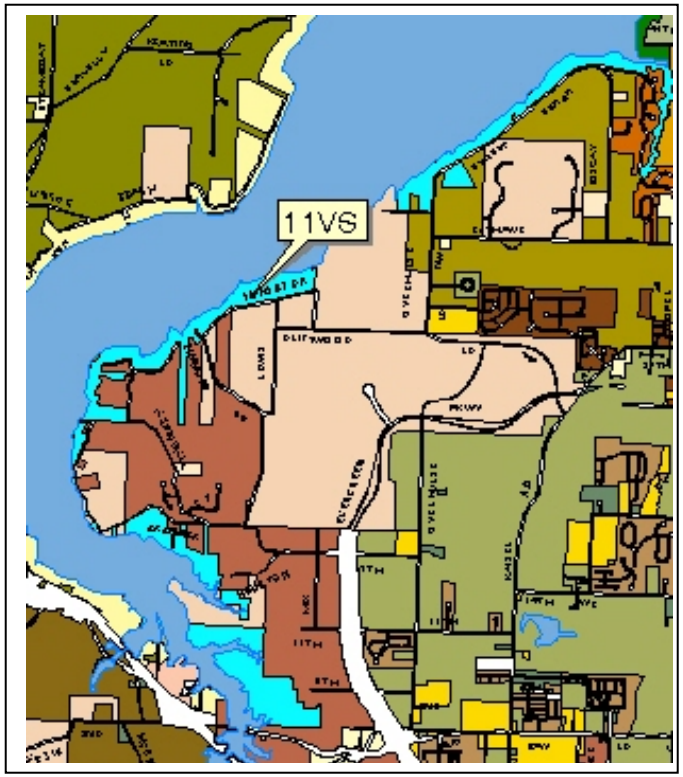
Saltwater Neighborhood Maps-Region 01West - Steamboat Island

