Bellevue Lake Shoreline Urbanization Study

2012

Prepared by Martin Nizlek[1], PhD for WSSA

INTRODUCTION

The City Shoreline Inventory focused on a subjective evaluation of four ecologic functions. WSSA (WA Sensible Shorelines Association) provided a critique of that report and use of the four functions. We found fault with its assessment of the same elements under several of the functions and the use of one (Hyporheic function) as inappropriate. (Subsequently, the State has directed that the Hyporheic function should not be applied to shorelines.)

Its WSSA's position that such an assessment, based only on a desired level of ecologic function, is insufficient and inappropriate. Virtually all of Bellevue's residential shorelines (over 90%) have been completely developed in a legal fashion. And, the likelihood of their being redeveloped in the near future is minimal.

A balanced assessment of the urban characteristics and potential of City shorelines to provide ecologic function should have been included in the City analysis. Lacking that, WSSA has undertaken the study reported here. Following, a series of "urbanization" factors are used to evaluate the residential segments of the shorelines of Lake WA, Lake Sammamish, and Phantom Lake. Only with this information in hand can a reasonable decision be made on the potential benefits (and risks) of regulations aimed at them. Put simply, high urbanization reflects a low ecologic function and ability to improve the latter in a reasonable timeframe, at reasonable cost and risk, and in an equitable manner.

STUDY JUSTIFICATION

The need to establish "urbanization" assessment factors for the study is based upon review of City documentation, technical literature[2] and anecdotal knowledge of lakeshore lifestyles. Sufficient concern with a variety of issues underlined the need to look at Bellevue specific conditions in a manner similar to the City Shoreline Inventory and Characterization study. Some of these are described here.

<u>Setbacks and Buffers</u> – The beneficial width and composition of the total setback from shore waters is debatable and inconclusive as was reported in a comprehensive study by Liu, et al in 2008[3]. Liu notes –

> Under-sized buffers provide inadequate protection for water bodies. Over-sized buffers remove land from production, which may result in economic losses. However, a universal optimum width for buffers does not exist due to the wide range of variables governing the efficacy of the vegetated buffers.

[1] Dr. Nizlek holds degrees in Civil Engineering (Emphasis – Transportation and Planning) and Industrial Engineering (Emphasis – Systems Analysis)

[2] See the work of Dr. Gilbert Pauley, previously submitted to the record.

[3] "Major Factors Influencing the Efficacy of Vegetated Buffers on Sediment Trapping: A Review and Analysis", Xingmei Liu, et al, <u>Journal of Environmental Quality</u> • Volume 37 • September–October 2008, pg. 1669

Further, if more is better, yet our lake shorelines are built out, the reality of re-establishing (i.e., restoring) or enhancing native shoreline vegetation in a meaningful manner and timeframe should be questioned. This study considers the extent shorelines contain traditional landscaping (versus natural state).

Wildlife - Habitat in urban settings carries risk and reward. WSSA has provided a series of submissions to the record documenting inappropriate aspects of creating isolated pockets of wildlife. The most recent submission, entitled "Examples of 'Urban Inappropriate' Wildlife and Agency Awareness" provided copies of warning announcements from Bellevue and King County to residents on the dangers of rodents such as mice, raccoon, coyote, bear, cougar, and even deer. Earlier, WSSA is also on record citing State WAC 365-190-130, which forewarns –

"Fish and wildlife habitat conservation" means land management for maintaining populations of species in suitable habitats within their natural geographic distribution so that the habitat available is sufficient to support viable populations over the long term and isolated subpopulations are not created.

In addition, the City's consultant on the SMP notes[4] –

Total habitat area is reduced; dispersal and travel by many wildlife species is altered or obstructed; and the processes of predation, parasitism and interspecies competition are affected (Marzluff and Ewing 2001).

Equally reflective of the lack of specificity that has surrounded identification of non-aquatic needs along City shorelines, the consultant makes the following observation (emphasis added) –

The City of Bellevue has designated 19 species of local importance (LUC 20.25H.150), excluding fish. Of these species, three are herpetiles, four are bats, and twelve are birds. These species are drawn from a number of taxa and depend upon a variety of habitat types and special features. Not all are documented or likely to occur in the City of Bellevue.

Clearly, promotion of any species of animal life along shorelines in urban settings should not be carried out casually. Bellevue's studies have NOT established appropriate animal vectors for inclusion or exclusion or studied the adequacy of corridors to connect shoreline habitat to larger habitat areas. As grievous, inference that species of local importance would populate restored lake shorelines, yet whose habitat is primarily wetlands, does little to support mandating change.

Shoreline armoring - "The effectiveness of alternative shoreline armoring (bioengineering) techniques is unknown." This statement will be found in the City of Bellevue: 2005 BAS Review prepared by Herrera Environmental Consultants. It attests to the questionable effectiveness of "soft shoreline" treatments in Bellevue. It is not justified, in these circumstances, to require changes by property owners, or to require that they indemnify the City should these changes fail[5].

Unknowns, Uncertainties, and Balanced Decisions – A great deal of reliance has been placed on BAS (science) developed during the period leading to City adoption of its current Critical Areas Ordinance. That science has also been cited as supportive of proposed SMP regulations. However, a review of the City BAS[6] reveals a series of additional *unknowns* that must be considered in adopting the Shoreline Management Program. Here are the more dramatic of the consultant's cited limitations (emphasis added) –

- The current habitat conditions and the degree of shoreline development along Bellevue's Lake Washington, Lake Sammamish, and Phantom Lake are partially unknown.

