WSACA Conference
June 15, 2010

STARS
Statistical Tool for Analytics and Ratio Studies

MARS
Modeling Analysis ReSource

Department of Revenue

STARS & MARS

- STARS and MARS are tools developed by the DOR for use by the Assessor's Offices

- Based on Excel they are templates that are automated through the use of Dynamic Named Ranges, Pivot Tables and Macro Programming.

- They can be used separately or in conjunction with each other.

- Information on these tools and other resources are available on the resource website set up for your use and located at **http://propertytax.dor.wa.gov**

Other Statistical Tools

- NCSS
- SPSS (PASW Statistics, now owned by IBM)
- SAS

- AM Statistical
- R
- OpenStat
- Gnumeric
- MicrOsiris
- Open Office with Statistical Tool

Other Statistical Tools

- MRA- multiple regression analysis using statistical tools

	A	B	C	D	E	F	G	H	I
1	SUMMARY OUTPUT								
2									
3	*Regression Statistics*								
4	Multiple R	0.469337405							
5	R Square	0.220277599							
6	Adjusted R Squar	0.155866175							
7	Standard Error	61606.94036							
8	Observations	200							
9									
10	ANOVA								
11		*df*	*SS*	*MS*	*F*	*Significance F*			
12	Regression	15	1.98363E+11	13224220261	3.733137759	9.73903E-06			
13	Residual	185	7.02152E+11	3795415100					
14	Total	200	9.00515E+11						
15									
16		*Coefficients*	*Standard Error*	*t Stat*	*P-value*	*Lower 95%*	*Upper 95%*	*Lower 95.0%*	*Upper 95.0%*
17	Intercept	-469965.1336	1199961.722	-0.391650104	0.695767516	-2837333.5	1897403.233	-2837333.5	1897403.233
18	PropClass	-1332.025537	1910.327009	-0.697276189	0.486505288	-5100.8522	2436.801126	-5100.8522	2436.801126
19	Nbrhood	5600.009299	2262.580383	2.475054297	0.014221533	1136.232557	10063.78604	1136.232557	10063.78604
20	Acreage	830.5740669	502.9786464	1.651310792	0.100371583	-161.7373669	1822.885501	-161.7373669	1822.885501
21	FrontFoot	11.22630951	14.59041725	0.769430327	0.442619166	-17.55868556	40.01130457	-17.55868556	40.01130457
22	Bank	-3473.787414	4018.206392	-0.864511943	0.388426285	-11401.18587	4453.611044	-11401.18587	4453.611044
23	Topography	-5160.160884	3660.998549	-1.409495474	0.160367512	-12382.83474	2062.512971	-12382.83474	2062.512971
24	ViewQuality	2836.739711	7347.373585	0.386088944	0.699874445	-11658.67251	17332.15193	-11658.67251	17332.15193
25	Privacy	0	0	65535	#NUM!	0	0	0	0

Other Statistical Tools

- MRA- multiple regression analysis using statistical tools

Regression

[$DataSet] C:\MichaelDahle_SPSS\2004SaltwaterMod.sav

Variables Entered/Removed

Model	Variables Entered	Variables Removed	Method
1	GD Good, imprvd, SM Med Bank, FR Fair, VV VGd View, ST Steep, depth10, LG Lagoon, region02W, front75, EV Exc View, SH High Bank, region02E, LV Lmt View[a]	.	Enter

a. All requested variables entered.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.848[a]	.718	.703	768.88482

a. Predictors: (Constant), GD Good, imprvd, SM Med Bank, FR Fair, VV VGd View, ST Steep, depth10, LG Lagoon, region02W, front75, EV Exc View, SH High Bank, region02E, LV Lmt View

b. Dependent Variable: trndsppff

ANOVA[b]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.829E8	14	2.735E7	46.262	.000[a]
	Residual	1.502E8	254	591183.859		
	Total	5.331E8	268			

a. Predictors: (Constant), GD Good, imprvd, SM Med Bank, FR Fair, VV VGd View, ST Steep, depth10, LG Lagoon, region02W, front75, EV Exc View, SH High Bank, region02E, LV Lmt View

b. Dependent Variable: trndsppff

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	-1709.583	996.910		-1.715	.088
	front75	73829.104	5057.898	.562	14.597	.000

a. Dependent Variable: trndsppff

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	depth10	1027.042	514.620	.074	1.996	.047
	region02E	142.007	139.620	.044	1.017	.310
	region02W	-412.942	117.885	-.143	-3.503	.001
	LV Lmt View	-260.915	160.807	-.078	-1.623	.106
	VV VGd View	84.899	128.384	.028	.661	.509
	EV Exc View	533.120	145.692	.153	3.659	.000
	LG Lagoon	-563.764	198.108	-.126	-2.846	.005
	SM Med Bank	-345.922	118.374	-.114	-2.922	.004
	SH High Bank	-687.614	131.350	-.221	-5.235	.000
	ST Steep	-413.242	220.929	-.065	-1.870	.063
	imprvd	403.658	124.053	.119	3.254	.001
	FR Fair	-816.919	331.374	-.086	-2.465	.014
	GD Good	771.412	143.544	.215	5.374	.000

a. Dependent Variable: trndsppff

Residuals Statistics[a]