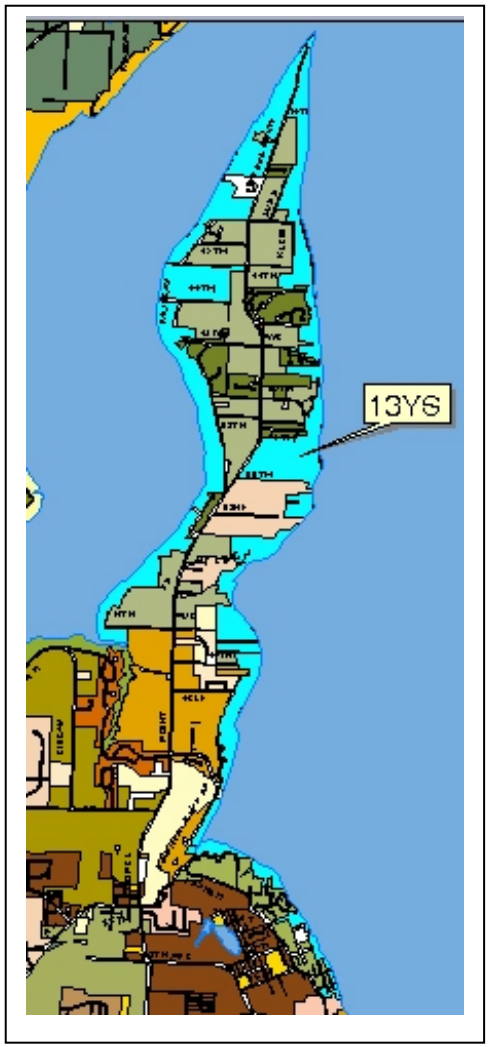




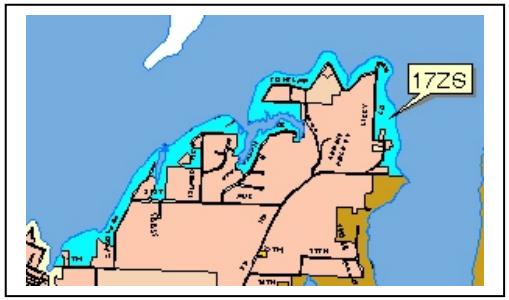


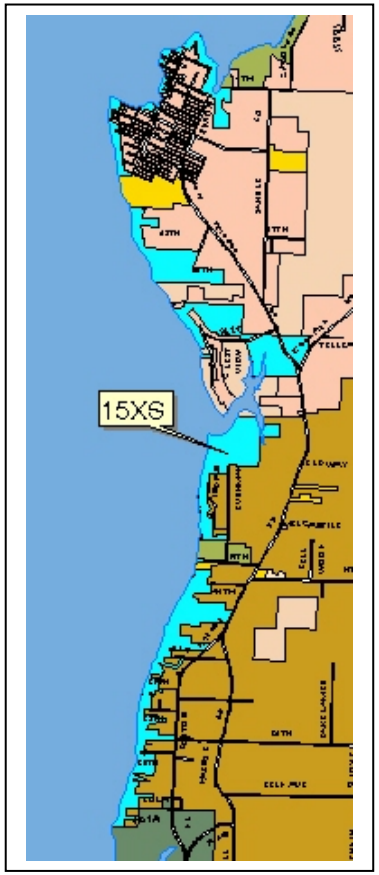
SaltWater Neighborhood Maps-Region 01 West - Cooper Point

