Relationship between Lake Water Clarity & Residential Housing Value in Vilas and Oneida Counties, Wisconsin

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Purpose of the Study

❖ Determine the impact of water clarity on

residential housing prices

❖ I.e., if water clarity either increases or decreases how do the sale prices of homes either increase or decrease?

The Impact of Water Clarity on Home Prices in Vilas and Oneida Counties, Wisconsin

UWEC – Department of Economics

Quick Q&A

Q: Does the clarity of lake water have an impact on home sale prices?

A: Yes, we find that home prices rise as water clarity improves. Using actual home sales data we find that within Vilas and Oneida Counties, an improvement of water clarity by 1 meter would increase average home sale prices by 8 to 32 thousand dollars.

Q: How to you determine the clarity of a lake?

A: We use Secchi disk readings averaged over the year in which the house was most recently sold to determine water clarity. This has been shown to be the most reliable and objective measure.

Q: Is water clarity the same as water quality?

A: No, our study measures the impacts of water clarity, not water quality. Undoubtedly water quality also effects property prices but that was not the focus of our study. Previous work has shown that the perception of water quality (clarity) has the most significant impact upon property prices.

Q: Do the benefits of improving water clarity outweigh the costs?

A: Uncertain, the causes of poor water clarity and costs associated with improving clarity vary from lake to lake. Poor clarity can be indicative of poor water quality or it can be a result of the natural environment in which the lake is located. This study considers only the benefits to single family home sale prices associated with improved water clarity.

Q: Are your findings consistent with other similar studies?

A: Yes, although our findings differs somewhat from other similar studies they are within expected ranges. Generally speaking, lake water clarity has a significant impact on the market price of single-family homes.

Method

❖ **Hedonic Model**

❖ Uses actual home sales data to estimate changes associated with a change in a specific home attribute.

❖ Similar methods are used to determine the change in home value associated with – for example – a bathroom update.

❖ Statistically isolates the marginal value of all housing attributes.

❖ Need to have data that incorporates variation in all housing attributes.

Data Sources

- ❖ Housing sales data – Zillow.com, Wisconsin DoR

  – 271 home sales of houses adjacent to lakes within Vilas or Oneida County between Jan 2014 and June 2018.

- ❖ Water Clarity Data – Wisconsin DNR (Secchi Disk Readings)

