PLANNING COMMISSION
REGULAR MEETING AGENDA

Wednesday, October 17, 2018
Mercer Island City Hall

CALL TO ORDER & ROLL CALL **6:00 PM**

MINUTES

August 29, 2018
September 5, 2018
October 3, 2018

APPEARANCES **6:05 PM**

This is the time set aside for members of the public to speak to the Commission about issues of concern. If you wish to speak, please consider the following points:

- Speak audibly into the podium microphone
- State your name and address for the record
- Limit your comments to three minutes

The Commission may limit the number of speakers and modify the time allotted. Total time for appearances: 15 minutes

REGULAR BUSINESS **6:15 PM**

Agenda Item #1: ZTR18-006 Fall 2018 Code Cleanup Code Amendment

Introduction and overview of proposed "clean up" amendments to the Mercer Island City Code, intended to clarify and create internally consistent regulations.

Agenda Item #2: ZTR18-002 Critical Areas Code Amendment

Review of the Best Available Science (BAS) report related to geohazard areas. Review of staff recommended administrative amendments to the critical areas regulations. Identification of recommended amendments to the City's critical area regulations.

Agenda Item #3: 2019 Comprehensive Plan Amendment Docket

Preliminary discussion regarding the 2019 Comprehensive Plan Amendment docket recommendation to City Council. Docket recommendation will occur on October 16.

OTHER BUSINESS

Interim Director's report
Planned Absences for Future Meetings
Next Regularly Scheduled Meeting: October 16, 2018 at 6:00PM

ADJOURN

PHONE: 206-275-7729
WEB: www.mercergov.org

AGENDA TIMES ARE APPROXIMATE

PLANNING COMMISSION
MEETING MINUTES
AUGUST 29, 2018

CALL TO ORDER
The Planning Commission was called to order by Chair Daniel Hubbell at 6:06 PM in the Council Chambers at 9611 SE 36th Street, Mercer Island, Washington.

ROLL CALL
Chair Daniel Hubbell, Vice Chair Tiffin Goodman, Commissioners Carolyn Boatsman, Jennifer Mechem, Lucia Pirzio-Biroli, Craig Reynolds, and Ted Weinberg were present.

Evan Maxim, Interim Development Services Director, Andrea Larson, Senior Administrative Assistant, Robin Proebsting, Senior Planner, Nicole Gaudette, Senior Planner, and Bio Park, Assistant City Attorney were present.

MINUTES
There were no minutes to approve.

APPEARANCES
There were no public appearances.

REGULAR BUSINESS – PUBLIC HEARING
Agenda Item #1: 2018 Comprehensive Plan & Code Amendments
Evan Maxim, Interim DSG Director, provided a brief presentation on the 2018 Comprehensive Plan & Code Amendments.

Chair Hubbell opened the public hearing at 6:30pm

Marjorie Offer, 2980 76th Ave Se, Apt 301. She has lived on islanded for 10 years and is a member of the SJCC & Herzel Ner Tamid. She understands the concerns of the neighbors because of her experience with a variance on a property next to her condominium, but she supports of the purposed rezone for the SJCC, FASPS & Herzel Ner Tamid properties. She met with the CEO of the SJCC and stated that the SJCC wants to work with the neighbors in everyway to make it a better environment for the neighborhood.

Susan Greisse, 4717 89th Ave SE. She is both and alumni parent and current parent at the FASPS and also currently a trustee on the board of the school. She spoke to express her support of the Comprehensive Plan amendment and zoning change. She has been a resident of the island for 11 years. She believes that this provides a balanced way for our island to grow, sees the benefit of community facilities and will help the community move forward in a strategic way.

Aaron Kiviat, 8147 W Mercer Wy. He is an attorney, third generation islander, and graduated the class of 1994, Mercer Island High School. He is a board member of Herzel Ner Tamid and spoke in support of the Comprehensive Plan amendment and zoning update. He believes the proposed amendment will support the land use goal 17.4, in the City's Comprehensive Plan; adding a designation will help with the city goal and long-term viability of public community facilities.

Joel Espelien, 9920 SE 40th St. He has lived here for 8 years, his kids attend FASPS, and he is a past member of SJCC. He spoke in support of the purposed rezone, stating that his property abuts proposed properties. He spoke regarding the hap-hazard current development of the property, that isn't ideal and that anyone who is dropping kids off at school or children crossing the street can see that it is not optimal. He believes that the properties will continue to be sub-optimally used if this amendment does not proceed.

Steve Dispensa, 3990 92nd Pl SE. He has lived on the island for 5 years, has three children at FASPS, and is vice chair of the board. He spoke in support of Comprehensive Plan amendment and new zoning designation for SJCC, FASPS & Herzel Ner Tamid. He values the planning process and can clearly see how this planning model will benefit Mercer Island residents and is worthy of the support of the Planning Commission.

Natalie Heitzeberg, 5818 80th Ave SE. She is a Mercer Island resident and a parent of a son at FASPS. She has spoken to many colleagues and friends and feels that the proposed amendments are a very positive step which supports the children's development, is a reason why people move to and value Mercer Island and supports the diversity of our community. She stated that these amendments help to bring predictability and development requirements to an area that is already used for community facilities.

Laura Mousseau, 1696 NE 36th Place, Bellevue. She is the current chair of the FASPS board and former parent. She found when her family joined the school found a profound sense of community. FASPS families and students deeply value their relationships with the Mercer Island Community. She supports the Comprehensive Plan amendment as she feels this long-range planning will help the respective organizations update aging facilities, plan for the future and address concerns in the most effective way.

Eric Thuau, 18945 NE 20CT Redmond. He is the head of the FASPS and an alumni parent. He spoke in support of the Comprehensive Plan and zoning amendments, stating that these amendments will offer the chance for these organizations to create something wonderful that will benefit the island, residents and community. He explained that they look forward to continuing the dialog with the neighbors and are very mindful of the shared concerns about traffic, pedestrian safety and parking; working towards the goal of creating a plan that meets everyone's needs.

Paige Fisher, 4125 W Mercer Wy. She is 16 years old, grew up on Mercer Island, attends MIHS, went to preschool and programs at the SJCC and her family attends Herzel Ner Tamid. She supports the Comprehensive Plan amendment and feels that the proposed investments that these facilities want to make for the future will be very beneficial to the community and let them grow responsibility.

Rabbi Jay Rosenbaum, Senior Rabbi at Herzel ner Tamid, 9900 SE 40th St. He is a 17-year resident of Mercer Island and lives right behind the SJCC, and he can empathize with the needs of both the neighbors and the facilities. Granddaughter at JCC preschool. As a community leader, he appreciates that the City needs to balance a variety of needs, and that it benefits the community to have flourishing institutions. He also stated that he understands and appreciates that neighbors have very real needs in this process as well. He believes this would provide the City Council the ability to balance those needs.

Dona Peha, 7653 W Mercer Wy. She is a life-long member of Herzel Ner Tamid, the SJCC and graduated MIHS class of 1982. She moved back to the island a little over a year ago and what has struck her the most is the pride of the citizens. She spoke in support of the Comprehensive Plan amendment and doesn't feel that it is in the City's best interest to hinder the upgrading of buildings for organizations that are so well loved and used by the community.

Michael Leahe, 9852 Mercerwood Dr. He requested that the Planning Commission reject amendment No. 8. He is a member SJCC, but states that the first priority of the Planning Commission is to protect the best interests of the residents of Mercer Island, and not other entities. He believes that if this Comprehensive Plan amendment is adopted, it would adversely affect the property values of neighbors as well as negatively impacting the overall residential character of the community and provide an unsafe environment for traffic, pedestrians as well as creating noise and light pollution.

Julie Garwood, 9772 SE 41st St. She spoke regarding amendment 8 and has many concerns regarding this Comprehensive Plan amendment. She spoke to the number of houses that would be lost if this amendment is passed and how it will have an enormous impact on the neighborhood.

Ryan Ralfs 9703 SE 40th St. He submitted written comments and would like to speak at next meeting.