[4] "Bellevue Urban Wildlife Habitat Review", The Watershed Company, 2009, page 16
[5] NOTE: WSSA supports efforts to encourage mitigation of the impacts of vertical-faced bulkheads.
[6] "City of Bellevue's Critical Areas Update – 2005 Best Available Science Review", Herrera Environmental Consultants, Inc., 2005

- The maximum rehabilitation potential of the shorelines of Lake Washington, Lake Sammamish, and Phantom Lake is unknown.
- The effectiveness of supplemental beach nourishment as a restoration technique in these lakes is unknown.
- The review of the best available science leaves some remaining questions on the subject of bulkhead impacts.
- No studies were found that specifically examined salmon mortality due to predation associated with over-water structures.
- No studies were found that address the cumulative effect of in- and overwater structure on Bellevue's Lake Washington, Lake Sammamish, and Phantom Lake shorelines.
- The best available science for shoreline protection is neither complete nor consistently covers all functions, and it remains an active field of research.
- Much of the science used for developing protection of shorelines is derived from research specific to streams and riparian areas.
- Currently over 80 percent of shorelines within the City of Bellevue have some stabilization structure, over 50 percent of all parcels have structures within 50 feet of the OHWM, and virtually every shoreline lot has been developed, primarily for residential use.
- (D)evelopment along the shorelines of Lake Washington, Lake Sammamish, and Phantom Lake have altered the physical, chemical, and biological processes that create and maintain the shoreline aquatic and terrestrial habitats typical of these natural ecosystems. Consequently, these anthropogenic changes have degraded shoreline functions and values within Bellevue.

Above, we've shown that a very narrow perspective was applied in the early stages of the SMP process, despite acknowledgement of unknowns. Under uncertainty, City staff leveraged this uncertainty to promote speculative shoreline regulations. A broader, alternative analysis is required. One is offered here by WSSA. It supports the association's "Sensible Shorelines Plan".

Such an alternative analysis is worthy of consideration. To that end we offer the following quote[7] –

It is critical, also, that we look for data that contradicts our view. This is not merely a good idea. The influential scientist Karl Popper believed it is the very essence of the scientific method. Attempting to falsify a hypothesis is a more robust approach to learning the truth than attempting to prove a favored theory is correct. It is a difficult thing to do. Everyone wants to be right. Forcing ourselves to find data that contradicts our ideas is difficult. But doing so shows respect for the truth and for protecting the environment.

URBANIZATION ANALYSIS FACTORS

The following factors were selected to speak to the lack of available ecological function on Bellevue shorelines. The degree of development, as well as the shoreline and near shore characteristics, are subsequently assessed using these factors.

For each factor it is important to consider that its existence indicates a higher degree of urbanization and, thus, low ecological function OR the ability the restore it. That is –

High Urbanization = Low Ecologic Function

[7] "Eco-Fads – How the Rise of Trendy Environmentalism Is Harming the Environment", T. Myers, WA Policy Center, 2011, Page 222

Development Characteristics

<u>Impervious Area</u> – Urbanization is characterized by creation of surfaces that gather and direct storm water. There are current efforts to mitigate the downstream effects of these collected waters which often transport pollutants untreated into streams, lakes, and rivers. The Shoreline Inventory cites impervious areas along all shoreline development in Bellevue with the exception of Mercer Slough. This development, however, has occurred under standards established by the City and will remain impervious. It would be desirable to have less than 25% imperviousness on residential properties. Therefore a value of greater than 25% was chosen as the threshold for this analysis.

<u>Structures Present Along Shoreline</u> – The City's CAO consultant reports supported and led to the establishment of a 50 ft. total buffer and building setback. The exiting 1970's SMP, however, established 25 ft. and was actively used to condition development until adoption of the CAO in 2007. As has been reported during the current SMP process, creation of non-conformity along the shorelines is not justified through sound, thorough, peer reviewed science. Study findings are inconsistent as to the amount of setback appropriate for conditions as found in Bellevue. A "more is better" approach is not acceptable. The extensive, existing development within 50 ft. should be understood by decision makers. To account for this characteristic, a level of 50 ft. was chosen to assure consideration of the amount of development within the more restrictive (wider) boundary.

<u>Storm Water Outfall and Receiving Water Bodies</u> – This factor is associated with Impervious Area but is unique. If impervious area is high, but the drainage treated and properly disposed of, there is little consequence to shoreline management. Unfortunately, in Bellevue the City has not accepted responsibility for the system. Staff has reported a lack of ownership and policy direction that has left the burden of responsibility on property owners. This is obviously unreasonable, since upland development, as well as discharges from roadway surfaces, for example, should not impact a few individuals.

This situation is exacerbated by storm waters being dumped to several City lakes under the assumption that they are receiving water bodies – fully able to pass these flows without creation of other problems. In the case of Lake Sammamish and Phantom Lake, however, this is an errant assumption. Through a lack of appropriate government action both cannot meet that criterion. Inundation of properties and damages to private improvements have been the result.

The City Shoreline Inventory reported locations of storm outfalls. However, the near continuous presence of these outfalls, combined with the receiving body issue, dictates all sections be shown with this urbanization factor present.

<u>Degree of Development ("Build-Out")</u> – As noted above, the potential for shoreline properties, which were developed under approved regulations, to provide restored ecologic function is inversely proportionate to the degree the shoreline properties have been developed. The City report acknowledges the highly developed nature of the City's shorelines and then fails to consider this factor.