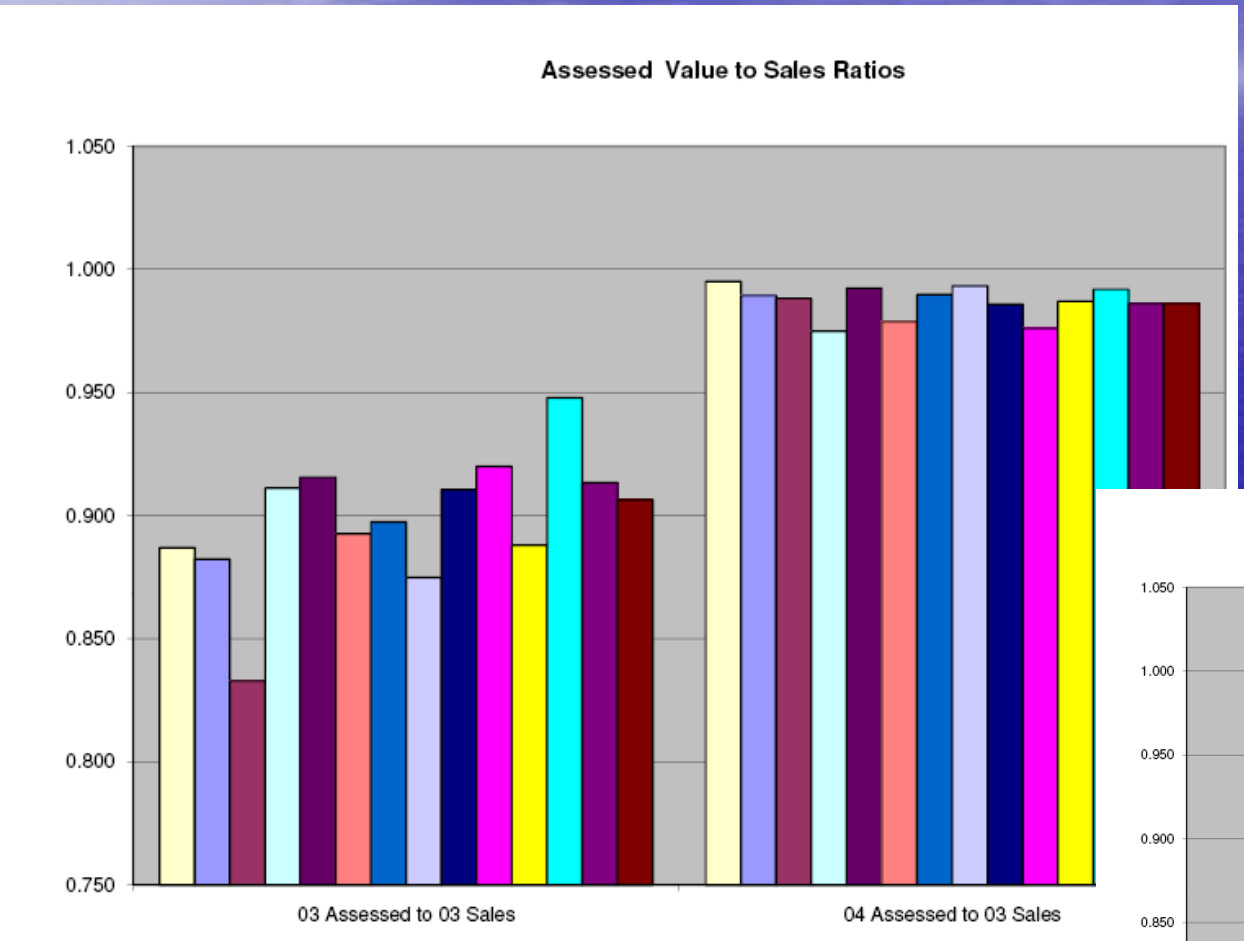
	Minimum	Maximum	Mean	Std. Deviation	N
Predicted Value	-650.9409	5780.3413	2369.0482	1195.28585	269
Residual	-2141.74683	3036.08862	.00000	748.53264	269
Std. Predicted Value	-2.527	2.854	.000	1.000	269
Std. Residual	-2.786	3.949	.000	.974	269