Liz Friedman, 2035 80th Ave SE. She has been a resident since 2004 and is currently chair of the SJCC board. She spoke in support of the Comprehensive Plan amendment and rezone. She indicated that the three organizations are a beginning of long-range planning process to update aging facilities and plan for the future; these facilities are very old and require a lot of maintenance. She spoke to the want of the organizations to work collaboratively and responsibly with the City and the neighbors.

Amy Lavin, 7835 SE 22nd Pl. She is currently the CEO of the SJCC and a 33-year resident of Mercer Island. She spoke to the number of users of the SJCC, how most of them live on Mercer Island and how the SJCC is focused on enhancing community. She stated that the organizations could redevelop with current zoning, but that they don't believe that it would effectively address all of the concerns of the neighbors and community. She indicated that the Comprehensive Plan and zoning amendments would allow for wiser more comprehensive design and development and community engagement to assure that neighborhood interests and interests of the broader community are incorporated.

Jeff Davis, 4568 E Mercer Wy. He has been an island resident for 58 years and a member of the SJCC. He considers the SJCC an important part of the community but does not support the Comprehensive Plan and zoning amendment. He feels that the community can benefit by the current facility that the SJCC has with maintenance and remodeled. He spoke to all of the changes that have occurred since the SJCC was built. He stated concerns that if this Comprehensive Plan and zoning amendment pass regarding what other facilities on Mercer Island would want to take advantage of the new zoning.

Suzanne Zhar, 2441 76th Ave SE. She disclosed that she is a member of Design Commission and indicated that she was speaking as a resident, business owner, real estate owner. She commented on amendments 13 & 15. She encouraged the Planning Commission to reconsider amendment 13. She spoke to the giving the opportunity for a potential demonstration project could possibly be explored as a way to creatively and thoughtfully develop the Town Center. She also voiced her support for amendment 8 that her and her family are participants of those facilities.

Mark Hall, 6818 E Mercer Wy. He is building new home at 3832 E Mercer Wy. He requested that current zoning be maintained and that amendment 8 is not adopted. He is a member of Emmanuel Church and the have been operating with a conditional use permit. He stated that the church has been able to do lots of things with the CUP and respected neighbors. He stated that traffic has already changed dramatically because of traffic change on I-90 and the City vacating 97th Ave that used to go through to 37th. He does not want this city to look like Huston.

Marie Bender, 7890 81st Ave SE. She has lived here for 18 years. She spoke regarding process. She thought that commission was just tidying up the comp plan, but then realized that there was much more going on. She talked about the process with the school district and City for the Middle School remodel, and how it could have gone better. She also stated that the financial impact needs to be considered; how people off the island may benefit from this amendment.

Nicole Kelley, 9821 SE 40th St. She spoke regarding the private sales of properties surrounding the SJCC and questioned if the discussion regarding the mixed zoning problems that they have were self-created; that these properties were purchased with the knowledge that they were zoned residential. She questioned why this is taking away tax-paying residents to support these nonprofit facilities. She also spoke regarding the traffic safety issues and that she supports the redesign of these facilities but that she believes that the current footprint they have now is plenty.

Teresa Hall, 4242 E Mercer Wy. She spoke regarding her property taxes being depressed due to living close to Mercerwood Shore Club. She questioned why the organizations bought the properties they did knowing that they were zoned residential. She spoke regarding how busy East Mercer Wy is and how much of the traffic is not island residents but rather people coming to drop off their kids and then leave again and that the job of the Planning Commission and City Council is to protect Mercer Island.

John Hall. 9970 Se 40th St. He has lived on the island for 60 years. He has followed the SJCC in all expansion tries and they have been turned down many times. He talked about how the City suggested that the SJCC buy property to the north of them that is zoned commercial, which would fit their needs. HE spoke regarding how the JSCC talks about how they care about neighbors, yet in last year they have trimmed up over 60 trees and have cut down at least 7 trees.

Mat Goldbach. 9980 SE 40th St. He spoke to how Amendment 1 seems a bit odd with out amendment 8, that there is already a Private Community Facility in Amendment 1. He stated that he has asked previously what is meant by private community facility and how can the Planning Commission approve a land use map with a designation that cannot be defined. He spoke of being skeptical of approving these amendments and then doing the regulations after they have been approved. He spoke to our both the SJCC and the City have not done a good job engaging the community and that the community does not know what is going on.

Tina Vedrickson, 6206 89th Ave SE. She moved from LA two years ago and that she moved here for the community. She stated that she knew nothing about this amendment, until yesterday. She indicated that her concerns with this type of amendment is what it could mean for this area. She questioned the percentage of residents that benefit from the school and sees no reason why these facilities could not go through a renovation; why do they need to expand and further change a residential neighborhood. She stated that she does not want to see happen in so many other communities happen here.

Don Thompson, 7265 N mercer Wy. He has been an island resident since 1970. He spoke to how creating an entirely new zone in a residential neighborhood, is a big deal; that once this Comprehensive Plan amendment is approved it would create a whole new set of regulations for this zone in a residential neighborhood. He questioned whether the development regulations must be concurrently adopted at the same time as this amendment and stated that the reason it is so critical for the regulations to be done concurrently, is because that is asking the citizens to trust DSG, who has not been very trust worthy over the last 5 years. He suggested moving the amendment to the 2019 docket.

Chair Hubbell continued the Public Hearing to September 5, 2018.

The Commission recessed at 7:35pm.
The Commission reconvened at 7:47pm

OTHER BUSINESS
Evan Maxim, Interim DSG Director, spoke to the Commission regarding City emails for the Planning Commission and how email is handled for the Commission.

The Commission discussed the pros and cons of City email accounts and agreed to proceed with moving email communication to City email accounts.

Evan Maxim, Interim Director, provided a brief Planning Manager report, regarding the procedural code amendment and the code compliance code amendment going to City Council for a first reading and possible approval on September 17th.

PLANNED ABSENCES
There were no planned absences.

NEXT MEETING
The next Planning Commission meeting will be on September 5, 2018 at 6:00PM at Mercer Island City Hall.

ADJOURNMENT
The meeting was adjourned at 8:30 PM.

PLANNING COMMISSION MEETING MINUTES SEPTEMBER 5, 2018

CALL TO ORDER

The Planning Commission meeting was called to order by Chair Daniel Hubbell at 6:09 PM in the City Hall Council Chambers at 9611 SE 36th Street, Mercer Island, Washington.

ROLL CALL

Chair Daniel Hubbell, Vice Chair Tiffin Goodman, Commissioners Carolyn Boatsman, Jennifer Mechem (arrived at 6:19pm), Lucia Pirzio-Biroli, Craig Reynolds, and Ted Weinberg were present.

Evan Maxim, Interim Development Services Director, Nicole Gaudette, Senior Planner, and Kari Sand, City Attorney were present.

APPEARANCES

There were no public appearances.

REGULAR BUSINESS – PUBLIC HEARING

Agenda Item #1: 2018 Comprehensive Plan & Code Amendments

Evan Maxim, Interim Director, provided a brief presentation on the 2018 Comprehensive Plan & Code Amendments.

Chair Hubbell opened the public hearing at 6:14pm

Julie Garwood, 9772 SE 41st St spoke about Amendment 8, how 4 houses, 1 lane and 1 community garden would be lost if this amendment is approved and how neighbors have been left to fend for themselves for encroachment on the neighborhood. She stated how she wants more time to work on proposal, that there should be more discussion.

Julie Chivo, 2824 61st Ave SE, supports Amendment 8 but is concerned about traffic. She supports a zone that allows nonprofits to plan for capital improvements and applauded the citizens who are proposing a structure which will benefit Islanders for years to come.

Trea Schocken Diament, 13 El Dorado Dr, asked that the Planning Commission support Amendment 8. She stated that the community should support Island community facilities that support the physical, mental, spiritual, social and cultural health of Mercer Island.

Alan Merkle, 5080 W Mercer Way, spoke about the need to constantly evaluate current plans and policies. He supports Amendment 8 and believes it will enable long term planning of facilities. He stated that integration into the neighborhood should be considered and that without the amendment, development will be piecemeal and that new regulations will address impacts.

Ben Orillon, 7225 SE 36th St, FASPS Lower School Head, stated that he can see how the new zone would benefit the Island and will offer further opportunity.