  – Average annual DNR Secchi Disk readings for the adjacent lake during the year of sale.
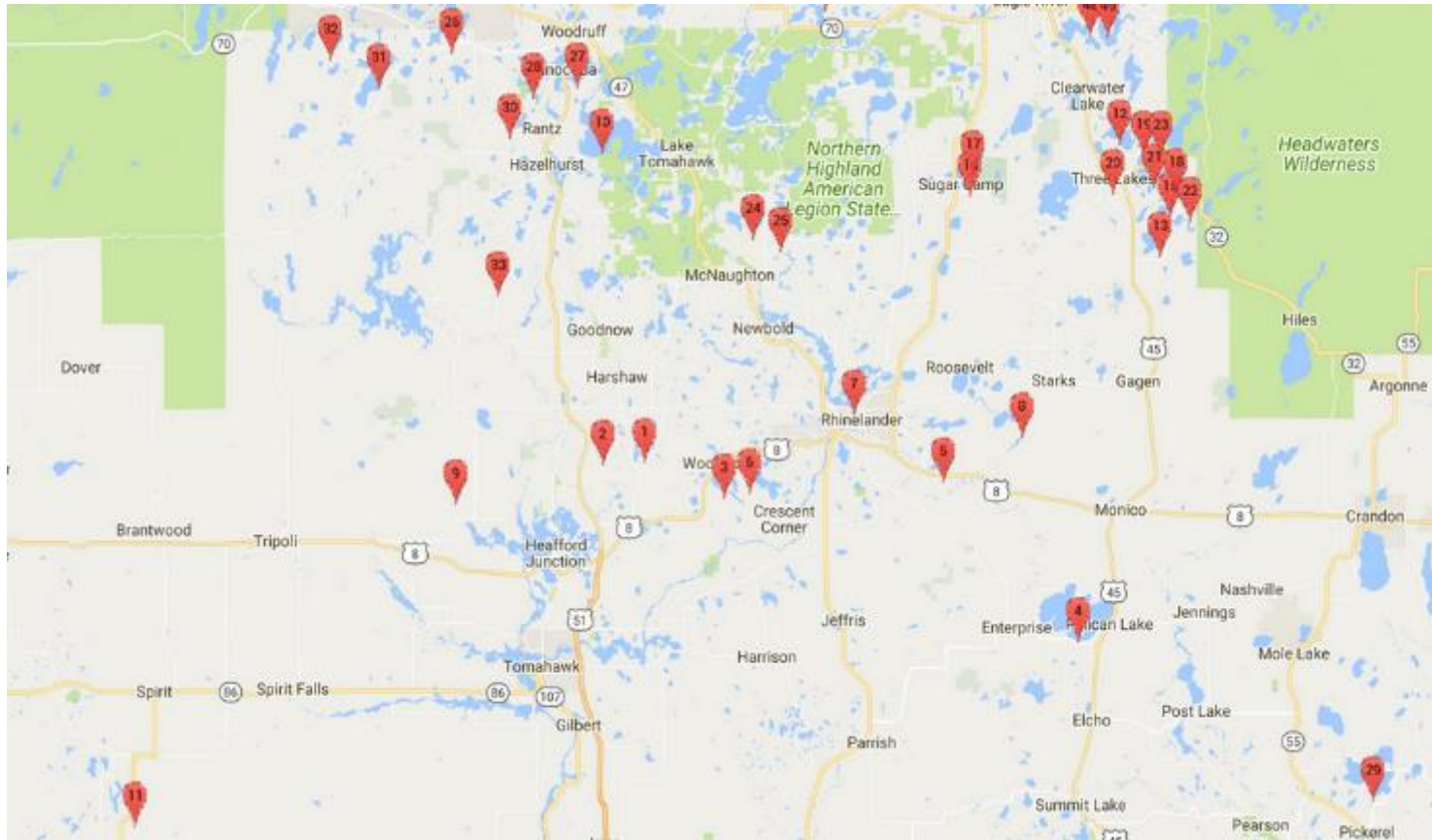
The Lakes

#	Lake		#	Lake
1	Hancock Lake		32	Squirrel Lake
2	Oscar-Jenny Lake		33	Buckskin Lake
3	Squash Lake		34	Lost Lake
4	Pelican Lake		35	Big Saint Germain Lake
5	George Lake		36	Plum Lake
6	Crescent Lake		37	Towanda Lake
7	Boom Lake		38	Crawling Stone Lake
8	Fifth Lake		39	Flambeau Lake
9	Killarney Lake		40	Ike Walton Lake
10	Tomahawk Lake		41	White Sand Lake
11	Spirit Lake		42	Manitowish Lake
12	Planting Ground Lake		43	Little Star Lake
13	Big Lake		44	Presque Isle Lake
14	Sugar Camp Lake		45	South Turtle Lake
15	Long Lake		46	Papoose Lake
16	Deer Lake		47	Anvil Lake
17	Indian Lake		48	Catfish Lake
18	Big Stone Lake		49	Cranberry Lake
19	Island Lake		50	Kentuck Lake
20	Maple Lake		51	Spectacle Lake
21	Laurel Lake		52	Upper Buckatabon Lake
22	Virgin Lake		53	Black Oak Lake
23	Little Fork Lake		54	Scattering Rice Lake
24	Two Sisters Lake		55	Yellow Birch Lake
25	Tom Doyle Lake		56	South Twin Lake
26	Shishebogama Lake		57	North Twin Lake
27	Minocqua Lake		58	Otter Lake Lake
28	Kawaguesaga Lake		59	Snipe Lake
29	Pickerel Lake		60	Little Saint Germain Lake
30	McCormick Lake			
31	Blue Lake			

The Lakes (Oneida Co)