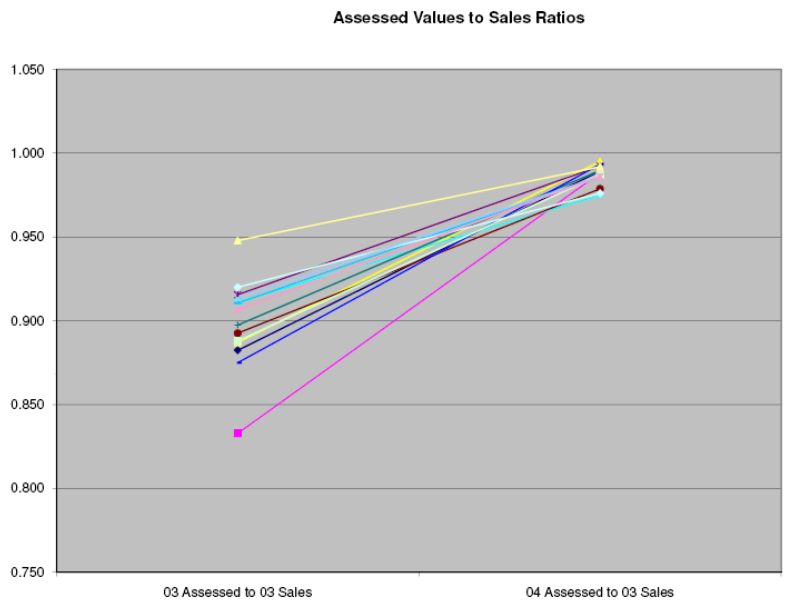
a. Dependent Variable: trndsppff

Some of the Goals for STARS & MARS

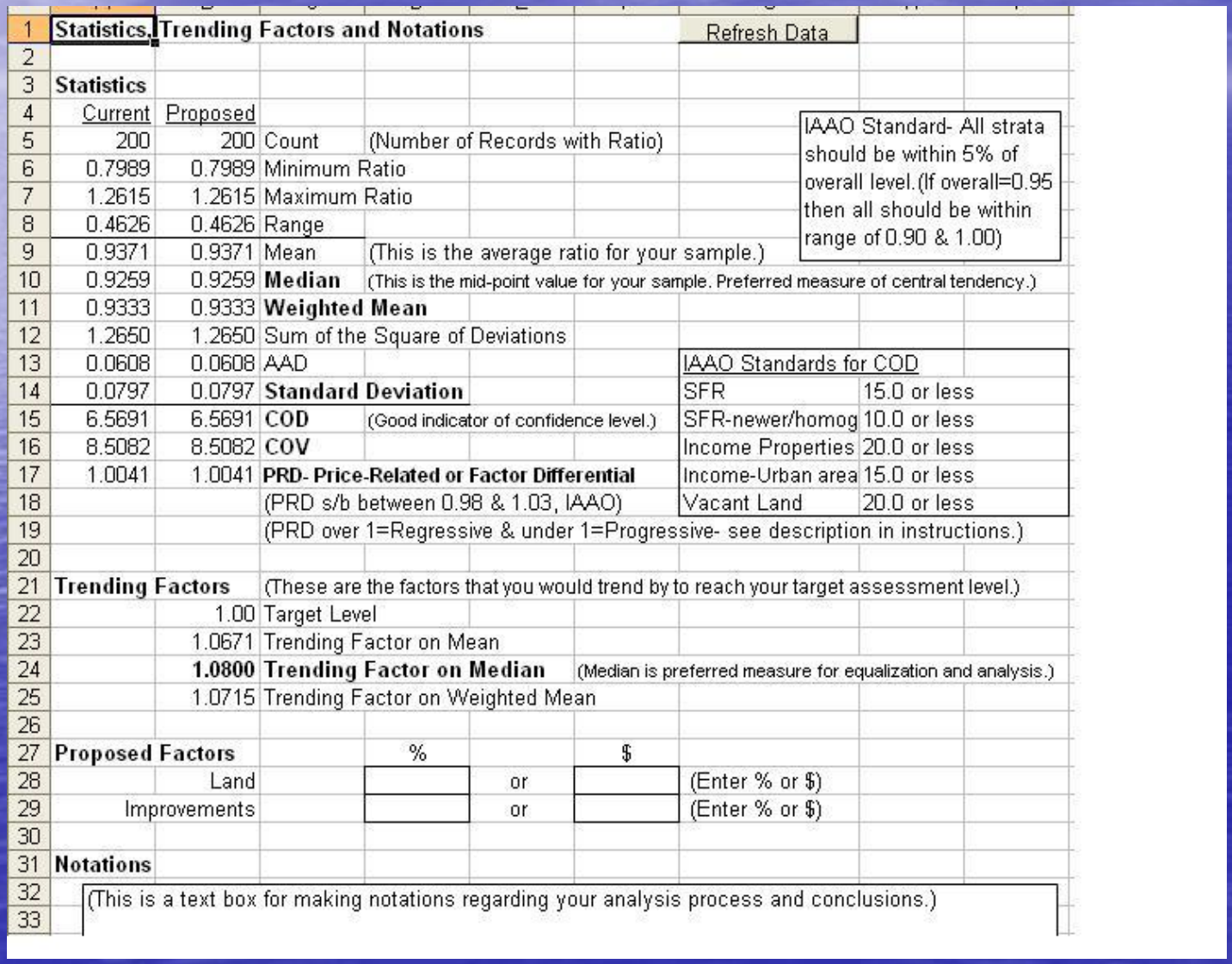
- Provide practical tools to assist with mass appraisal
- Provide tools that could be used outside of the primary (CAMA) software
- Provide solutions based on an available platform
- Provide tools for a straightforward approach
- Usable by all counties (with any staffing level)
- Bridge the gap between textbook theories and practical application
- Provide analysis and modeling approaches that are more conducive to being explained to staff, the public and the BOE

A Primary Goal of Analysis & Modeling
(of STARS, MARS and mass appraisal)
Increased Equity and Uniformity





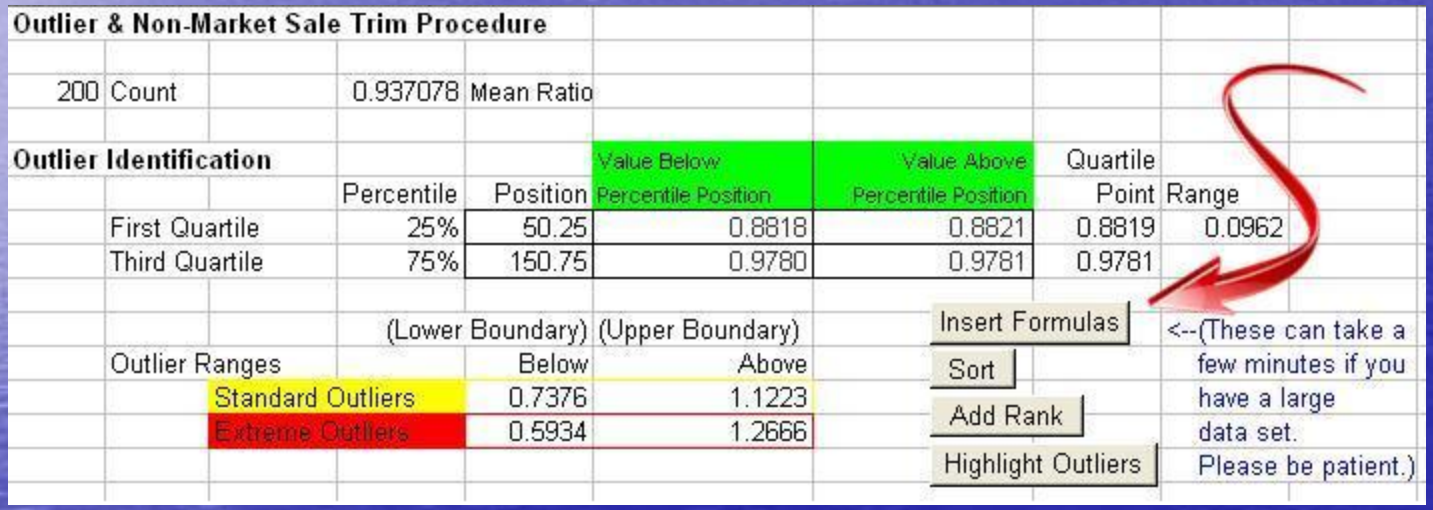
STARS – Statistical Tool for Analytics and Ratio Studies