Shoreline and Off-shore Characteristics

<u>Shoreline Armoring</u> – Both bulkheads and upland rockeries were characterized together in the City report. WSSA members conducted a separate analysis to distinguish actual bulkhead characteristics and found the City figures misleading. In spite of this determination, significant

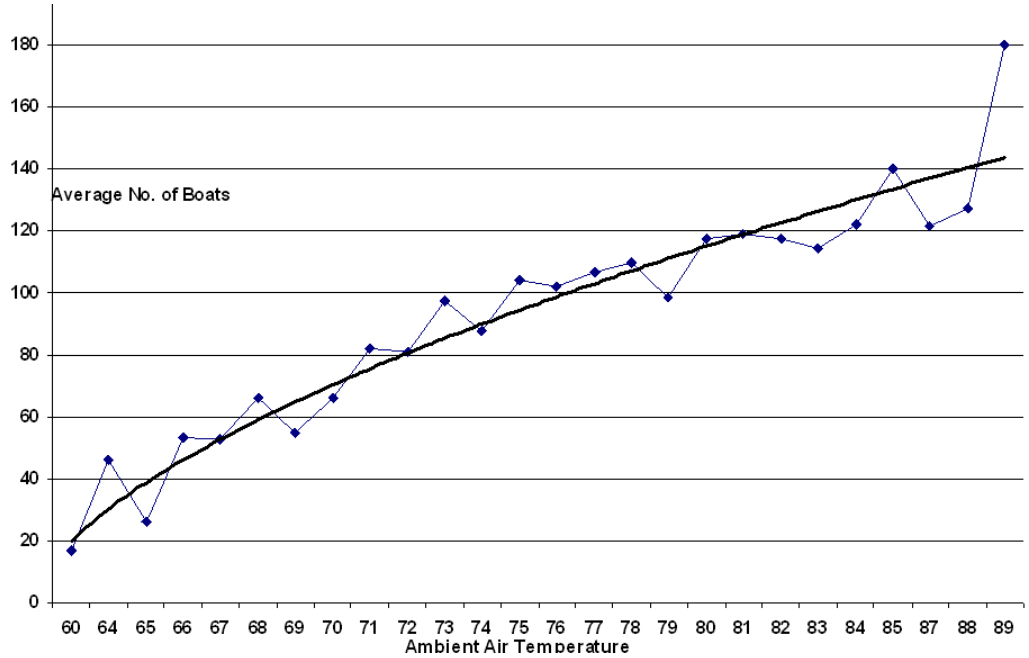
amounts of protection of properties have been required, whether for protection of shorelines or as decorative features.

Armoring is present on nearly all sections of Lake WA and Lake Sammamish. WSSA is not opposed to mitigating the effects of vertical-faced bulkheads. But, it is an ill-conceived notion that soft shoreline treatments can replace them. Therefore, this study includes consideration of armoring in assessing urbanization.

<u>Sewerlines & Sewage</u> – The lake edges on our larger lakes house the collection system for sanitary sewage. For obvious health reasons this system is separate from storm and surface drainage, but the presence of these lines reflects the urbanized nature of our properties. Attempts to create a natural environment would be thwarted by the need to periodically dig into vegetated buffers and the like. The City Inventory did not account for their presence. This study does.

<u>Lake Access</u> – A goal of the SMA is to promote access and use of our lakes. On private properties this occurs along shore front and via docks (though staff have noted the Dept. of Ecology recommends docks not be viewed as a means of lake access; only beyond as moorage access). Direct lake access along shorelines includes use of various light water craft not amenable to moorage. Kayaks, floats, and even small sailboats abound on some shore sections. Use of aerial photos from BING and Google are used to make this assessment.

<u>Fetch, Wave, and Wake Exposure</u> - Each of these reflect elements critical to determining feasible actions on our lake shores. Fetch is the naturally occurring, mostly wind driven, wave action which builds across open waters. Little can be done to mitigate this phenomenon; except to protect from it. As critical, but possibly more manageable, boating activity has a similar impact. Increased recreational boating (which certainly will occur if the goals of the SMA are achieved and the City grows) will increase boat wakes. And, as shown here, increasing temperatures will play a roll.



Boating Activity on Lake Sammamish WA – Peak Period Demand Vs Temperature [8]

[8] Source: Observed mid-afternoon, weekend counts (n=199) taken between 1994 and 2012 by Dr. Martin Nizlek; unpublished.

To assess exposure, resident knowledge of shoreline conditions and consultant observations are used to assess this aspect of our developed shorelines.

<u>De-nourishment and Inundation</u> – Whether through wave action, lack of "natural" shoreline recruitment, or mismanaged water levels, sections of our lake beaches have been denuded of fine grained material (sand and "soil"), leaving only fist-sized rock. Other areas have been eroded by waters left unnaturally high for extend periods. And, our historic development patterns, including bulkheads where needed and normal use of our shores, have removed most vegetation[9]. A partnership is needed to correct this pattern and an assessment in this analysis is seen as desirable.

<u>Over Water Structures</u> – On all but a few sections of shoreline docks are prevalent and indicate urbanization. Assessment of their presence is included in this analysis.

Vegetation Characteristics

<u>Landscaping</u> – Both lawns and gardens reflect the presence of man. WSSA has documented the benefits of lawns (as acceptable for urban environment shorelines) and, while we do not expect gardens or lawns to be legislated out of existence, we have included this factor as an indication of urbanization. Where more than 25% of the properties in a reach grouping (explained elsewhere) reflect urban landscaping, this factor is included.

<u>Tree Canopy</u> – The City of Bellevue has exemplary policies with respect to tree retention. While shoreline property owners adhere to these (in even greater proportion than throughout the City[10]), the desire for views and the difficulty of maintaining trees along wind swept or inundated shorelines has resulted in fewer trees along many shoreline sections than needed to create Large Woody Debris (LWD) and associated habitat. Typically, the coverage is better upland, away from the shore[11]. This factor is considered in the analysis. If less than 25% of the parcels' near-shore area contains trees, this was selected as another example of "urbanization" and the relative difficulty to reestablish ecologic function.

<u>Wildlife Habitat</u> – Shorelines in rural settings support a range of wildlife. In an urban setting, attempts to provide this are thwarted by man and his infrastructure, such as roads, bridges, etc. This creates an imbalance. Prey-predator relationships are lost, and as a result, isolated species may predominate… species that are not compatible with modern urban lifestyles. Consideration of the <u>absence of existing habitat</u> is included in this analysis as an indication of urbanization. Failure to do so would result in pockets of habitat, too often housing nuisance critters (nutria, opossum, raccoon, and geese) or worse (coyote, cougar, or bear).