The Lakes (Vilas Co)
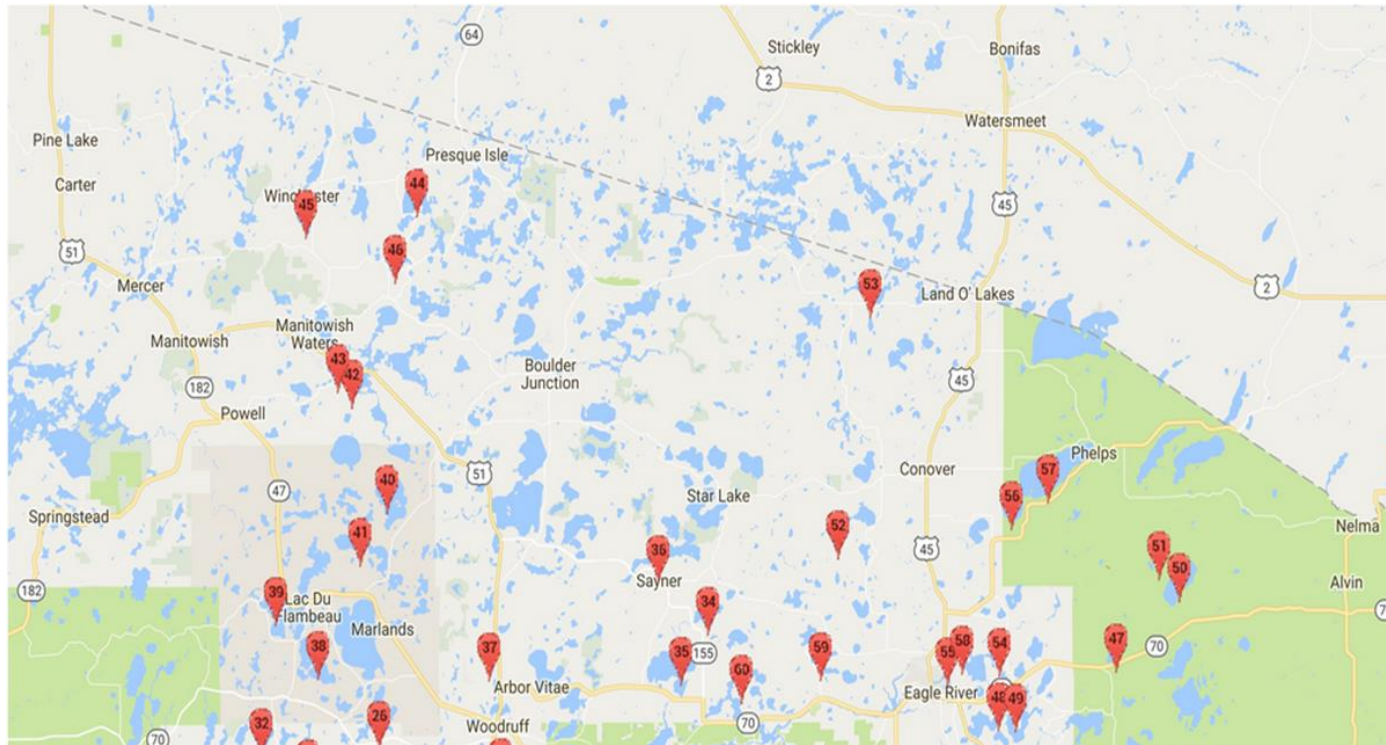
Method: Variables

❖ Response variable: Inflation indexed corrected price

❖ Predictor variables:

– Square meters of living area (zero for empty lots)

– Sale Date

– Lake Frontage

– Fireplace

– Heat

– Basement

– Bathrooms

– Bedrooms

– Deck

– Garage

– Lot Size in Hectares

– Local Tax Rate (Effective Mill Rate)

– Distance from a Public Airport

– Distance from an Emergency Room

– Lake Area

– Water Clarity (Linear)

– Water Clarity (Log)