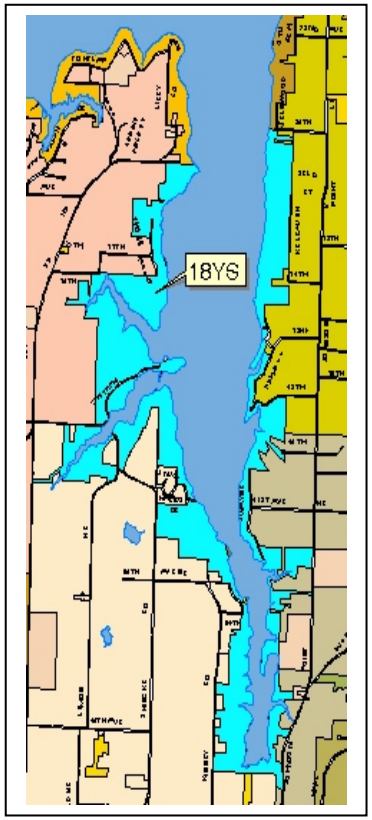


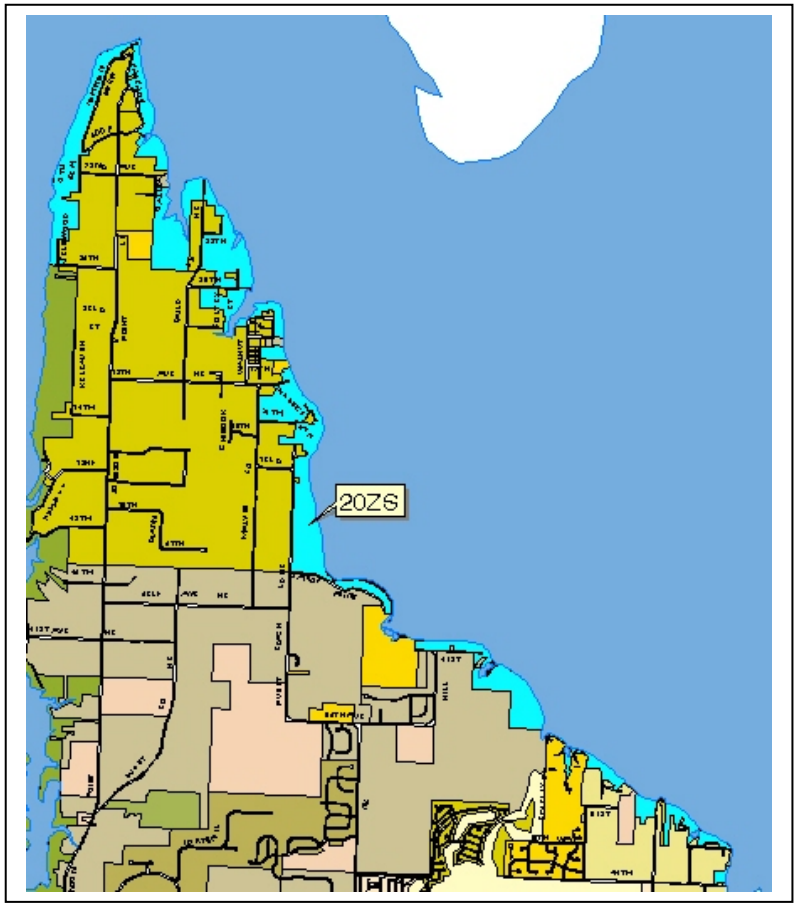


Saltwater Neighborhood Maps-Region 01 East - East Bay, Boston Harbor to Johnson Point