JP Kirby, 8201 SE 35th StFASPS Trustee, supports Amendment 8 indicating that this is the right time to look to the future and work together with the community and City to have a careful plan moving forward and listen to input from the neighbors.

Rob Wolf, 2208 80th Ave SE, SJCC Board Member, stated that the SJCC brought him to Mercer Island for the first time and influenced him to move here. He talked about how the building needs to be rebuilt and impacts can be addressed in partnership with neighbors.

Ira Appleman, 9039 E Shorewood Dr, opposes intensification of activities on the property (Amendment 8). He spoke about how the SJCC received a vacation of 99th and entrance to the SJCC. He stated that it's a breach of faith for staff and oCuncil to support this. He also does not support the Arts Comp Plan amendment (Amendment 6); he believes MICA will be moving to the Tully's site.

Iantha Sidell, 2770 65th Pl SE, SJCC Board Member, spoke about her support of local business on the Island. She believes safety should be a priority.

Dana Weiner, 4364 E Mercer Way, is a member of Herzl and SJCC and now works at the SJCC. She supports Amendment 8 and agrees with language requiring design review; she supports concept of master planning.

Willy Mullins, 7800 SE 27th St #201, expressed his concern about the rate at which Amendment 15 was introduced and the impacts on the condo residents including access to building and deliveries. He spoke about his meeting with the City last week and discussed impacts that hadn't been considered. He is concerned about park space will be taken from the community and voiced concerns with something that urban being placed next to light rail.

John O'Rourke, 4043 97 Ave SE, spoke about not using emotion to make a decision on Amendment 8 and asked the Planning Commission if they have the data the need for the decision.

Cartlin Monson, 3808 E Mercer Way, spoke about the population increased since 1979 and how home values have increased because nothing was built except nice houses. He is concerned that setbacks will be a dead minimum; he looks at the SJCC from his front door. He stated his concerns about property values being impacted. He asked the Planning Commission if they want this zone to be something that could be repeated in other neighborhoods

Ryan Rahlfs, 9703 SE 40th St, spoke about the expansion being harmful to the neighborhoods and how the residential codes were recently changed because large houses can have a negative impact. He stated that a 'no' vote is an affirmation of the concerns of the neighbors and asked the Planning Commission to cast a vote against Amendment 8.

Peter Struck, 9134 SE 39th St stated that 4 of the amendments should be recommended. He spoke about Amendment 6 how it is overreaching, is at odds with other parts of the Comp Plan and should be rewritten. He stated that Amendment 8 is at odds with the overarching Comp Plan Vision statement that states that City leaders will maintain the integrity of existing approved land use policies; land use goal 15 states the Mercer Island should remain principally a low density single-family residential community. The talked about proposed Policy 29.6 is written so that the zone could be applied to any residential area and that proposed Policy 29.5 allows for upzoning in single-family residential areas. He stated that Amendment 9: Disaster Planning is not appropriate for a

Comp Plan. Lastly, he talked about how Amendment 15: Commuter Parking is labeled as an emergency; rezoning of a small parcel of land for parking is not an emergency.

John Rivera Dirks, 8011 84th Ave SE, thanked the Planning Commission for the work done. He supports Amendment 8; his kids go to the SJCC and he is a member. The SJCC promotes education, culture and health. He stated that special thought needs to be given to the safety and security; that traffic, safety, design, scale and aesthetics are all important.

Rick Tydings, 2065 80th Ave SE, spoke about living along the south end of the SJCC parking lot and their bedroom was 6 feet from the property; noise and commotion grew over time. He stated that on November 6, 2002 the Planning Commission met about vacating a street the ran through the SJCC's property and how other projects were proposed over time and that nothing was approved.

Anna Fein, 8846 SE 59th St, spoke in support of Amendment 8. She supports language including element to address traffic and parking impacts and pedestrian circulation; including the new language about reducing conflicts among transportation.

Paul Burstein, 8367 SE 30th St, belongs to the SJCC and Herzl, he stated that non-profit organizations benefit a community. He talked about how Amendment 8 would lead to a quality of life on Mercer Island.

Cheryl D'Ambrosio, 3712 E Mercer Way, lives next to Herzl, across from JCC and FASPS. She spoke against zoning changes without understanding the detail of the zoning change. She stated that there are huge safety, traffic, and noise issues.

Tim McGuire, 4029 91st Ave SE, voiced his concerned about rezoning. He stated that the applicants do not qualify for other ways to develop; don't qualify for variance and that if this needs to be changed, it should be a legislative change and a new zone be created; this is eminent domain by proxy. He voiced that a decision is being sought through the planning commission that the City Council can implement. He opposes Amendment 8, because City Council should do it.

El Jahncke, 9729 SE 43rd St, stated that he supports Willy Mullins comments in regard to Amendment 15 that he does not support or oppose. He is concerned with the public private partnership joint venture; Town Center regulations grants a larger height with the dedication of public amenities.

Jeff Davis, 4568 E Mercer Way, questioned why the City address the safety and parking issues as the scope of the facility had changed over the last 50 years. He stated that a 50-year-old building is a new building in other countries and that upgrading a 50-year-old building shouldn't take much talent. He believes that the property owner should have addressed the problem issues.

Debbie Newell, 2029 82nd Ave SE, stated that her kids attended FASPS and she is currently CFO of the School. She supports the amendment language, especially considering nonmotorized solutions. She also supports language requiring eliminating conflict between transportation modes.

Tracy Granbois, 8440 SE 82nd St, spoke about Amendment 15: MICC 2.24.030 states that ordinances will not go into effect for 30 days after passage the resolution is void because it went into effect 25 days after adoption. She said that on June 25 there was no mention of emergency of facts to support an emergency. She spoke about Amendment 6, considering the homeless crisis, she questioned why the City would be concerned about housing for artists and not the homeless.

Doug Cargill, 8940 SE 56th St, stated that Amendment 8 makes no sense that other jurisdictions only

have generalities, and not a fully fleshed out development. He stated that the design charettes are about advantaging the developer and not the community. He fears this is the process that is happening and that there is more homework that needs to be done.

John Hall, 9970 SE 40th St, owns a vacant lot at 9902 SE 40th St. He questioned why DSG didn't provide history of the applicants to the Planning Commission. He stated that the applicant's facility is very intrusive and that the hodgepodge of zoning was a result of the applicant buying residential properties.

Tim Lemon, 4219 Shoreclub Dr, spoke in opposition to Amendment 8. He stated that the approach and process are not appropriate. He is concerned about a precedent being set and he would like to see a design first. He stated that he believed that there must have been some knowledge of this zone change being approved and questioned why the properties would have been purchased. He spoke about his children being in an accident during a peak hour time in the area. He is surprised there aren't more accidents. He stated that changes should not be made without a design being presented.

Winky Lai, 3716 E Mercer Way, lives next to the Herzl parking lot. She opposes Amendment 8. She stated that the area is developing, and expansion is inevitable down the road. She talked about how promises have not been kept by the applicants. She questioned why they are being given more power when they have not kept promises. She said that she would love to see a new facility, but more questions need to be asked before a blank check amendment is passed.

Dan Thompson, 7265 N Mercer Way, stated that the City should look into what Tracy Granbois said. He spoke to Amendment 3, stating he does not believe that the study could say that traffic has improved. He thinks that inaccurate traffic numbers will haunt us. He spoke about Amendment 11, stating he does not want to see an increase in GFA. He stated that he doesn't know regulations or designs and have not seen architectural renderings.

Paul Shoemaker, 4546 Forest Ave SE, stated that the Arts Council will do a study session with the City Council on September 17 and everyone is invited to join.

Matt Goldbach, 9980 SE 40th St, stated that there is no definition for Private Community Facility and therefore very little to talk about. He stated that a decision should not be made if a Private Community Facility cannot be defined.

Nicole Kelly, 9821 SE 40th St, spoke to Amendment 1. She has not heard of policies to protect the neighborhood; protecting them from lights, trespassing, traffic, no stop light on E Mercer Way, requiring underground parking. She indicated that she sees the parking lot from her property and no one knocked on her door. She indicated that they should remodel their current facility and that they should not have purchased the properties next door.