Method: Testing for correlation

	AIRPORT__KM_	BATH	BED	BSMNT	C_PRICE	DECK
AIRPORT__KM_	1.000000	-0.197291	-0.201463	-0.092650	-0.194846	-0.031510
BATH	-0.197291	1.000000	0.641422	0.355385	0.555830	0.302373
BED	-0.201463	0.641422	1.000000	0.218721	0.389583	0.198173
BSMNT	-0.092650	0.355385	0.218721	1.000000	0.308414	0.194715
C_PRICE	-0.194846	0.555830	0.389583	0.308414	1.000000	0.238093
DECK	-0.031510	0.302373	0.198173	0.194715	0.238093	1.000000
FIRE	-0.153999	0.340060	0.274216	0.273662	0.274450	0.183370
FRONTAGE	-0.015821	0.074892	0.235552	0.048099	0.093443	0.033525
HEAT	-0.092948	0.178267	0.190070	0.282952	0.082146	0.266198
GARAGE	-0.002030	0.493329	0.394848	0.261412	0.290237	0.216704
LKAREA__HECTARES_	0.305830	-0.089351	0.005097	-0.164269	-0.037093	0.021236
LN_WC_M	0.021899	0.066652	0.002010	0.006601	0.305573	0.141704
LOT_SZ__HECTARES_	-0.065514	0.116902	0.129368	0.063957	0.082041	-0.022886
LVAREA__SQM_	-0.139229	0.726234	0.559960	0.394481	0.676668	0.325153
MEDICAL__KM_	0.426632	-0.229557	-0.136151	-0.106945	-0.234389	-0.115739
SEPTIC	-0.363996	0.101102	0.048662	0.217119	0.137141	0.196631
STORY	0.017016	0.419807	0.331804	0.123722	0.279172	0.221018
TAXRT	-0.183411	0.030362	0.058838	-0.028964	-0.053983	0.007025
WC_MEAN__M_	0.013758	0.073199	0.022109	0.026879	0.275762	0.121212

Testing for Correlation (2)

	FIRE	FRONTAGE	HEAT	GARAGE	LKAREA__HE	LN_WC_M	LOT_SZ__HE
AIRPORT__KM_	-0.153999	-0.015821	-0.092948	-0.002030	0.305830	0.021899	-0.065514
BATH	0.340060	0.074892	0.178267	0.493329	-0.089351	0.066652	0.116902
BED	0.274216	0.235552	0.190070	0.394848	0.005097	0.002010	0.129368
BSMNT	0.273662	0.048099	0.282952	0.261412	-0.164269	0.006601	0.063957
C_PRICE	0.274450	0.093443	0.082146	0.290237	-0.037093	0.305573	0.082041
DECK	0.183370	0.033525	0.266198	0.216704	0.021236	0.141704	-0.022886
FIRE	1.000000	0.010413	0.264338	0.241261	-0.103465	0.003664	0.006584
FRONTAGE	0.010413	1.000000	0.036603	-0.038366	0.037524	0.095058	0.416533
HEAT	0.264338	0.036603	1.000000	0.232547	-0.105883	-0.097244	0.010031
GARAGE	0.241261	-0.038366	0.232547	1.000000	-0.062497	-0.057243	0.089612
LKAREA__HECTARES_	-0.103465	0.037524	-0.105883	-0.062497	1.000000	0.104035	-0.007028
LN_WC_M	0.003664	0.095058	-0.097244	-0.057243	0.104035	1.000000	0.005444
LOT_SZ__HECTARES_	0.006584	0.416533	0.010031	0.089612	-0.007028	0.005444	1.000000
LVAREA__SQM_	0.437949	0.144767	0.128472	0.378639	-0.129069	0.134332	0.168188
MEDICAL__KM_	-0.112087	0.075698	-0.071153	-0.077411	0.220309	-0.187302	0.012033
SEPTIC	0.227656	0.060978	0.172651	0.009584	-0.379143	0.190939	0.036304
STORY	0.281886	0.202030	0.135841	0.170413	0.119181	0.077385	0.163226
TAXRT	-0.027733	0.003707	-0.029021	-0.046069	-0.025524	0.158624	-0.051478
WC_MEAN__M_	-0.012512	0.111422	-0.086627	-0.052865	0.110909	0.950765	0.020516

Testing for Correlation (3)