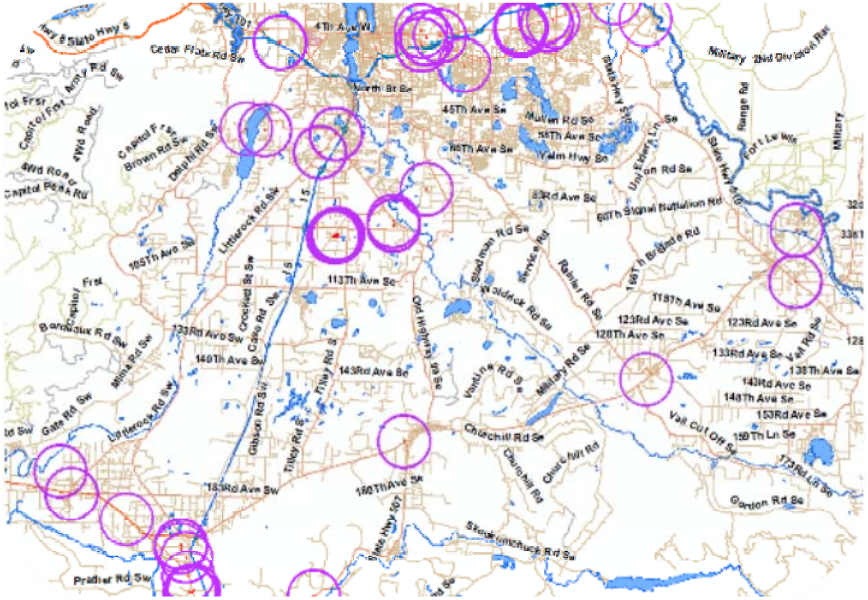




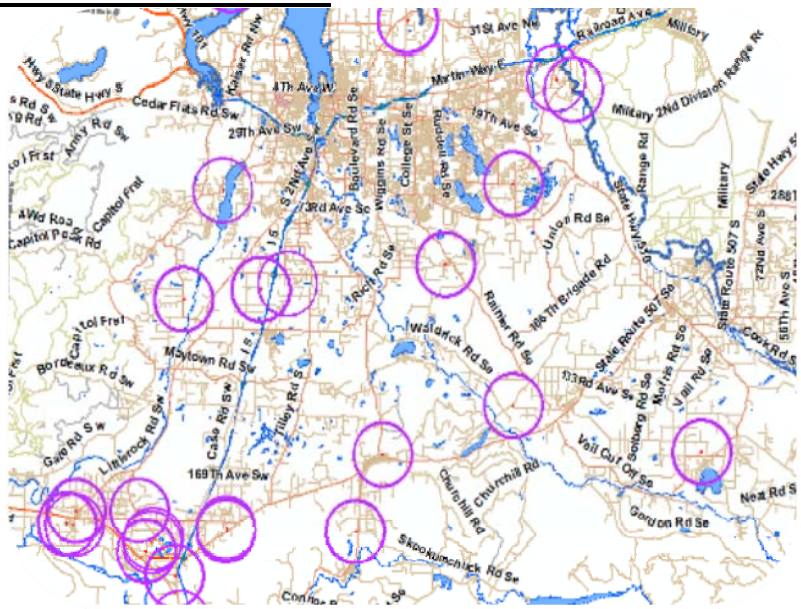




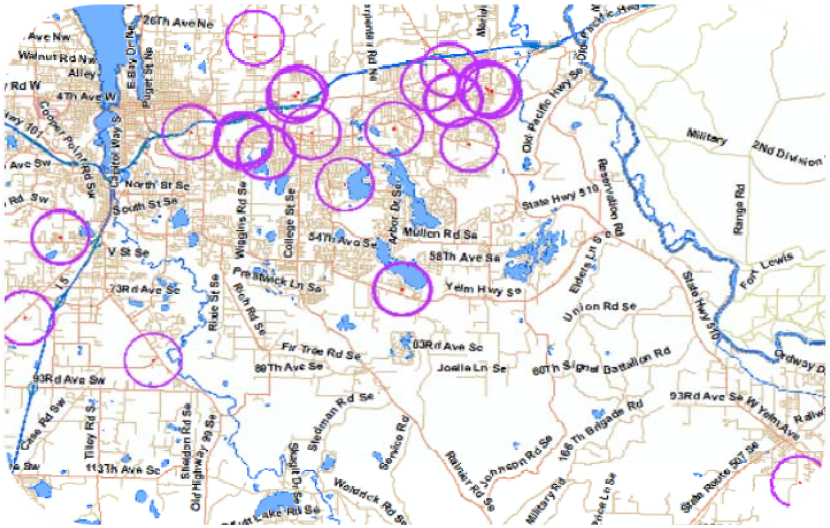
MANUFACTURED HOME PARKS