1	**Statistics, Trending Factors and Notations**					Refresh Data	
2							
3	**Statistics**						
4	Current	Proposed					
5	200	200	Count	(Number of Records with Ratio)			
6	0.7989	0.7989	Minimum Ratio				
7	1.2615	1.2615	Maximum Ratio				
8	0.4626	0.4626	Range				
9	0.9371	0.9371	Mean	(This is the average ratio for your sample.)			
10	0.9259	0.9259	**Median**	(This is the mid-point value for your sample. Preferred measure of central tendency.)			
11	0.9333	0.9333	**Weighted Mean**				
12	1.2650	1.2650	Sum of the Square of Deviations				
13	0.0608	0.0608	AAD			IAAO Standards for COD	
14	0.0797	0.0797	**Standard Deviation**			SFR	15.0 or less
15	6.5691	6.5691	**COD**	(Good indicator of confidence level.)		SFR-newer/homog	10.0 or less
16	8.5082	8.5082	**COV**			Income Properties	20.0 or less
17	1.0041	1.0041	**PRD- Price-Related or Factor Differential**			Income-Urban area	15.0 or less
18			(PRD s/b between 0.98 & 1.03, IAAO)			Vacant Land	20.0 or less
19			(PRD over 1=Regressive & under 1=Progressive- see description in instructions.)				
20							
21	**Trending Factors**		(These are the factors that you would trend by to reach your target assessment level.)				
22		1.00	Target Level				
23		1.0671	Trending Factor on Mean				
24		**1.0800**	**Trending Factor on Median**	(Median is preferred measure for equalization and analysis.)			
25		1.0715	Trending Factor on Weighted Mean				
26							
27	**Proposed Factors**			%		$	
28		Land			or		(Enter % or $)
29		Improvements			or		(Enter % or $)
30							
31	**Notations**						
32	(This is a text box for making notations regarding your analysis process and conclusions.)						
33							

IAAO Standard- All strata should be within 5% of overall level.(If overall=0.95 then all should be within range of 0.90 & 1.00)

STARS - Statistical Tool for Analytics and Ratio Studies



Outlier & Non-Market Sale Trim Procedure

200	Count	0.937078	Mean Ratio

Outlier Identification			Value Below	Value Above	Quartile	
	Percentile	Position	Percentile Position	Percentile Position	Point	Range
First Quartile	25%	50.25	0.8818	0.8821	0.8819	0.0962
Third Quartile	75%	150.75	0.9780	0.9781	0.9781	

	(Lower Boundary)	(Upper Boundary)
Outlier Ranges	Below	Above
Standard Outliers	0.7376	1.1223
Extreme Outliers	0.5934	1.2666

Insert Formulas

Sort

Add Rank

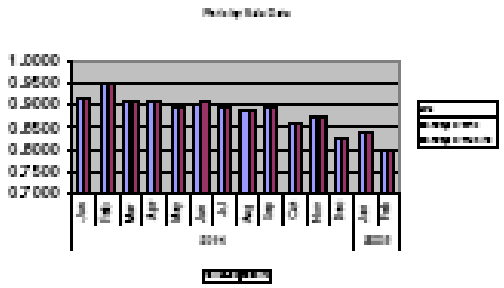
Highlight Outliers

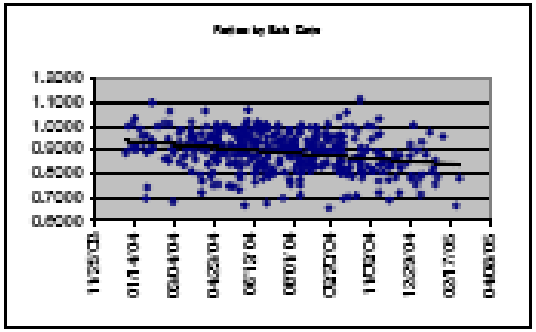
<--(These can take a few minutes if you have a large data set. Please be patient.)

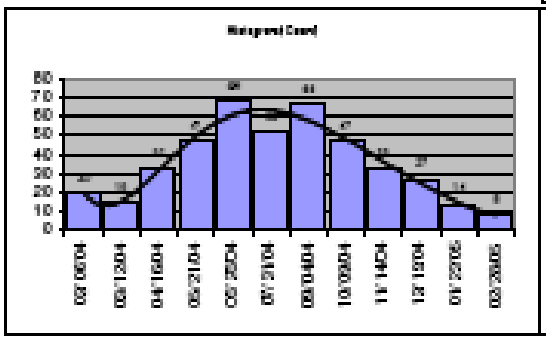
STARS - Statistical Tool for Analytics and Ratio Studies

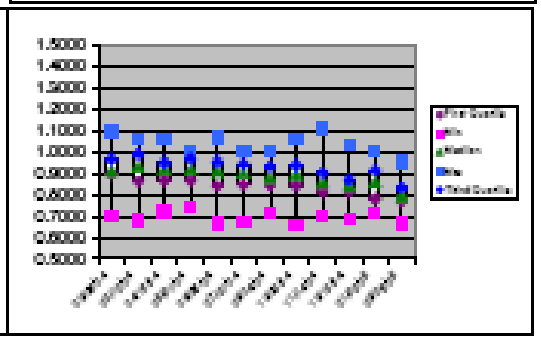
Statistical Tables and Charts for Sale Date

		Data		Count 429		Min 01/02/04		Median 07/20/04		Max 02/28/05	
Years	SaleDate	e of Ratio	PAVRatio	Bins/Strata	Count	Ratios					Notations
						First Quartile	Min	Median	Max	Third Quartile	
2004	Jan	0.9149	0.9149	01/01/04	0						
	Feb	0.9516	0.9516	02/05/04	20	0.9012	0.8968	0.9132	1.0285	0.9672	
	Mar	0.9087	0.9087	03/12/04	15	0.8639	0.6803	0.9330	1.0636	0.9914	
	Apr	0.9065	0.9065	04/16/04	32	0.8688	0.7212	0.9197	1.0552	0.9513	
	May	0.8959	0.8959	05/21/04	47	0.8684	0.7457	0.9193	1.0068	0.9715	
	Jun	0.9024	0.9089	06/26/04	68	0.8432	0.6680	0.9117	1.0691	0.9563	
	Jul	0.8918	0.8918	07/31/04	52	0.8477	0.6757	0.9042	1.0080	0.9460	
	Aug	0.8848	0.8848	09/04/04	66	0.8451	0.7114	0.8815	1.0044	0.9350	
	Sep	0.8939	0.8939	10/09/04	47	0.8446	0.6553	0.8951	1.0584	0.9386	
	Oct	0.8579	0.8579	11/14/04	33	0.8157	0.7030	0.8580	1.1134	0.9044	
	Nov	0.8716	0.8716	12/19/04	27	0.8164	0.6886	0.8444	1.0308	0.8712	
	Dec	0.8285	0.8285	01/23/05	14	0.7816	0.7152	0.8595	1.0053	0.9167	
2004 Total		0.8916	0.8925	02/28/05	8	0.7722	0.6650	0.7950	0.9550	0.8326	
2005	Jan	0.8400	0.8400								
	Feb	0.7994	0.7994								
2005 Total		0.8328	0.8328								
Grand Total		0.8893	0.8902								