The Public Hearing closed at 7:38 pm.

The Commission took a break until 7:55 pm.

Agenda Item #2: Planning Commission Recommendation on 2018 Comprehensive Plan & Code Amendments

Evan Maxim, Interim Director, provided a recommended motion for the Planning Commission.

It was moved by Boatsman; seconded by Goodman to:
Recommend that the City Council approve the proposed Comprehensive Plan amendments as detailed in Exhibit 1, and further moved to recommend that the City Council approve the proposed amendments to the Mercer Island City Code Title 19 as detailed in Exhibit 2.

Amendment 8

It was moved by Hubble; seconded by Pirzio-Biroli to:
Amend the previous motion as follows:
Revise Amendment 8 to the Land Use Element to:

- **strike the second "community" in Goal 8 of Section V. to read: "The community should accommodate facilities that support the physical, mental, spiritual, social, or cultural health of Mercer Island."**
- **Amend Goal 29 to read as follows: "Establish a zoning designation that would enable the location of community facilities that utilize master planning techniques and accommodate flexible design standards to encourage superior site and building design outcomes."**
- **Amend policy 29.7, to read "Community facilities are subject to design review and supplemental design standards."**
- **Amend policy 29.8 to read: "A master planning process shall be utilized for all major development of community facilities."**
- **Amend Goal 8 of Section V to state "The City should accommodate community facilities that support the physical, mental, spiritual, social, or cultural health of Mercer Island."**

Motion to Amend Passed 7-0

It was moved by Weinberg; seconded by Reynolds to:
Amend the previous motion as follows:
Revise Figure 1 Land Use Map to show the current Land Use designations of the FASPS, SJCC, and Herzl Ner-Tamid properties.
Motion to Amend Failed 1-6.

After discussion the Commission decided to discuss and approve the Amendments one by one.

It was moved by Boatsman; seconded by Goodman:
To withdraw the original motion for approval of all of the amendments.
Passed 7-0

It was moved by Boatsman; seconded by Goodman to:
Recommend that the City Council approve revised Comprehensive Plan Amendment 8 as detailed in Exhibit DH (as provided at the meeting).
Passed 6-1.

The Commission took a break until 10:21 pm.

Amendment 6

It was moved by Reynolds; seconded by Goodman to:
Recommend that the City Council approve the proposed Comprehensive Plan Amendment No. 6 as detailed in Exhibit 1.

It was moved by Boatsman; seconded by Reynolds to:
Amend the previous motion to:
Call Amendment 6 the Arts and Culture Plan instead of calling the submittal by the Arts Council the Comprehensive Arts and Culture plan.
Motion to Amend Passed 7-0.

It was moved by Pirzio-Biroli; seconded by Weinberg to:
Amend the previous motion to:
Remove the term "comprehensive" from the references of the Arts and Culture Plan.
Motion to Amend Passed 7-0.

It was moved by Boatsman; seconded by Goodman to:
Amend the previous motion to:
Amend 25.2 to remove the word "assist" community" and replace with the words "support".
Motion to Amend Passed 7-0.

It was moved by Reynolds; seconded by Boatsman to:
Amend the previous motion to:
Strike parenthetical comment at the top of page 64 regarding 2016 elementary school on page 64 of pdf, 63 of packet, 1st paragraph)
Motion to Amend Passed 7-0.

It was moved by Goodman; seconded by Weinberg to:
Amend the previous motion to:
Delete 24.6 regarding transportation projects and incorporate into 24.4 Revise 24.4 to state "Incorporate public art into capital improvement projects, including transportation projects."
Goodman withdrew the amendment and Weinberg agreed.

Main Motion as Amended Passed 7-0.

Amendment 6 passed as amended.

Amendment 15

It was moved by Goodman; seconded by Mechem to: Motion to
Recommend that the City Council approved Amendment 15 as detailed in Exhibit 1, and further move to recommend that the City Council approve the proposed amendments to the Mercer Island City Code Title 19 as detailed in Exhibit 2.
Passed 7-0.

Amendment 15 passed as presented.

Amendment 7

It was moved by Pirzio-Biroli; seconded by Goodman to:
Approve Amendment 7 for the Critical Areas Ordinance.

It was moved by Pirzio-Biroli; seconded by Boatsman to:
Amend the previous motion to:
Adopt the proposed amendments in document CBLPB (as provided at the meeting).
Motion to Amend Passed 7-0.

It was moved by Boatsman; seconded by Pirzio-Biroli to:
Amend the previous motion to:
Create Policy 19.16 that would read: "Promote the establishment of bird nest boxes in parks and on private property for species that would benefit. Remind pet owners of the very significant bird mortality related to cats and to keep them indoors." Motion to Amend Motion to Amend Passed 7-0.

Main Motion as Amended Passed 7-0.

Amendment 7 passed as amended.

Amendment 1

It was moved by Boatsman; seconded by Reynolds to:
Recommend that the City Council approved proposed Amendment 1 as detailed in Exhibit 1.

It was moved by Hubbell; seconded by Boatsman to:
Amend the previous motion to:
Amend the table so the land use designation currently named "private community facilities" would be "community facility", and to change the text to strike through the words "private" on lines 1 and 2 to change the word "facilities" to "facility" where appropriate.
Motion to Amend Passed 7-0.

It was moved by Hubbell; seconded by Boatsman to:
Amend the previous motion to:
Amend the legend on Figure 1 to change "private commercial facilities" to "community facility".
Motion to Amend Passed 6-0.

Main Motion as Amended Passed 6-1 (Weinberg dissented).

Amendment 1 passed as amended.

Amendments 2, 9, 12 and 13

It was moved by Boatsman; seconded by Weinberg to:
Recommend that the City Council approved proposed Amendments 2, 9, 12 and 13 as presented.
Passed 7-0.

Amendments 2, 9, 12 and 13 passed as presented.

Amendment 3

It was moved by Goodman; seconded by Pirzio-Biroli to:
Recommend that the City Council approves proposed Comprehensive Plan Amendment 3 as detailed in Exhibit 1.

It was moved by Pirzio-Biroli; seconded by Boatsman to:
Amend the previous motion to:
Add a rumble strip between the lane and shoulder on the blind curves on East and West Mercer Way.

Motion to Amend Passed 7-0

It was moved by Reynolds; seconded by Boatsman to:
Amend the previous motion to:
Amend Goal 9.1 on page 20 to delete the phrase "to the extent possible".
Motion to Amend Passed 7-0

It was moved by Reynolds; seconded by Boatsman to:
Amend the previous motion to:
Amend the last sentence on page 43 should be revised to state "who live more than one mile from MIHS and neither do not have a parking pass nor are assigned to a district bus".
Motion to Amend Passed 7-0

The Commission noted that the existing bicycle & pedestrian facilities map, Figure 5, on page 38 does not have sharrows and that this be added to the 2019 docket.

Main Motion as Amended Passed 7-0.

Amendment 3 passed as amended.

Amendment 4

It was moved by Boatsman; seconded by Mechem to:
Recommend that City Council approve the proposed Comprehensive Plan Amendment 4 as detailed in Exhibit 1.
Passed 7-0

Amendment 4 passed as presented.

Amendment 5

It was moved by Boatsman; seconded by Goodman to:
Recommend that City Council approve the proposed Comprehensive Plan Amendment 5 as detailed in Exhibit 1.

It was moved by Boatsman; seconded by Pirzio-Biroli to:
Amend the previous motion to:
Amend Comprehensive Plan Amendment 5 with the language that is contained in Exhibit CBLPB2 (as provided at the meeting).
Motion to Amend Passed 7-0.

It was moved by Pirzio-Biroli; seconded by Boatsman to:
Amend the previous motion to:
Amend to replace "standards" with "principles" throughout.
Motion to Amend Passed 7-0.

Main Motion as Amended Passed 7-0.

Amendment 5 passed as amended.

Amendment 10

It was moved by Mechem; seconded by Pirzio-Biroli to:

Recommend that City Council approves Amendment 10 as detailed in Exhibit 1.