<u>Wildlife Corridors</u> – Any restoration of shoreline wildlife habitat needs to consider the connectivity to larger wildlife habitat. While Bellevue's larger parks may provide the additional "room" needed for animals, safe corridors to these areas are necessary. This study considers the <u>absence of the safe pathways to reach</u> these larger areas. Creation of shoreline wildlife habitat in areas surrounded by urban arterial streets would only lead to the demise of that wildlife and create safety problems for the traveling public.

[9] Examples of high waters eroding bulkheads have been provided the City throughout the SMP process.
[10] See file VegetativeCoverCompStudy_Oct_20_10.pdf submitted to the SMP record 10/202010
[11] "Urban EcoSystem Analysis (Bellevue Tree Canopy Study)", American Forests, 2008

THE ANALYSIS AREAS

As found acceptable by Bellevue's SMP consultants, the 42 separate shoreline reaches identified in the SMP update process were grouped as part of this effort. Similarity in characteristics is evident along various sections of shorelines on the three lakes. Using knowledge of neighborhoods, the consultant's groups, and aerial photographs, the 42 zones were aggregated to 19 distinct groups as shown below -

Reach Groupings

Group A – North Meydenbauer Bay Residential

Group B – Meydenbauer Bay Yacht Club

Group C – East Meydenbauer Bay Multi-Family

Group D – South Meydenbauer Bay Residential

Group E – Outer Meydenbauer Bay Residential

Group F - Lake WA Residential North of Beaux Arts

Group G - Lake WA Residential South of Beaux Arts

Group H – Mouth of Mercer Slough

Group I – Newport Shores Yacht Club

Group J – Newport Shores Residential on Lk WA

Group K – Newport Shores Residential on Canals

Group L – Lk WA Residential South of New Castle Beach

Group M – Mercer Slough Wetlands

Group N – Mercer Slough Office/Kelsey Creek

Group O – North Lake Sammamish Residential

Group P – Central Lake Sammamish Residential

Group Q – Vasa Park Recreational

Group R – South Lake Sammamish Residential

Group S – Phantom Lake Residential

See Appendix A for further detail on these groups.

ANALYSIS OF RESULTS

A review of the Summary table, found on the next page, indicates a high degree of urbanization and lack of ecologic function along Bellevue shorelines[12]. The following distinctions are noted:

1. All residential parcels exhibit at least 10 or more of the 14 urban indicators.

2. By comparison, areas such as Mercer Slough display only several of these factors; thus demonstrating the distinction between "built" zones and those remaining in a natural state.

3. A predominant urbanization (ecologically detrimental) factor <u>on all 19 shoreline areas</u> (including Mercer Slough) is municipal storm drainage and associated impacts.

4. The next most predominant factors are impervious area and presence of structures. All residential reach groupings have been ecologically degraded by impervious area and placement of structures. This is corroborated by City/consultant studies which have labeled these shores as "built-out".

SUMMARY OF FINDINGS

This study has constructed, at no cost to the City, an effective additional assessment of shoreline ecologic function. It extends the City's Inventory showing that a narrow band of 3 (not 4) ecologic functions cannot provide an accurate assessment of shoreline potential as a means to preserve or restore ecologic function.

Based upon 14 factors evaluated across 13 residential shoreline zones (and 6 non-residential zones), it is very apparent that the City's residential shorelines have a uniformly low level of remaining ecologic function. This developed state (i.e., urbanization) will inhibit restoration and more effective measures than simply regulating shoreline development are needed.

RECOMMENDATIONS

1. **Priority, in the SMP, should be given to actions that mitigate urbanization impacts, but should occur at a scale sufficient to assure effectiveness. All Bellevue property owners and residents should participate, since we collectively have created the impacts.**

2. **Municipal storm drainage improvements, to lessen impacts to water bodies, should be given a high priority in the City SMP restoration program and in other City programs.**

3. **Programs currently in place should be supported to lessen the impacts of impervious surfaces. With awareness, all drainage basin property owners can contribute by seeking ways to lessen the flow of waters into the municipal storm drain system.**

4. **Emphasis in non-regulatory programs should focus on preservation of remaining natural shoreline sections – primarily Mercer Slough.**

[12] NOTE: With the exception of areas of Mercer Slough, this study intentionally excludes evaluation of public parks. The intensity of their use of shorelines obviously distinguishes them as urban and the City continues to balance remaining ecologic function with public use. However, parks should not be overlooked when investigating options to mitigate urbanization impacts; municipal storm water outfalls being one potential area for consideration.