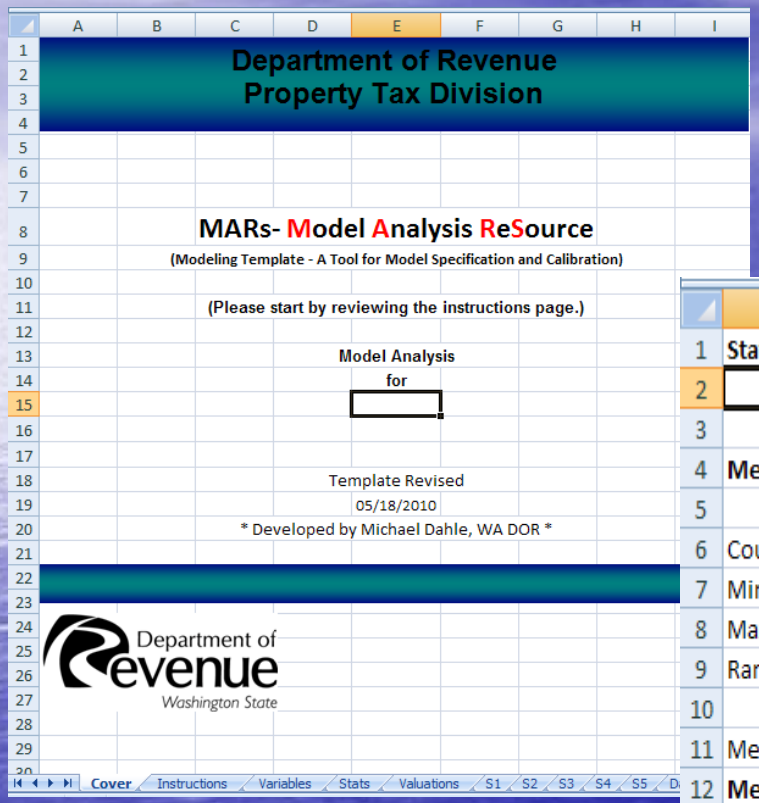








MARS - Modeling Analysis ReSource



Department of Revenue
Property Tax Division

MARs- Model Analysis ReSource

(Modeling Template - A Tool for Model Specification and Calibration)

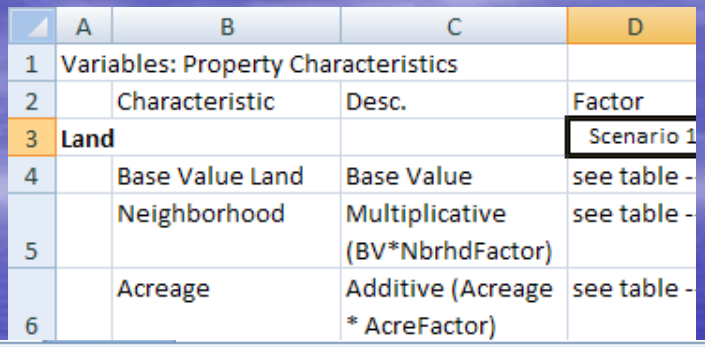
(Please start by reviewing the instructions page.)

Model Analysis
for

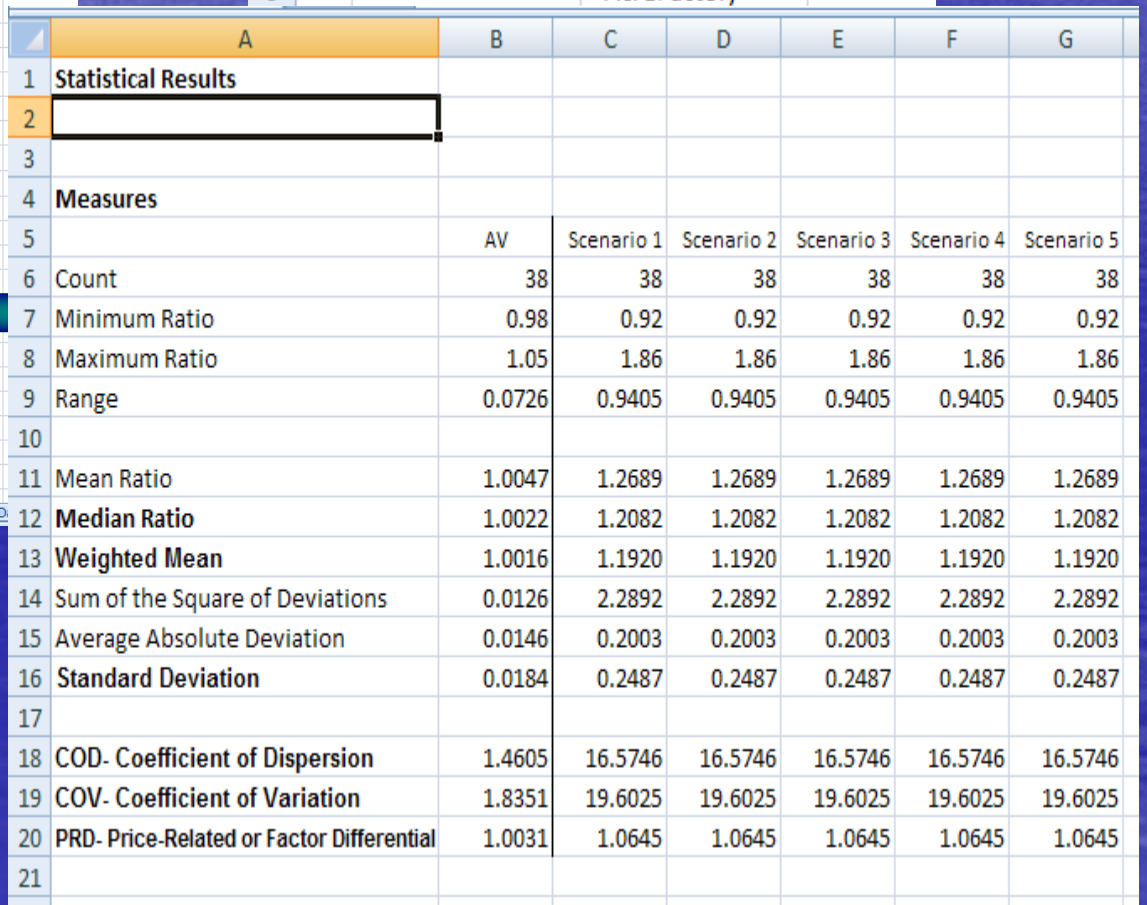
Template Revised
05/18/2010
* Developed by Michael Dahle, WA DOR *