It was moved by Reynolds; seconded by Pirzio-Biroli to:
Amend the previous motion to:
Change language for goal 3 on page 30 to state "...improvement, and, development of housing for a diverse community".
Reynolds withdrew his motion to amend the amendment.

Passed 7-0

Amendment 10 is passed as presented.

Amendment 11

It was moved by Boatsman; seconded by Weinberg to:
Recommend that City Council approves Amendment 11 as detailed in Exhibit 1.

It was moved by Boatsman; seconded by Weinberg to:
Amend the previous motion to:
Change Goal 20 to read "Promote the use of green building methods, design standards and materials, for residential; development, to reduce impacts on the built and natural environment and to improve the quality of life" as the first sentence of Goal 20.
Motion to Amend Passed 7-0.

Main Motion as Amended Passed 7-0.

Amendment 11 passed as amended.

Amendment 14

It was moved by Boatsman; seconded by Goodman to:
Recommend that City Council approves Amendment 14 as detailed in Exhibit 1.

It was moved by Boatsman; seconded by Goodman to:
Amend the previous motion to:
Amend Policy 16.6 as in our packet to substitute the word "wildlife habitat" for "vegetated open space."
Motion to Amend Passed 6-0-1 (???? abstained).

Main Motion as Amended Passed 6-0-1 (???? abstained).

Amendment 14 passed as amended.

MINUTES:

It was moved by Hubbell; seconded by Boatsman to:
Approve the minutes of August 15, 2018.
Passed 7-0

OTHER BUSINESS:
There was no other business.

PLANNED ABSENCES:

There were no absences.

NEXT MEETING:
The next Planning Commission meeting will be on October 3, 2018 at 6:00 pm at Mercer Island City Hall.

ADJOURNMENT:
The meeting was adjourned at 12:58 am on Thursday, September 6, 2018.

PLANNING COMMISSION MEETING MINUTES OCTOBER 3, 2018

CALL TO ORDER

The Planning Commission was called to order by Chair Daniel Hubbell at 6:07 pm in the City Hall Council Chambers at 9611 SE 36th Street, Mercer Island, Washington.

ROLL CALL

Chair Daniel Hubbell, Vice Chair Tiffin Goodman, Commissioners Carolyn Boatsman, Jennifer Mechem, Lucia Pirzio-Biroli, Craig Reynolds, and Ted Weinberg were present. Commissioner Craig Reynolds was absent.

Evan Maxim, Interim Development Services Director, Andrea Larson, Senior Administrative Assistant, Robin Proebsting, Senior Planner, Bio Park, Assistant City Attorney, and Troy Mandeville, Systems Administrator, were present.

MINUTES

There were no minutes to approve.

APPEARANCES

Ted Burns, Seaborn Pile Driving, 9311 SE 36th St, Ste 204, spoke regarding water course buffer areas, and how they cause them to create unnatural shorelines that is inconsistent with other state agencies. He also spoke regarding dock heights and the safety issues due to the changes in lake Washington water level. He spoke regarding moorage covers, and the amount of light penetration needed underneath. He stated that the City needs to identify and clarify the difference between soft and hard-shell moorage covers.

SPECIAL BUSINESS

Agenda Item #1: Planning Commissioner Email Accounts

Troy Mandeville, Systems Administrator, assisted the Planning Commissioners in setting up their City email accounts.

REGULAR BUSINESS

Agenda Item #2: ZTR18-002 Critical Areas Code Amendment

Robin Proebsting, Senior planner, provided a brief presentation on the Critical Areas Code Amendment.

Commissioner Boatsman stated that in 19.07.110.e.6.a “noxious weeds” should be defined.

Commissioner Prizio-Biroli indicated that it should be clarified how wording is used regarding crossing a stream or water course vs. running parallel.

The Commission took a break until 8:16 pm.

Agenda Item #3: 2019 Comprehensive Plan Amendment Docket
Evan Maxim, Interim Director, gave a brief presentation on the process for recommending the docket for Comprehensive Plan amendments to the City Council. He also presented the preliminary 2019 Comprehensive Plan Amendment Docket.
Commissioners proposed the following additional items for the 2019 Comprehensive Plan amendment docket:

- Establish goals and policies to prevent and mitigate climate change (excepting waste and water)
- Establish goals and policies to develop and implement an Urban Forest Management Plan
- The use of public rights of way for public benefit
- Goals and policies to reduce and manage (commercial) noise in residential neighborhoods
- Remove specific subarea designation in Comp Plan (single color for Town Center plan).
- Consider move some of the Comp Plan language to the City code.
- Possible alternative to item 1
- Reconstruction of the land use map - further simplify and refine the land use map.
- Clean up the Housing Element.
- City tree program.
- Pre-design for ADUs (plumb and wire)

OTHER BUSINESS

Evan Maxim, Interim DSG Director, gave a report on the regarding the two items that went before the City Council: Transportation Concurrency and 2018 Comprehensive Plan Amendments. He also spoke about the Code Compliance and Code Cleanup amendments that were approved by City Council and went into effect on October 1 ,2018. He also discussed two upcoming community meetings that he would like to have members of the of the commission attend.

Chair Hubble discussed the upcoming APA conference that he will be presenting at regarding public out reach during the Residential Design Standards updates.

PLANNED ABSENCES

Commissioner Weinberg will be absent on December 11, 2018.

NEXT MEETING

The next Planning Commission meeting will be on October 17, 2018 at 6:00 pm at Mercer Island City Hall.

ADJOURNMENT

The meeting was adjourned at 9:35 pm.

DEVELOPMENT SERVICES GROUP
9611 SE 36TH ST., MERCER ISLAND, WA 98040
(206) 275-7605

TO: Planning Commission

FROM: Lauren Anderson, Assistant Planner
Andrew Leon, Planner

DATE: October 17, 2018

RE: **ZTR18-006 – Fall 2018 Code Cleanup – Narrative**

Summary
The proposed amendments to the Mercer Island City Code (MICC) are intended to clean up the code in the following ways:

1. Improve consistency between different sections of the code.
2. Improve clarity of City regulations.
3. Correct errors in typography and wording.
4. Correct an error to the City zoning map.

Following adoption of the Residential Development Standards, the City Council directed staff to periodically review the MICC to ensure that it is consistent and free of errors. The currently proposed amendment is necessary to ensure that this objective is met. The proposed amendment consists of clarifying language in existing code, as well as ensuring that the code is consistent with the definitions found in MICC 19.16.

Staff has identified code sections that will require amendment. The code sections proposed for amendment at this time are simple in scale and involve minor edits to the code to improve consistency and correct errors, as seen in attachment A. More complex code amendments will be addressed at a later date through continued cooperation with the "user group," and/or as the part of larger code update processes (i.e. Shoreline Master Program, Town Center, Critical Areas, etc.).

Background
Ordinance 17C-15, adopted on September 19, 2017 and implemented on November 1, 2017, set forth new residential development standards within the City of Mercer Island's single-family residential zones. The changes to the residential development standards created conflicts with other sections of the code, especially the definitions found in Chapter 19.16, which prompted the first round of code clean up reviewed by the Planning Commission in early 2018. The current proposed list of amendments

continues to address conflicts created by the adoption of Ordinance 17C-15, and addresses other code issued identified during normal day-to-day project or permit review. Staff will continue to maintain the code and address other issues with the code on a regular basis.

In addition to code inconsistencies created by the adoption of Ordinance 17C-15, staff has identified other sections of code in need of amendment. Most of these code sections can be found in the Nonconforming code of MICC 19.01.050, the Shoreline Master Program of MICC 19.07.110, the Subdivision code of Chapter 19.08 MICC, and the Town Center code of Chapter 19.11 MICC, as well as in the Definitions of Chapter 19.16. The identified sections in the Shoreline Master Program and Town Center code will be addressed when those codes are next updated.

Staff intends to prepare draft language for review by the Planning Commission that will correct or clarify several code sections. Staff is also seeking additional guidance from the Planning Commission regarding the desired scope of this proposed amendment.

Next Steps

At the October 17th meeting, staff will provide a brief overview of the amendments, answer questions the Planning Commission may have, and seek input. Staff will request the Commissioners' input on the following:

1. Additional information that the Planning Commission anticipates needing; and
2. Direction regarding the proposed amendments.