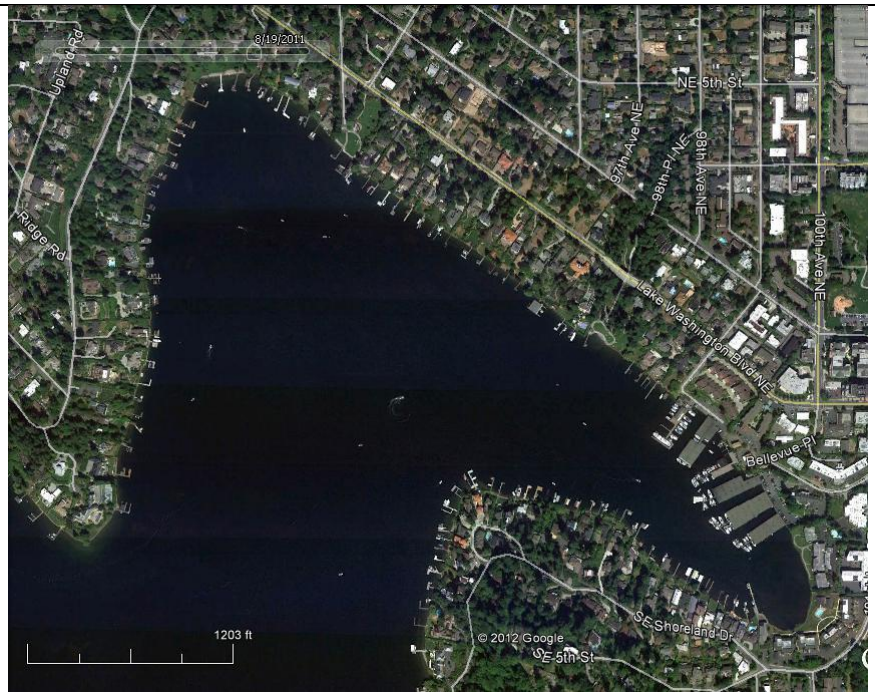
Summary Urbanization by Reach Groupings

	Development Characteristics					Shoreline and Off-Shore Characteristics						Vegetation Characteristics					
Grouping	**Impervious Area**	**"Structures" Present**	**Drainage/Rec'ving Body**	**City "Built-out"**	**Armoring**	**Sewer line/Septic Sys.**	**Lake Access**	**Fetch/Wake Exposure**	**De-Nourished/Inundat.**	**Overwater Structures**	**Landscapped**	**Tree Canopy**	**Wildlife Habitat**	**Wildlife Corr.**	**Area Title**	**Urban. Score**
A	X	X	X	X	X	X	X	X	X	X	X	X	X	X	N. Meydenbauer	**14**
B	X	X	X	X	X	X	X	X	X	X		X	X	X	M.B.Yacht Club	**13**
C	X	X	X	X	X	X		X	X		X	X	X	X	E. Meydenbauer	**12**
D	X	X	X	X	X	X		X	X	X		X	X	X	S. Meydenbauer	**12**
E	X	X	X	X	X	X		X	X	X	X		X	X	Outer Meydenbauer	**12**
F	X	X	X	X	X	X		X	X	X	X		X	X	N of Beaux Arts	**12**
G	X	X	X	X	X	X	X	X	X	X	X		X	X	S of Beaux Arts	**13**
H			X				X	X							Mercer Slough Mouth	**3**
I	X	X	X	X	X		X	X	X	X		X	X		N.Shores Yacht Basin	**11**
J	X	X	X	X	X			X	X	X	X	X	X	X	N.Shores on Lk WA	**12**
K	X	X	X	X	X	X		X	X	X	X	X	X	X	N.Shores. on Canals	**13**
L	X	X	X	X	X	X		X	X	X	X	X	X	X	S of Newcastle Pk	**13**
M			X												Mercer Sl. Wetlands	**1**
N	X	X	X	X	X				X		X				Mercer Sl. Office	**7**
O	X	X	X	X	X	X	X	X	X	X		X	X	X	North Lk Samm	**13**
P	X	X	X	X	X	X	X	X	X	X	X		X		Central Lk Samm	**12**
Q	X	X	X	X		X	X	X	X	X			X		Vasa Pk	**10**
R	X	X	X	X	X	X	X	X	X	X	X	X	X	X	South Lk Samm	**14**
S	X	X	X	X		X	X		X	X	X		X		Phantom Lake	**10**

APPENDIX A

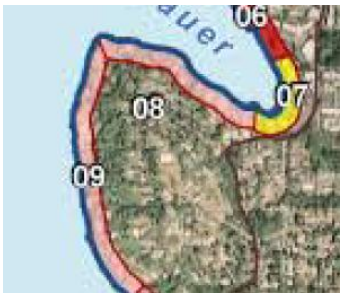
REACH GROUPINGS

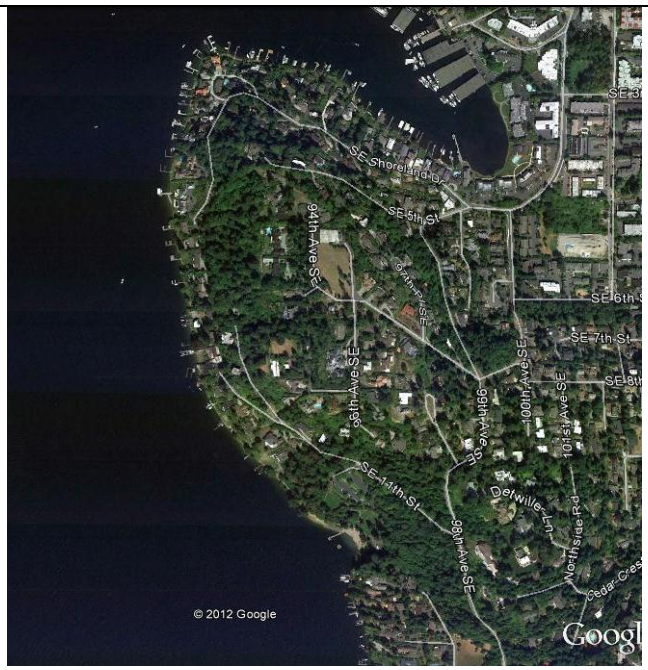
Urbanization-Ecological Function Study - Reach and Sub-area Analysis Groupings



Reach Groupings
Group A – 01, 03, 05
Group B – 06
Group C – 07
Group D – 08
Excluded as Parks - 02, 04

Group Titles
Group A – North Meydenbauer Bay Residential
Group B – Meydenbauer Bay Yacht Club
Group C – East Meydenbauer Bay Multi-Family
Group D – South Meydenbauer Bay Residential