Department of Revenue
Washington State

Cover | Instructions | Variables | Stats | Valuations | S1 | S2 | S3 | S4 | S5



	A	B	C	D
1	Variables: Property Characteristics			
2		Characteristic	Desc.	Factor
3	Land			Scenario 1
4		Base Value Land	Base Value	see table -
5		Neighborhood	Multiplicative (BV*NbrhdFactor)	see table -
6		Acreage	Additive (Acreage * AcreFactor)	see table -



	A	B	C	D	E	F	G
1	**Statistical Results**						
2							
3							
4	**Measures**						
5		AV	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5
6	Count	38	38	38	38	38	38
7	Minimum Ratio	0.98	0.92	0.92	0.92	0.92	0.92
8	Maximum Ratio	1.05	1.86	1.86	1.86	1.86	1.86
9	Range	0.0726	0.9405	0.9405	0.9405	0.9405	0.9405
10							
11	Mean Ratio	1.0047	1.2689	1.2689	1.2689	1.2689	1.2689
12	**Median Ratio**	1.0022	1.2082	1.2082	1.2082	1.2082	1.2082
13	**Weighted Mean**	1.0016	1.1920	1.1920	1.1920	1.1920	1.1920
14	Sum of the Square of Deviations	0.0126	2.2892	2.2892	2.2892	2.2892	2.2892
15	Average Absolute Deviation	0.0146	0.2003	0.2003	0.2003	0.2003	0.2003
16	**Standard Deviation**	0.0184	0.2487	0.2487	0.2487	0.2487	0.2487
17							
18	**COD- Coefficient of Dispersion**	1.4605	16.5746	16.5746	16.5746	16.5746	16.5746
19	**COV- Coefficient of Variation**	1.8351	19.6025	19.6025	19.6025	19.6025	19.6025
20	**PRD- Price-Related or Factor Differential**	1.0031	1.0645	1.0645	1.0645	1.0645	1.0645
21							

MARS - Modeling Analysis ReSource

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	**Model Results**														
2	The line below contains the formulas for this Scenario Comparison Sheet.														
3	351000	02/14/08	189,500	193,000	1.02	268,775	1.42	268,775	1.42	268,775	1.42	268,775	1.42	268,775	1.42
4	PIN	SaleDate	AdjSPrice	AV	AV Ratio	**Scenario 1**		**Scenario 2**		**Scenario 3**		**Scenario 4**		**Scenario 5**	
5						S1TotalV	S1Ratio	S2TotalV	S2Ratio	S3TotalV	S3Ratio	S4TotalV	S4Ratio	S5TotalV	S2Ratio
6	351000	02/14/08	189,500	193,000	1.02	219,475	1.16	219,475	1.16	219,475	1.16	219,475	1.16	219,475	1.16
7	351001	11/28/08	185,510	184,000	0.99	249,855	1.35	249,855	1.35	249,855	1.35	249,855	1.35	249,855	1.35
8	351002	12/15/08	192,252	195,500	1.02	233,216	1.21	233,216	1.21	233,216	1.21	233,216	1.21	233,216	1.21
9	351003	03/09/08	214,059	212,000	0.99	281,925	1.32	281,925	1.32	281,925	1.32	281,925	1.32	281,925	1.32
10	351205	05/11/08	248,177	252,200	1.02	269,875	1.09	269,875	1.09	269,875	1.09	269,875	1.09	269,875	1.09
11	351206	07/23/08	237,322	235,300	0.99	249,420	1.05	249,420	1.05	249,420	1.05	249,420	1.05	249,420	1.05
12	351207	08/09/08	308,035	315,000	1.02	345,498	1.12	345,498	1.12	345,498	1.12	345,498	1.12	345,498	1.12
13	351208	09/03/08	293,223	290,000	0.99	327,960	1.12	327,960	1.12	327,960	1.12	327,960	1.12	327,960	1.12
14	351209	03/08/08	377,063	382,400	1.01	348,497	0.92	348,497	0.92	348,497	0.92	348,497	0.92	348,497	0.92