Based upon the provided direction and discussion tonight staff anticipates returning to the Planning Commission for further review in November 2018.

We welcome questions you may have at this stage of the process, as well as topics that you would like covered during the October 17th meeting. If you provide questions in advance, staff will attempt to address them at the meeting. We can be reached at:

Lauren Anderson: lauren.anderson@mercergov.org or 206-275-7704
Andrew Leon: andrew.leon@mercergov.org or 206-275-7720.

Attachments:

A. Proposed Code Changes
B. Current Zoning Map
C. 1999 Zoning Map
D. 1968 Street Vacation

Proposed Code Changes:

A. MICC 19.01.050(D)(1)(b)(i):

Current Text:	A legally nonconforming detached single-family dwelling may be intentionally altered without losing its legal nonconforming status as long as no more than 40 percent of the length of the dwelling's exterior walls, excluding attached accessory buildings, are structurally altered. Any portion of the length of existing walls that are structurally altered shall be included in calculating the 40-percent threshold. In no event shall the alteration or enlargement increase any existing nonconforming aspect of the dwelling or create any new nonconformance. Legal nonconforming status shall be lost, and the structure shall be required to come into conformance with current requirements, if the 40-percent threshold is exceeded. …
Proposed Change:	Staff proposes the following changes to this code section: • Specify how the "numerator" and "denominator" used for calculating the 40% are determined. • Clarify that the 40% of walls to be changed applies only to existing walls. • Add a provision that only 40% of existing exterior walls may be changed within a 5-year period in order to maintain legal nonconformity.
Basis for Change:	This code section lacks clarity on how the "40% rule" for maintaining nonconforming status is calculated. The code also lacks a time limit for how frequently development can occur on a nonconforming structure before the structure's nonconforming status is affected.

B. MICC 19.01.050(F)(3)(b)(ii):

Current Text:	For lots where the minimum hardscape is exceeded, two square feet of legally existing hardscape are removed for every one square foot of new hardscape; …
Proposed Change:	Staff proposed to change the word "minimum" to "maximum."
Basis for Change:	This code section refers to nonconforming hardscape coverage. It should state that if the maximum allowed hardscape is exceeded, then existing hardscape may be removed at a ratio of 2:1 for each square foot of new hardscape added.

C. MICC 19.02.010(A) and MICC 19.16.010(O):

Current Text:	*There is currently no code section for this proposed amendment.*
Proposed Change:	Add open space as a permitted use in the single-family residential zones. Add a definition for open space in the definitions of MICC 19.16.010.
Basis for Change:	MICC 19.08.030(G) allows proposed lots of a subdivision to 75% the size of the size normally allowed if a private or public open space tract is set aside. MICC 19.08.030(G)(1) requires that the use of the land of a subdivision be a permitted use in the zone in which the subdivision is located. Open space is currently not a permitted use in the single-family residential zone, nor is there a definition for open space in the definitions of MICC 19.16.010. This creates a contradiction within MICC 19.08.030(G).

D. MICC 19.02.020(C)(2)(a):

Current Text:	Front Yard. The front yard is the yard abutting an improved street from which the lot gains primary access or the yard abutting the entrance to a building and extending the full width of the lot. If this definition does not establish a front yard setback, the code official shall establish the front yard based upon orientation of the lot to surrounding lots and the means of access to the lot.
Proposed Change:	Revise "entrance to a building" to state "primary entrance to a building."
Basis for Change:	As the code reads now, the front yard could be the yard abutting any entrance to a building, not the primary entrance to the building. Staff proposed to amend the code to clarify that the primary entrance of a building is the only entrance that may be used to determine the location of a front yard.

E. MICC 19.02.020(E)(3):

Current Text:	Antennas, lightning rods, plumbing stacks, flagpoles, electrical service leads, chimneys and fireplaces and other similar appurtenances may extend to a maximum of five feet above the height allowed for the main structure in [MICC 19.02.020(E)(1) and (2)].
Proposed Change:	Staff proposes to add attached fences or guard railings for rooftop decks to the list of appurtenances that may extend above the allowed height for the main structure.
Basis for Change:	It is currently unclear if fences or railings for rooftop decks would be considered an appurtenance that would be allowed to exceed the maximum building height for the main structure. Staff proposes explicitly adding such fences and railings to the appurtenances listed in MICC 19.02.020(E)(3) to improved clarity.

F. MICC 19.02.040(D):

Current Text:	Garages and Carports. Garages and carports may be built to within 10 feet of the front property line if the front yard of the lot, measured at the midpoint of the wall of the garage closest to the front yard property line, is more than four feet above or below the existing grade or finished grade, whichever is lower, at the point on the front property line closest to the midpoint of the wall of the garage at its proposed location. The height of such garage shall not exceed 12 feet from existing grade for that portion built within the front yard.
Proposed Change:	Staff proposes to add language specifying that the elevation of the midpoint of the wall of the garage would be the elevation of the midpoint of the wall where it intersects the ground.
Basis for Change:	This section of code currently lacks clarity of where the elevation of the midpoint of the wall of a garage nearest to the front property line would be measured. It is not explicitly stated that the elevation would be measured at the intersection of the wall segment and the ground.

G. MICC 19.02.050(C)(2):

Current Text:	Retaining Walls and Rockeries. The height of a retaining wall or rockery is measured from the top of the retaining wall or rockery to the existing or finished grade, whichever is lower, directly below the retaining wall or rockery.
Proposed Change:	Staff proposes to add a provision requiring retaining walls outside setbacks to meet a ratio of 1:1 separation with 45 degree slope for them to be separate structures.
Basis for Change:	The current code does not specify how far apart retaining walls or rockeries must be in order to be considered separate. This could crease situations where two 17-foot retaining walls could be built within a few feet of each other, effectively creating a wall over 30 feet in height.

H. MICC 19.04.020(B)(4):

Current Text:	Not more than 60 percent of a lot may be covered by building, structures, and other impervious surfaces, including outdoor storage areas, provided the exemptions for decks, pavers, patios and walkways detailed in MICC 19.02.020(D)(2) shall apply. The building footprint shall occupy no more than 35 percent of the gross lot area.
Proposed Change:	Change "MICC 19.02.020(D)(2)" to "MICC 19.02.060(C)."
Basis for Change:	MICC 19.04.020(B)(4) incorrectly references MICC 19.02.020(D)(2) for impervious surface standards for regulated improvements in the single-family residential zones. The correct reference is now MICC 19.02.060(C).

I. MICC 19.16.010(F):

Current Text:	*There is currently no code section for this proposed amendment.*
Proposed Change:	Staff proposes to add a definition for Finished Grade.
Basis for Change:	Finished Grade is frequently mentioned in various sections of the code, especially the single-family residential development standards of MICC 19.02 and in the definitions of MICC 19.16. However, there is no definition for Finished Grade in the MICC.

J. MICC 19.16.010(G):

Current Text:	Gross Floor Area: The total square footage of floor area bounded by the exterior faces of the building 1. The gross floor area of a single-family dwelling shall include: a. The main building, including but not limited to attached accessory buildings. b. All garages and covered parking areas, and detached accessory buildings with a gross floor area over 120 square feet. … e. Decks that are attached to the second or third story of a single-family dwelling and are covered by a roof. For the purposes of calculating the gross floor area of covered decks, the entire deck

	area covered by the roof shall be accounted for as floor area, provided an 18-inch eave extending beyond the edge of the deck shall not be included in the gross floor area. … 2. The gross floor area of a single-family dwelling does not include: a. Second- or third-story uncovered decks, or uncovered rooftop decks. …
Proposed Change:	Staff proposes to add language stating that first floor covered decks and detached covered patios are not included in the gross floor area of a single-family dwelling.
Basis for Change:	The current code is unclear if first story, covered decks or detached covered patios are included in GFA.