	LVAREA__SQ	MEDICAL__K	SEPTIC	STORY	TAXRT	WC_MEAN__
AIRPORT__KM_	-0.139229	0.426632	-0.363996	0.017016	-0.183411	0.013758
BATH	0.726234	-0.229557	0.101102	0.419807	0.030362	0.073199
BED	0.559960	-0.136151	0.048662	0.331804	0.058838	0.022109
BSMNT	0.394481	-0.106945	0.217119	0.123722	-0.028964	0.026879
C_PRICE	0.676668	-0.234389	0.137141	0.279172	-0.053983	0.275762
DECK	0.325153	-0.115739	0.196631	0.221018	0.007025	0.121212
FIRE	0.437949	-0.112087	0.227656	0.281886	-0.027733	-0.012512
FRONTAGE	0.144767	0.075698	0.060978	0.202030	0.003707	0.111422
HEAT	0.128472	-0.071153	0.172651	0.135841	-0.029021	-0.086627
GARAGE	0.378639	-0.077411	0.009584	0.170413	-0.046069	-0.052865
LKAREA__HECTARES_	-0.129069	0.220309	-0.379143	0.119181	-0.025524	0.110909
LN_WC_M	0.134332	-0.187302	0.190939	0.077385	0.158624	0.950765
LOT_SZ__HECTARES_	0.168188	0.012033	0.036304	0.163226	-0.051478	0.020516
LVAREA__SQM_	1.000000	-0.195587	0.136261	0.426403	-0.029353	0.120338
MEDICAL__KM_	-0.195587	1.000000	-0.328443	-0.086302	-0.140091	-0.178273
SEPTIC	0.136261	-0.328443	1.000000	-0.021703	0.185072	0.204213
STORY	0.426403	-0.086302	-0.021703	1.000000	-0.013820	0.077825
TAXRT	-0.029353	-0.140091	0.185072	-0.013820	1.000000	0.193185
WC_MEAN__M_	0.120338	-0.178273	0.204213	0.077825	0.193185	1.000000

Results: Property Value Impacts

Lake 2017 (or most recent)	WC Mean (m)	Current Water Value	Value Increase 1	Value Increase 2	Value Loss 1	Value Loss 2
Anvil Lake	3.60	101,120.79	13,034.58	23,921.76	16,242.51	37,805.91
Big Lake	1.02	46,589.22	26,648.21	45,601.04	45,277.05	46,589.22
Big Saint Germain	3.09	93,334.16	14,493.86	26,379.43	18,578.36	44,487.59
Big Stone	0.89	42,181.38	28,140.47	47,830.65	42,181.38	42,181.38
Black Oak	6.70	135,257.02	8,090.87	15,300.45	9,218.01	19,928.82
Blue	5.65	125,542.66	9,282.68	17,423.31	10,798.28	23,705.50
Boom	1.05	47,566.09	26,326.34	45,116.84	44,333.12	47,566.09
Buckskin	2.70	86,693.82	15,852.03	28,634.37	20,878.16	51,532.90
Catfish Lake	1.46	59,647.23	22,602.73	39,425.54	34,570.96	59,647.23
Cranberry Lake	1.30	55,190.91	23,921.76	41,461.04	37,805.91	55,190.91
Crawling Stone Lake	4.60	114,155.37	10,887.18	20,235.45	13,034.58	29,277.08
Crescent	3.48	99,369.25	13,350.77	24,457.44	16,737.38	39,185.48
Deer	1.20	52,245.41	24,828.24	42,847.34	40,164.27	52,245.41
Fifth Lake	0.73	36,320.07	30,227.79	50,908.85	36,320.07	57,173.69
Flambeau Lake	5.68	125,840.91	9,243.77	17,354.47	10,745.63	23,577.63
George	1.06	47,888.54	26,220.79	44,957.80	44,027.47	47,888.54
Hancock	1.65	64,577.07	21,215.20	37,260.09	31,394.29	64,577.07
Indian	2.74	87,406.33	15,701.08	28,385.24	20,616.20	50,704.34
Island	2.06	74,109.33	18,737.01	33,326.99	26,220.79	70,248.26