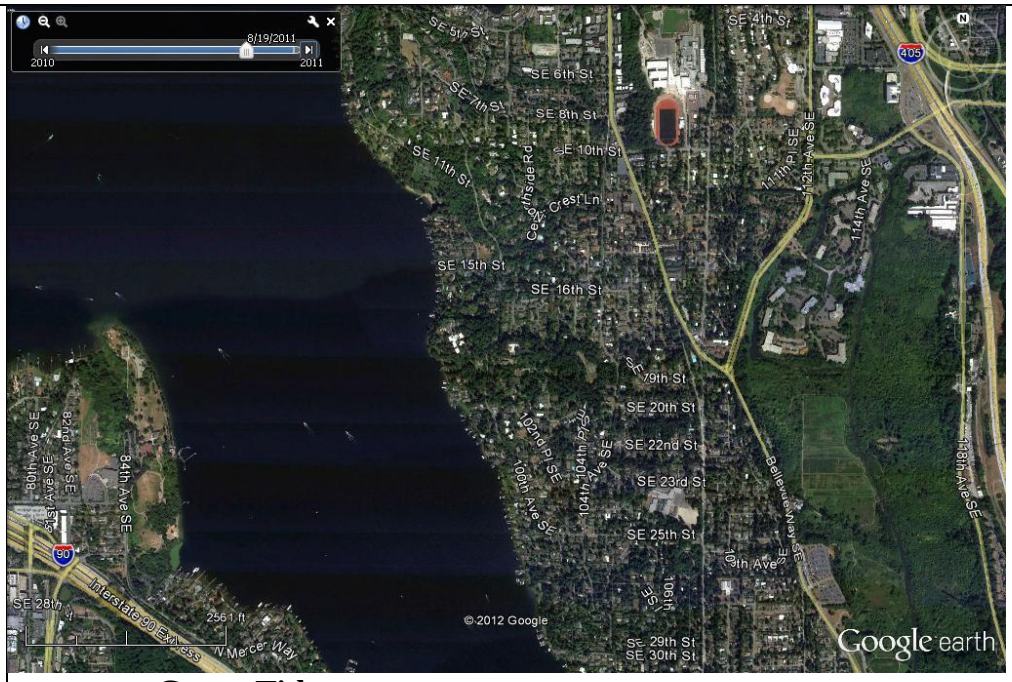


Reach Grouping

Group E - 09

Group Title

Group E – Outer Meydenbauer Bay Residential



Reach Grouping

Group F – 11, 13, 15
Excluded As Parks – 10,12,14

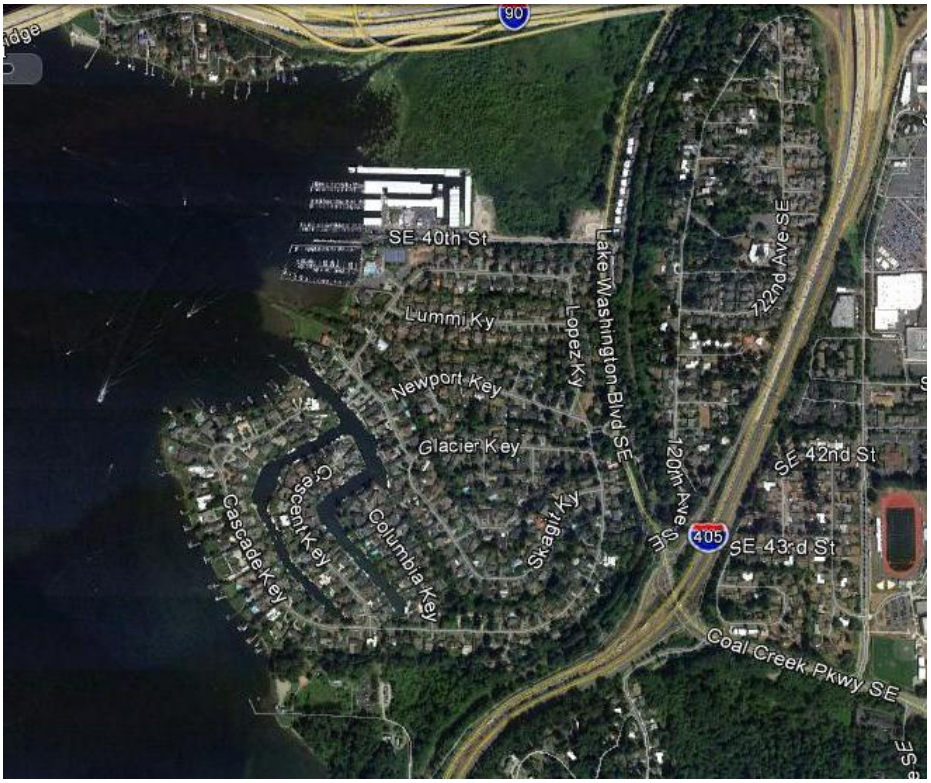
Group Title

Group F - Lake WA Residential North of Beaux Arts

Reach Grouping
Group G – 16, 18
Excluded as Park - 17

Group Title