K. MICC 19.16.010(H):

Current Text:	Hardscape: The solid, hard elements or structures that are incorporated into landscaping. the hardscape includes, but is not limited to, structures other than buildings, paved areas other than driving surfaces, stairs, walkways, decks, patios, and similar constructed elements. The hardscape within landscaping is usually made up of materials that include, but are not limited to, wood, stone, concrete, gravel, and permeable pavements or pavers, and similar materials. Hardscape does not include solid, hard elements or structures that are covered by a minimum of two feet of soil intended for softscape (for example, a septic tank covered with at least two feet of soil and planted shrubs is not hardscape). Hardscape areas do not include driving surfaces or buildings.
Proposed Change:	Staff proposes to add artificial turf to the list of types of hardscape in the definition of hardscape in MICC 19.16.
Basis for Change:	The definition for hardscape currently does not account for artificial grass, such as Astroturf. Artificial turf is functionally more similar to other types of hardscape than it is to vegetative landscaping.

L. MICC 19.16.010(K):

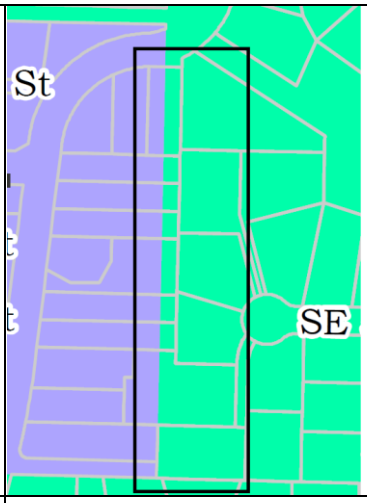
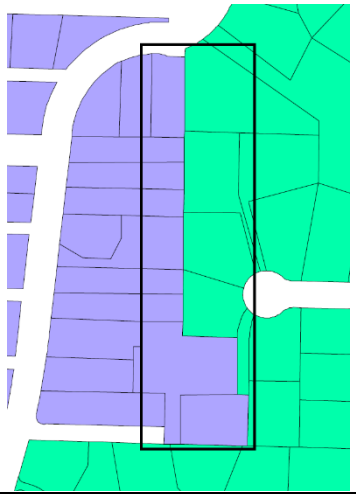
Current Text:	*There is currently no code section for this proposed amendment.*
Proposed Change:	Staff proposes to add a definition for Kitchen
Basis for Change:	The definitions of MICC 19.16 do not include a definition for Kitchen. This has caused confusion for determining whether spaces within single-family dwellings would qualify as an accessory dwelling unit.

M. MICC 19.16.010(R):

Current Text:	*There is currently no code section for this proposed amendment.*
Proposed Change:	Staff proposes to add a definition for Remodel.
Basis for Change:	The definitions of MICC 19.16 do not include a definition for Remodel. The parking standards MICC 19.11.130(B)(1)(a) are triggered when greater than 10% of a building is remodeled. Without a definition for remodel, it is difficult to

	determine whether or not a proposed development would cause the parking standards to be triggered.

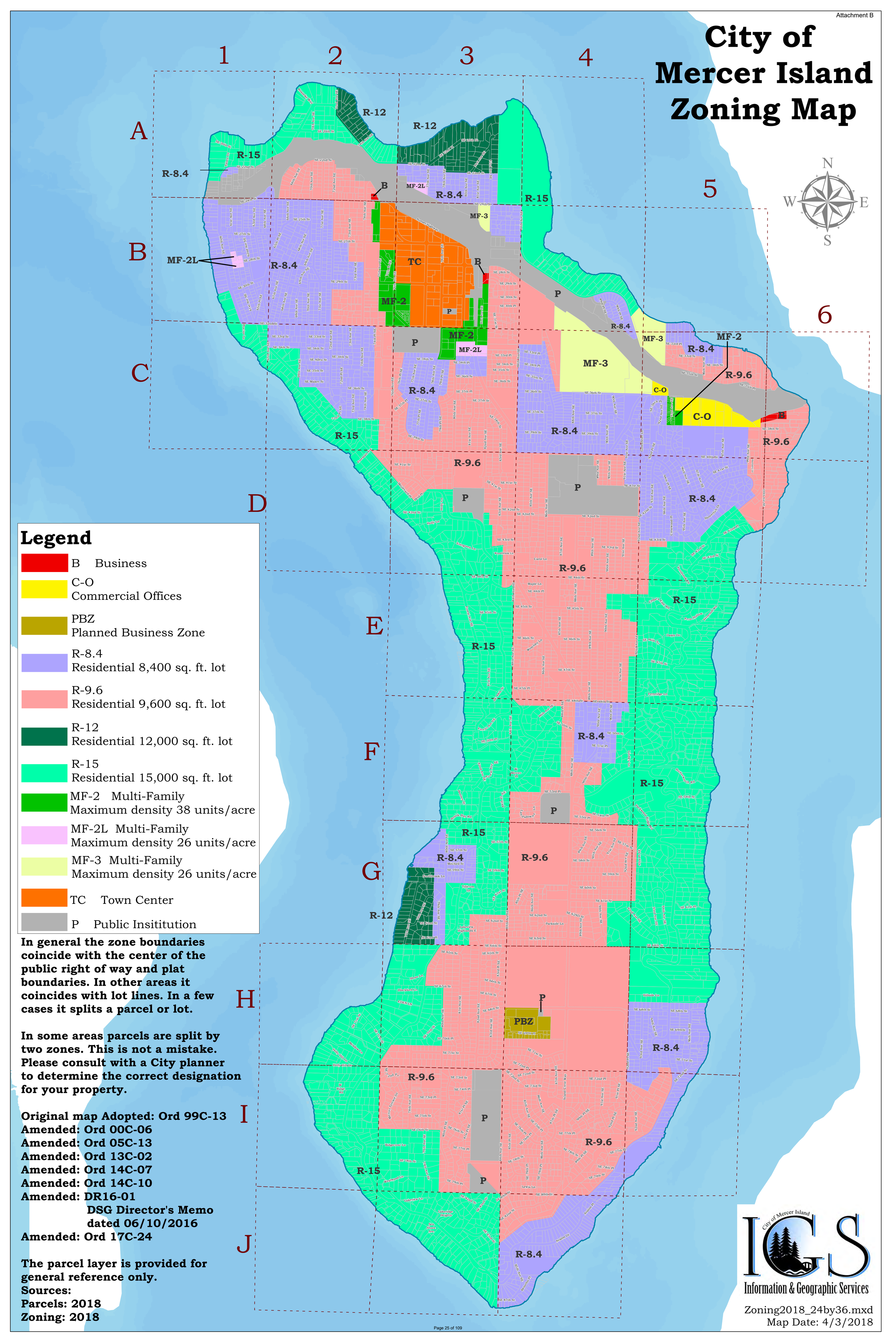
N. MICC Title 19 Appendix D Zoning Map:

Current Map:		The current zoning map incorrectly illustrates 8 lots in question being split zoned of R-8.4 and R-15 and 1 lot being zoned R-15 when it should be R-8.4. Refer to Attachment B.
Proposed Change:		Change the zoning map to match the original 1999 Zoning Map with the 9 lots in question being 100% zoned R-8.4. Refer to Attachment C.
Basis for Change:	There was no evidence of an Ordinance changing these 8 lots in question to be split zoned R-8.4 and R-15 and 1 lot to be R-15, thus there is no basis for the deviation from the 1999 zoning map for those lots. There was a street vacation in 1968 (Attachment D), however this did not result in a change of the zoning. In addition, per MICC 19.01.040(G)(2) the lots in question would need to follow R-15 regulations which is more restrictive than the R-8.4 zoning regulations.	

O. MICC Title 19 Appendix D Zoning Map:

Current Map:	The current zoning map, as codified, shows the zoning of the site of the Covenant Shores retirement facility as R-15.
Proposed Change:	Staff proposes to change the zoning of the site to MF-3.
Basis for Change:	As the result of an interpretation of the City of Mercer Island Director of Development Services in 2016 (which will be provided as an attachment at a future meeting), the zoning of this site was changed to MF-3. Staff proposes to change the zoning of the site under the zoning map amendment process to match the zoning identified by the Director's interpretation.