Results: Property Value Impacts

Kawaguesaga Lake	3.48	99,369.25	13,350.77	24,457.44	16,737.38	39,185.48
Kentuck Lake	2.63	85,428.19	16,123.35	29,081.21	21,353.11	53,053.50
Killarney	0.70	35,160.92	30,654.74	51,532.90	35,160.92	35,160.92
Lake Minocqua	4.96	118,283.80	10,277.96	19,173.71	12,170.14	27,089.99
Laurel	0.75	37,081.72	29,949.81	50,501.55	37,081.72	37,081.72
Little Fork Lake	1.56	62,287.53	21,850.38	38,254.54	32,821.40	62,287.53
Little Saint Germain	1.43	58,834.18	22,838.74	39,791.38	35,133.66	58,834.18
Little Star Lake	4.26	110,004.96	11,532.99	21,353.11	13,972.30	31,700.39
Long Lake	1.35	56,615.97	23,493.15	40,802.03	36,730.19	56,615.97
Lost Lake	1.50	60,716.01	22,295.60	38,948.40	33,848.75	60,716.01
Manitowish Lake	2.90	90,182.14	15,125.06	27,431.20	19,631.41	47,651.10
Maple Lake	4.30	110,506.96	11,453.05	21,215.20	13,855.01	31,394.29
McCormick	0.60	31,143.77	32,171.12	53,734.52	31,143.77	31,143.77
North Twin Lake	8.70	150,557.47	6,501.57	12,421.82	7,209.58	15,300.45
Oscar-Jenny	1.65	64,577.07	21,215.20	37,260.09	31,394.29	64,577.07
Otter Lake	0.90	42,531.05	28,019.69	47,651.10	42,531.05	42,531.05
Papoose Lake	3.00	91,859.77	14,786.12	26,867.26	19,062.63	45,929.89
Pelican Lake	1.40	58,011.03	23,079.78	40,164.27	35,715.43	58,011.03
Pickerel	1.62	63,822.65	21,422.75	37,585.62	31,855.73	63,822.65
Planting Ground	1.30	55,190.91	23,921.76	41,461.04	37,805.91	55,190.91

Results: Property Value Impacts

Plum	2.94	90,858.30	14,987.63	27,202.77	19,399.84	46,946.73
Presque Isle	7.35	140,627.03	7,495.31	14,228.28	8,452.57	18,143.21
Scattering Rice	2.40	81,090.81	17,084.48	30,654.74	23,079.78	58,795.21
Shishebogama	2.80	88,460.94	15,479.98	28,019.69	20,235.45	49,512.53
Snipe Lake	2.81	88,635.08	15,443.74	27,959.69	20,173.36	49,319.57
South Turtle Lake	1.97	72,131.18	19,229.74	34,115.94	27,202.77	72,131.18
South Twin Lake	3.12	93,818.42	14,399.00	26,220.79	18,422.40	44,027.47
Spectacle Lake	2.47	82,441.19	16,779.99	30,157.80	22,525.15	56,912.62
Spirit	3.35	97,418.00	13,711.15	25,065.83	17,308.88	40,802.03
Squash	4.85	117,049.41	10,456.74	19,486.03	12,421.82	27,722.28
Squaw	1.16	51,029.54	25,210.60	43,429.11	41,194.81	51,029.54
Squirrel	2.75	87,583.27	15,663.79	28,323.65	20,551.74	50,501.55
Sugar Camp	3.70	102,545.86	12,782.34	23,493.15	15,852.03	36,730.19
Tom Doyle	1.48	60,183.77	22,448.10	39,185.48	34,205.96	60,183.77
Tomahawk	5.38	122,796.14	9,648.23	18,068.53	11,296.47	24,922.73
Towanda Lake	3.10	93,495.98	14,462.10	26,326.34	18,526.08	44,333.12
Two Sisters	4.43	112,051.61	11,210.26	20,795.58	13,500.89	30,475.36
Upper Buckatabon Lake	2.05	73,892.43	18,790.50	33,412.81	26,326.34	70,659.45
Virgin Lake	1.21	52,545.92	24,734.48	42,704.41	39,914.88	52,545.92
White Sand Lake	4.00	106,645.89	12,081.14	22,295.60	14,786.12	33,848.75
Yellow Birch Lake	1.43	58,834.18	22,838.74	39,791.38	35,133.66	58,834.18

Results: Shorthand

❖ On lakes where water clarity is fairly low (about 1 meter) gaining one meter of clarity will improve home values by about 10 -12% (Roughly 23-26K in this case)

❖ On lakes where water clarity is currently high (about 3 meters) losing one meter of clarity will cause homes to lose roughly 15 – 18K.

❖ All things equal the gains to improved clarity are greatest in low clarity environments.

❖ All things equal, losing clarity causes more lost value than gaining clarity.

Results: Shorthand

❖ We have found similar results in the West and East central Portions of the State.

❖ On lower clarity lakes a one meter improvement in water clarity produces a 10-12% improvement in sale price of a median lake house.

❖ Current work focuses in Secchi versus Satellite water clarity readings and ability to predict variation is sale price.

Thank You! Questions?