Group G - Lake WA Residential South of Beaux Arts

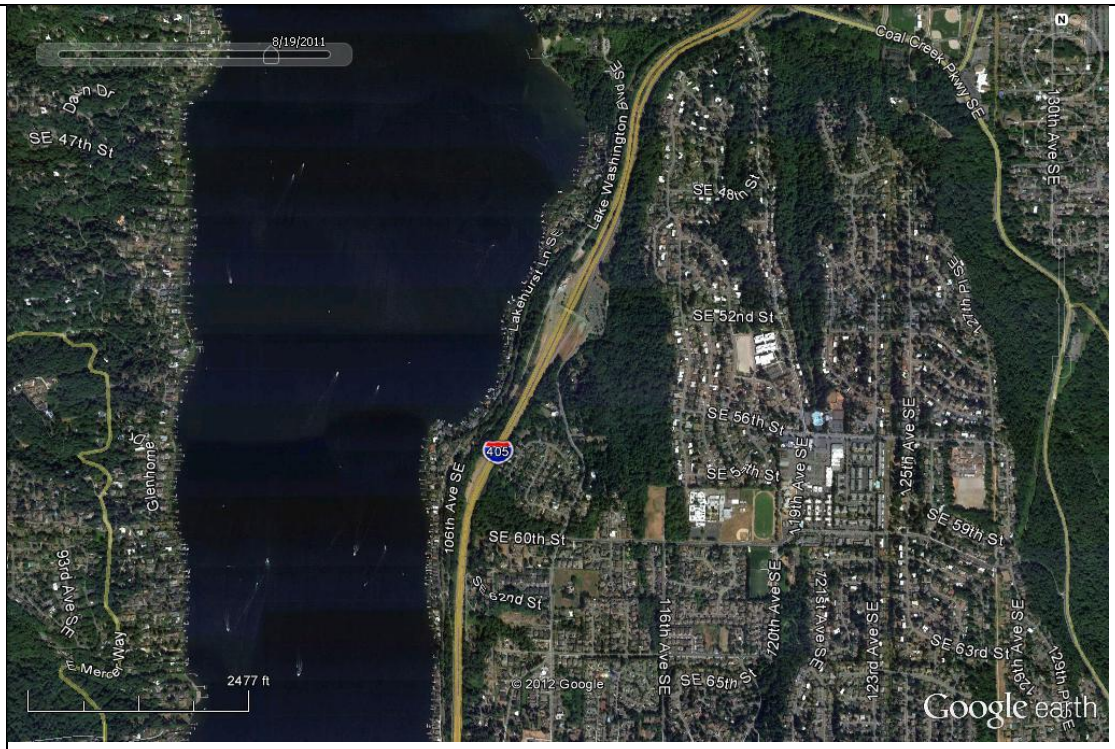


Reach Groupings

Group H – 19
Group I – 20
Group J – 21, 23
Group K – 22

Group Titles

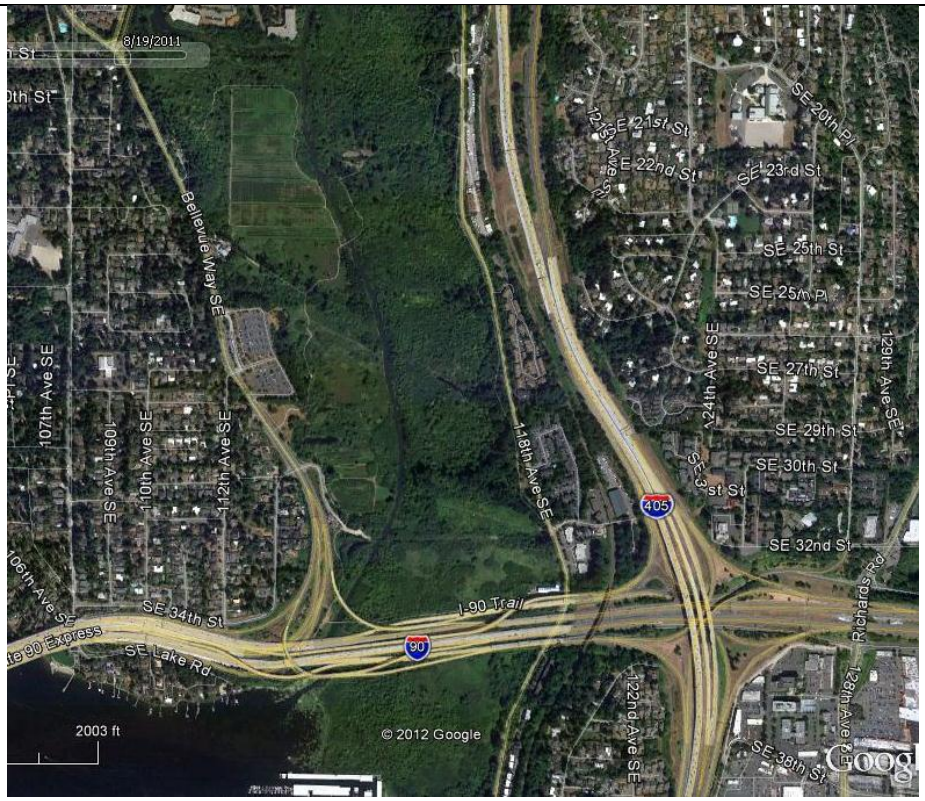
Group H – Mouth of Mercer Slough
Group I – Newport Shores Yacht Club
Group J – Newport Shores Residential on Lk WA
Group K – Newport Shores Residential on Canals