	A	B	C	D	E	F	G	H	I	J	K	L
1	**Scenario 1 Model Results**											
2	The line below contains the formulas that drive the Scenario 1 model.											
3	351000	02/14/08	189,500	193,000	129,575	139,200	268,775	1.42	40,000	-	4,000	-
4	General				Land							
5	**PIN**	**SaleDate**	**AdjSalePrice**	**AV**	**LandBase**	**Zoning**	**ValArea**	**Acreage**	**FF**	**FFQual**	**Bank**	**Shape**
6	351000	02/14/08	189,500	193,000	117,075	102,400	219,475	1.16	40,000	-	4,000	-
7	351001	11/28/08	185,510	184,000	120,200	129,655	249,855	1.35	40,000	-	(2,000)	-
8	351002	12/15/08	192,252	195,500	118,250	114,966	233,216	1.21	40,000	2,000	6,000	-
9	351003	03/09/08	214,059	212,000	131,050	150,875	281,925	1.32	40,000	(2,000)	2,000	-
10	351205	05/11/08	248,177	252,200	113,615	156,260	269,875	1.09	40,000	-	(800)	540
11	351206	07/23/08	237,322	235,300	114,870	134,550	249,420	1.05	40,000	-	400	1,170

MARS - Modeling Analysis ReSource

	A	B	C	D	E	F	G
1	Land Base Value						
2							
15	LBVCode	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	
16		1000	1050	1100			<--- Factor
17	1	1000	1050	1100			
18	2	2000	2100	2200			
19	5	5000	5250	5500			
20	40	40000	42000	44000			
21	50	50000	52500	55000			
22	60	60000	63000	66000			
23							

	A	B	C
1	Neighborhood Factor		
2		Factor	
3	Neighborhood	Scenario 1	Scenario 2
4	1	1.15	1.50
5	2	0.95	1.55
6	3	1.05	1.05
7	4	1.07	0.75
8	5	1.10	0.74
9			

We have presented STARS and MARS in various classes, workshops and webinars in the past year. In those presentations we covered numerous associated areas.

We are not going to cover those areas today but here is a quick list of areas related to the use of STARS and MARS that we have covered.

Related Subjects Covered

- **Property Characteristics-** Importance of, Categorization of, Influence of, Scaling of, Use of in Valuation Models
- **Data Issues-** Critical Nature, Scaling, Format Conversion Options
  - One Data area that we have presented on several times is the critical steps of Sales Validation and Sales Verification
- **Statistical Analysis-** Considerations, Statistical Measures, Structure of, Handling of Outliers, Skewed Distributions, Examples of How to Interpret & Use
- **Model Specification and Calibration-** General Overview, Types, Decisions, Keys to, Practical Guide to
- **Utilizing GIS in Analysis and Modeling-** Examples of, Symbology Options, Potential Uses

Related Subjects Covered

GIS

General Uses Include:

- Administration
- Planning
- Analysis
- Modeling
- Verification
- Presentations

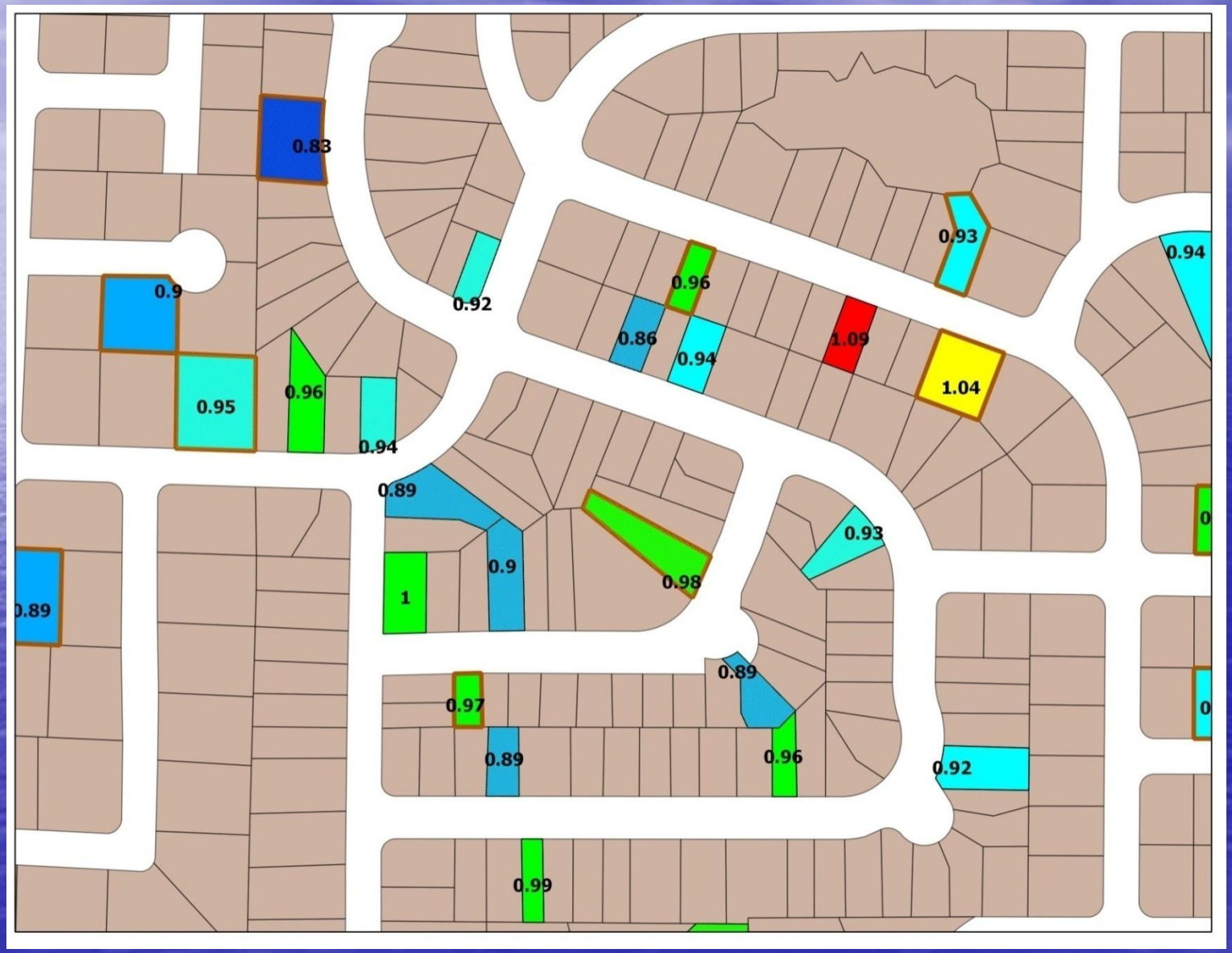
Examples of Use of GIS in Analysis

Here are just a few examples of items that can be mapped, illustrated and represented with GIS.