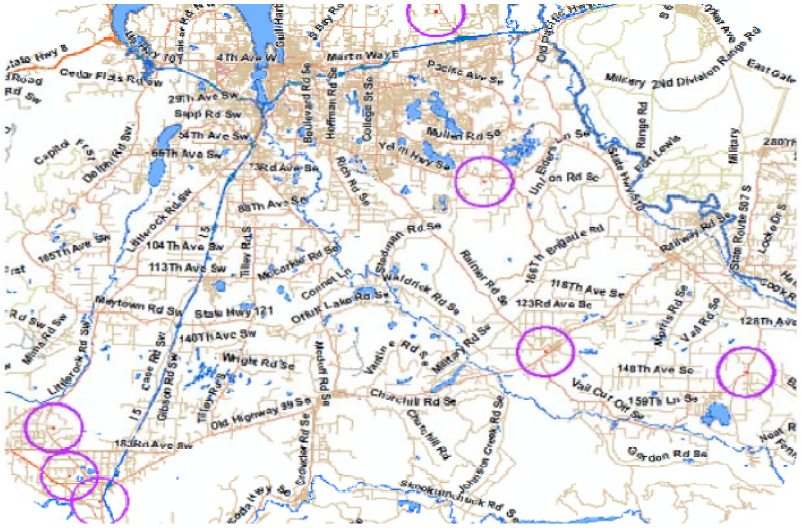
MHPR



MRFR

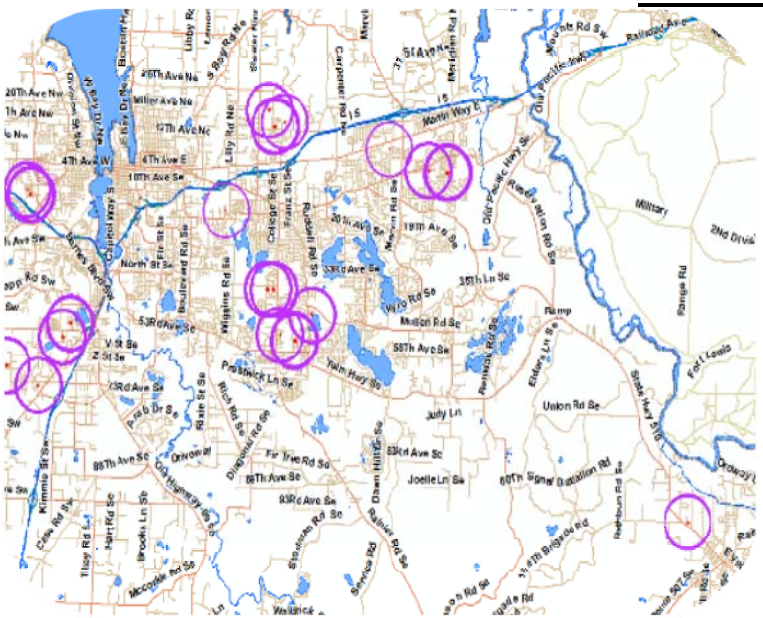


MUFR

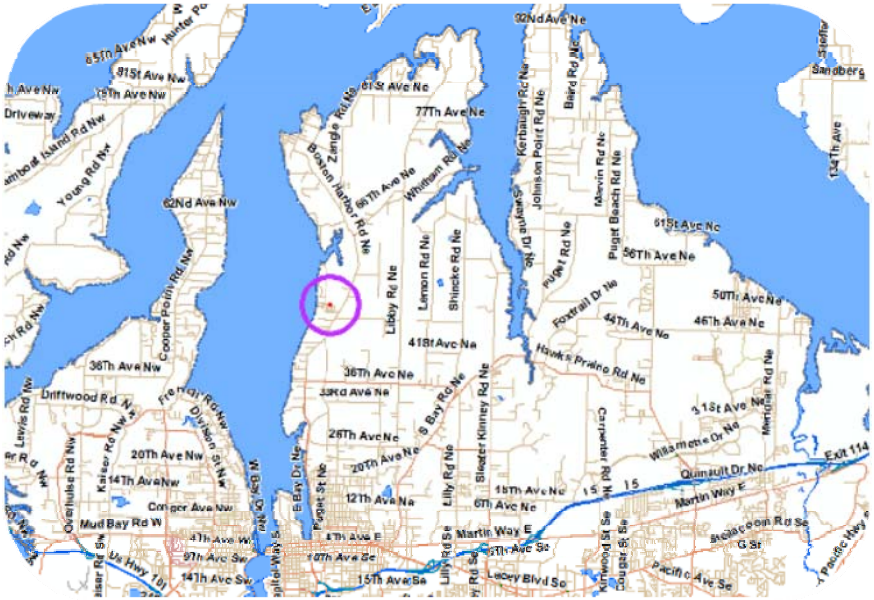


MRAV

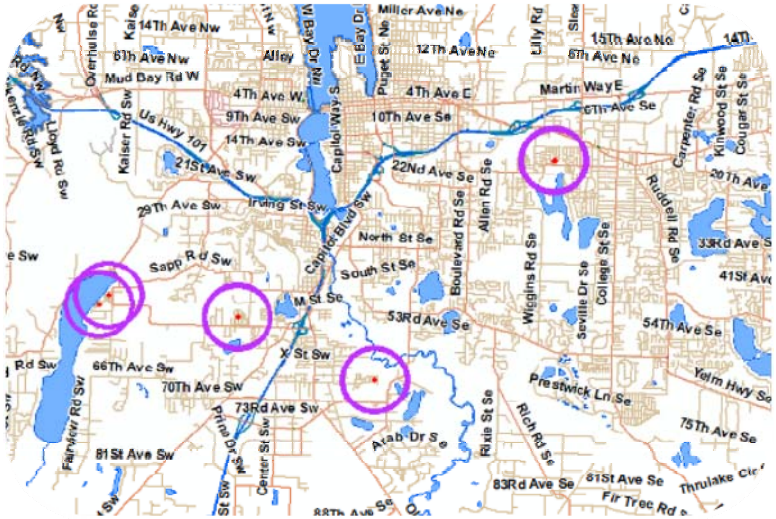