Reach Groupings
Group L – 25 – 28
Excluded as Park - 24

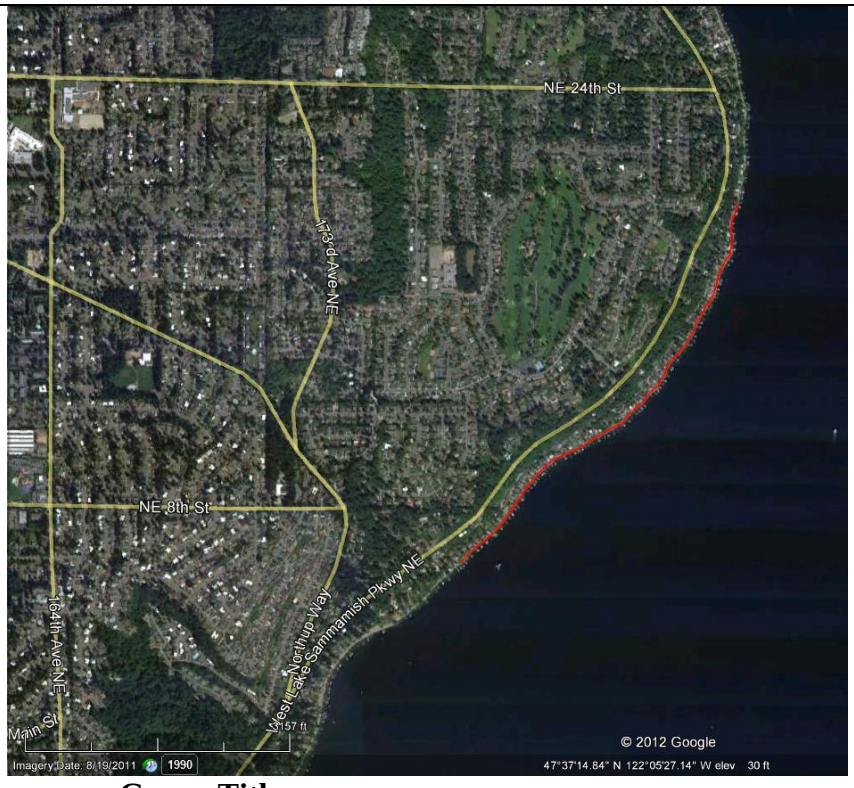
Group Titles

Group L – Lk WA Residential South of New Castle Beach



Reach Groupings
Group M – 29
Group N – 30 - 32

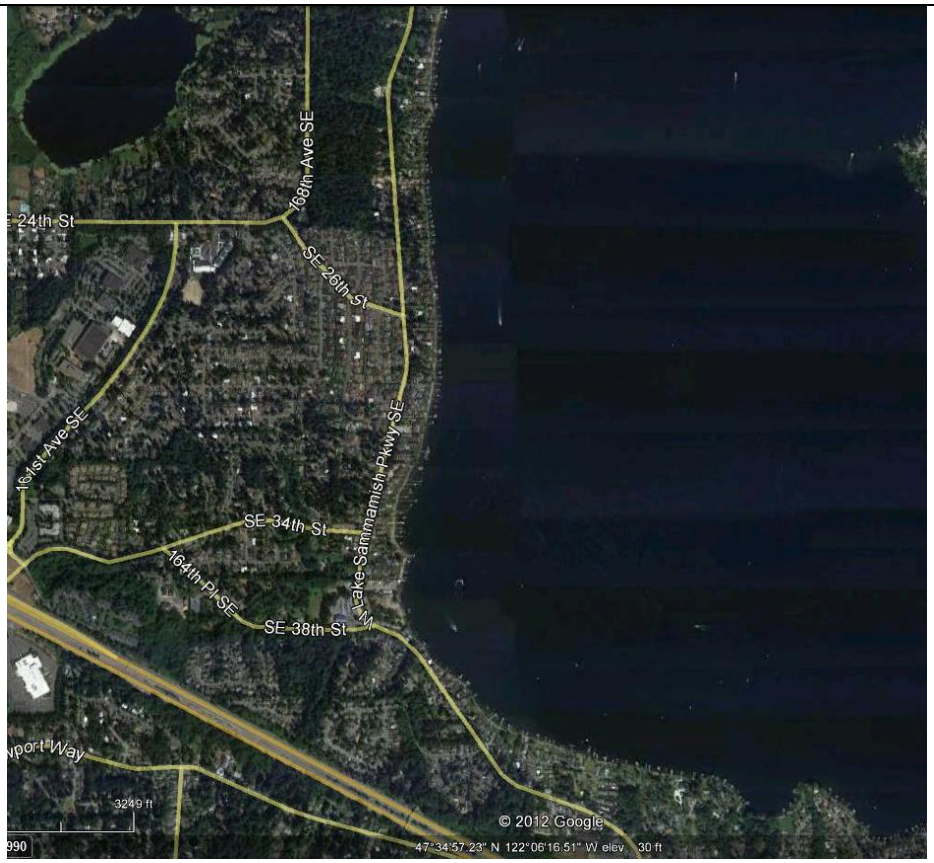
Group Titles
Group M – Mercer Slough Wetlands
Group N – Mercer Slough Office/Kelsey Creek



Reach Groupings

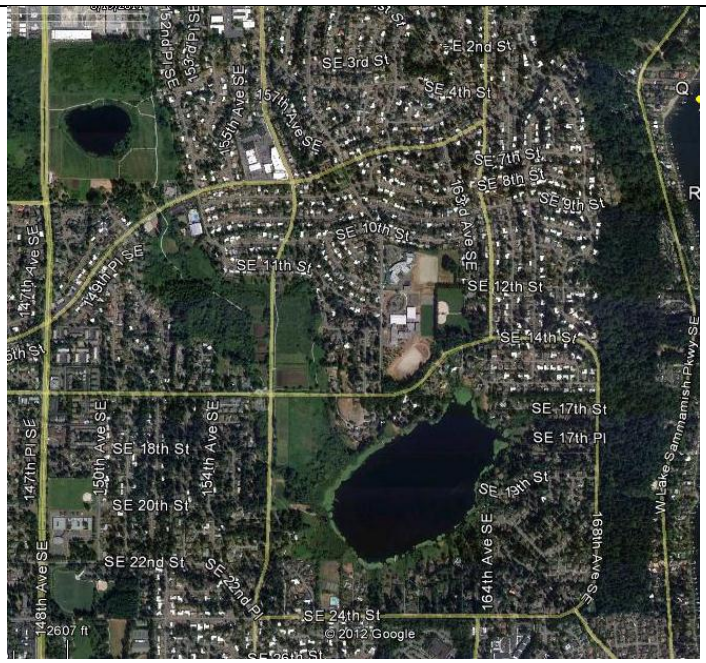
Group O – 33 – 34
Group P - 35

Group Titles
Group O – North Lake Sammamish Residential
Group P – Central Lake Sammamish Residential



Reach Groupings
Group P – 35
Group Q – 36
Group R - 37

Group Titles
Group P – Central Lake Sammamish Residential
Group Q – Vasa Park Recreational
Group R – South Lake Sammamish Residential



Reach Groupings
Group S – 38, 40
Excluded as Parks – 39, 41, 42

Group Titles
Group S – Phantom Lake Residential