- **Ratios (Assessed Value to Sales Price)**
- Percentages of Change
- Property Characteristics or Attributes
  - Can be mapped alone such as indicating all view properties
  - Can be highlighted or identified as part of other analysis such as ratios
- Zoning, Land Use, Topography and a Utility (Usability) Rating
- Sales- volume, locations, sales price, price per SF
- Land Values- Price per Acre and Site/Lot Values
- Paired Sales- Percent or rate of change
- Outliers (maybe a pattern emerges)
- Photographic, topographic, flood zones, wetlands and other overlays
- External Influences- Environmental, Governmental, Social, Economic
- Inspection Areas
- Note: can use background/fill colors, outline colors and fill patterns.

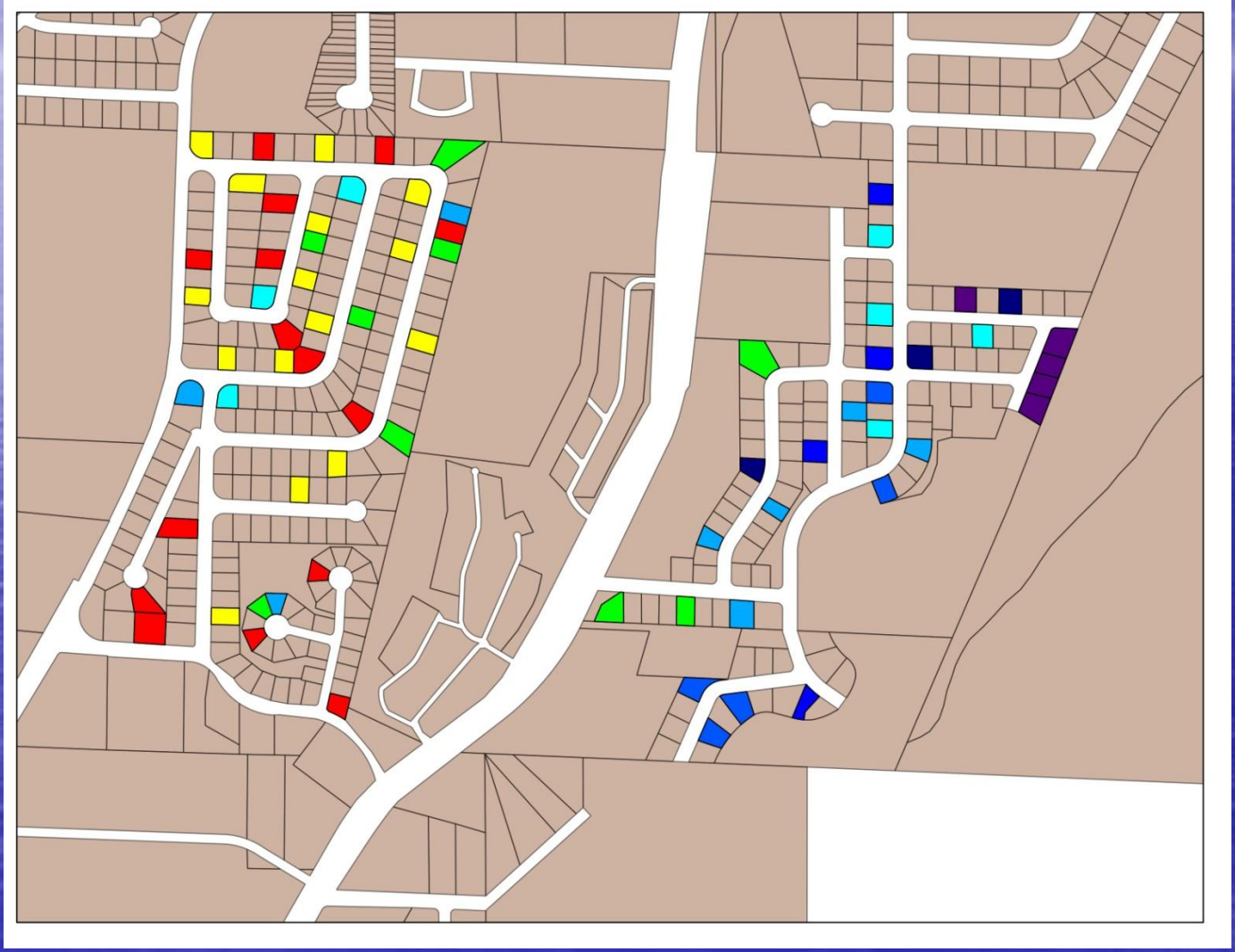
Examples of Use of GIS in Analysis

- **Symbology**



Examples of Use of GIS in Analysis

- Sample 2: Ratios: 5% steps blue to green to red



Examples of Use of GIS in Analysis

- Sample 3: Land Values: Purple over 60,000 & Lt Blue Under 60,000

Statistical Analysis Utilizing STARS

Examples - Possible Uses or Applications of STARS

- Analysis of assessment levels and uniformity
- Determination of trending factor
- Identification of areas for review, research or attention

- Specification and Calibration of your valuation model
- Analysis of markets
- Analysis of appraisal adjustments
- Analysis of appraisals
- Paired Sales Analysis
- Basis for presentations to BOE

Note-

- STARS is useful in analysis of both residential and commercial properties or markets.

Modeling Utilizing MARS

Examples - Possible Uses or Applications of MARS

- Specification of your model when starting from ground zero, as a guide for building in your CAMA.
- Annual Calibration of your existing model, as represented within your CAMA

- Specification and Calibration of your valuation model especially when you do not want to be playing around in your CAMA.
- Modeling that is more straight forward and understandable than plugging data into a black box.
- Testing of assumptions.
- Side by side comparison of different models, weighting within a model or formula/table structures.

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Thank you !

Presentation Continues With

- Demo of STARS
- Demo of MARS
- Q&A