MANUFACTURED HOME PARKS



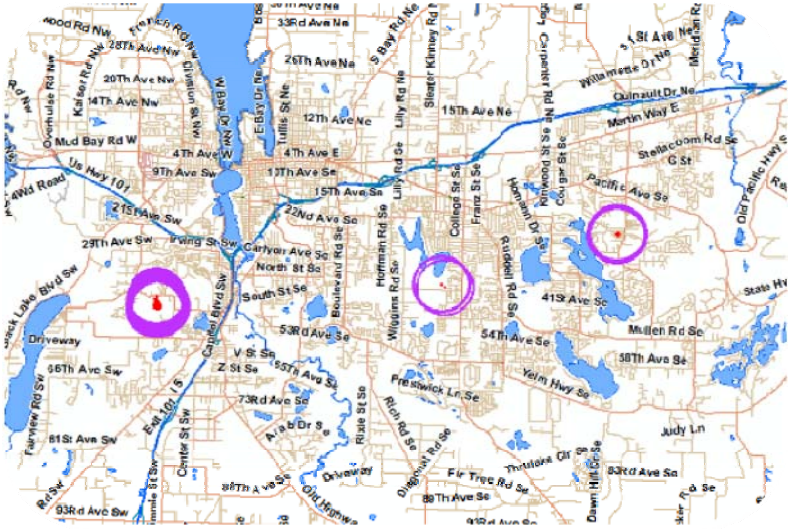
MUAV



MRGD

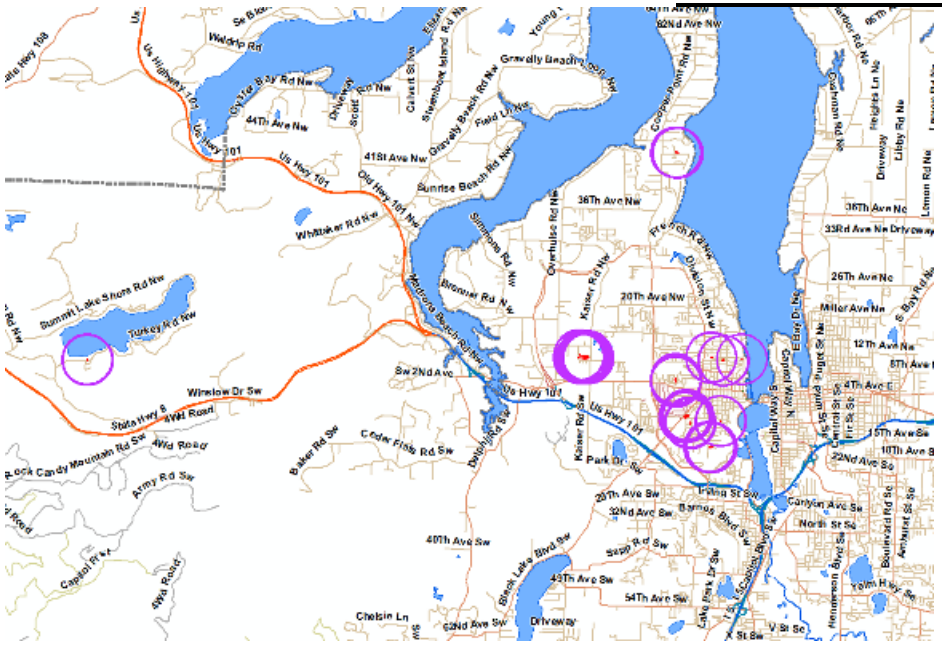


MUGD



MUEX

CONDOMINIUM NEIGHBORHOODS



CN01