City of Mercer Island Zoning Map



Legend

- B Business
- C-O Commercial Offices
- PBZ Planned Business Zone
- R-8.4 Residential 8,400 sq. ft. lot
- R-9.6 Residential 9,600 sq. ft. lot
- R-12 Residential 12,000 sq. ft. lot
- R-15 Residential 15,000 sq. ft. lot
- MF-2 Multi-Family Maximum density 38 units/acre
- MF-2L Multi-Family Maximum density 26 units/acre
- MF-3 Multi-Family Maximum density 26 units/acre
- TC Town Center
- P Public Insititution

In general the zone boundaries coincide with the center of the public right of way and plat boundaries. In other areas it coincides with lot lines. In a few cases it splits a parcel or lot.

In some areas parcels are split by two zones. This is not a mistake. Please consult with a City planner to determine the correct designation for your property.

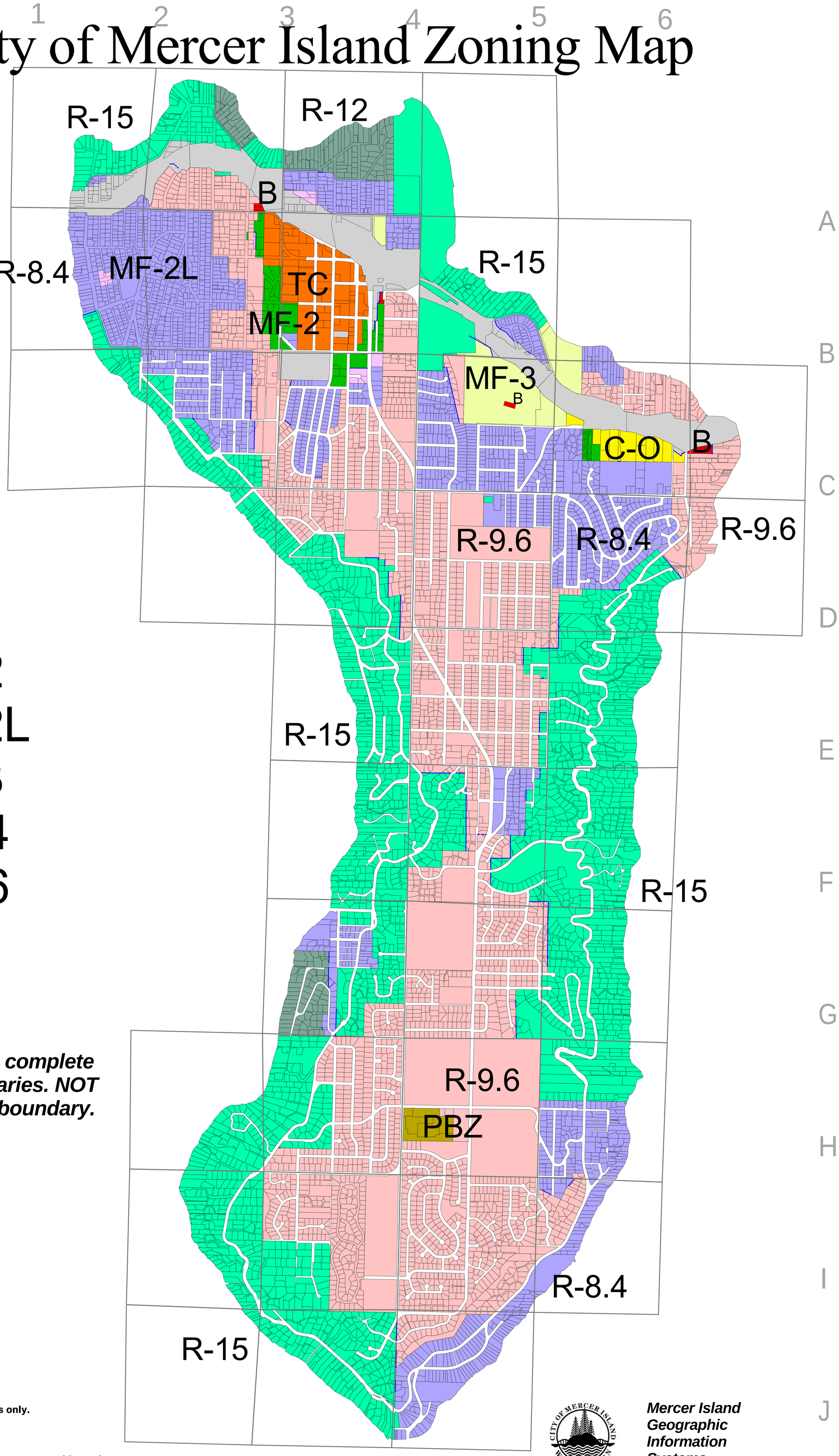
Original map Adopted: Ord 99C-13
Amended: Ord 00C-06
Amended: Ord 05C-13
Amended: Ord 13C-02
Amended: Ord 14C-07
Amended: Ord 14C-10
Amended: DR16-01
DSG Director's Memo dated 06/10/2016
Amended: Ord 17C-24

The parcel layer is provided for general reference only.
Sources:
Parcels: 2018
Zoning: 2018

City of Mercer Island
Information & Geographic Services

Zoning2018_24by36.mxd
Map Date: 4/3/2018

City of Mercer Island Zoning Map



LEGEND

- B
- C-O
- PBZ
- R-12
- R-15
- MF-2
- MF-2L
- MF-3
- R-8.4
- R-9.6
- TC
- P

lines added to complete zoning boundaries. NOT part of parcel boundary.

July 21, 1999

revision 5

Sources:
The underlying parcel base map is from the King County Assessor's maps which was converted to digital files in 1992 by Puget Power. Updated using non-accurate methods in 1999.

The zoning designations were transferred from Mercer Island's zoning map, 1960; updated 1990.

Disclaimers:

This map is not to scale.
This map should be used for planning purposes only.
Public right-of-ways may not be correct.
Street names may not be correct.

No warranties of any sort, including accuracy, accompany this product.

Mercer Island Geographic Information Systems

Deed 5168 62

6433594

Attachment D

SD

ORDINANCE NO. 199

AN ORDINANCE VACATING A PORTION OF 82ND AVENUE SOUTHEAST.

6433594

WHEREAS, a petition was filed by Walter L. Wood for the vacation of a portion of 82nd Avenue Southeast, and

WHEREAS, Resolution No. 407 was adopted on July 22, 1968 fixing September 23, 1968 as the date for the public hearing on said petition, and

WHEREAS, notices were posted and all of the necessary procedural steps have been taken, and

WHEREAS, the matter was referred to the City of Mercer Island Planning Commission and to the City of Mercer Island Road Committee, both of which have expressed no objection to the proposed vacation, and

WHEREAS, the public hearing was held on September 23, 1968, now, therefore,

BE IT ORDAINED BY THE MAYOR AND CITY COUNCIL OF THE CITY OF MERCER ISLAND:

Section 1. The portion of 82nd Avenue Southeast, City of Mercer Island, King County, Washington, legally described as follows, is hereby vacated:

> The West half of 82nd Avenue Southeast (Anderson Avenue per plat of Christian Church Community Camp, Division No. 2, Volume 31 of Plats, at page 42) lying Northerly of the Easterly extension of the South line of Lot 14 of Block 9 in said plat and Southerly of a line 60.71 feet North of and parallel to the Easterly extension of the South line of Lot 1 of said Block 9.

Section 2. This Ordinance shall take effect immediately upon its passing, signing and publication.

6433594

PASSED by the Council of the City of Mercer Island, Washington at its regular meeting on the 14th day of October, 1968 and signed in authentication of its passage this 14th day of October, 1968.

Mayor

Councilman

Councilman

ATTEST:

Robert C. Weiss, City Clerk

Date of Publication: October 17th 1968.

NOV-15-68 001186 6433594 — HF 3.00

FILED for Record at Request of

Name City of Mercer Island

Address 3505 88th Ave S.E.

Mercer Island, Wash. 98040

RECORDED
VOL. 5168 deeds OF
PAGE 62 REQUEST OF

1968 NOV 13 PM 2 12

ROBERT A. MORRIS
KING COUNTY

DEVELOPMENT SERVICES GROUP
9611 SE 36TH ST., MERCER ISLAND, WA 98040
(206) 275-7605

TO: Planning Commission

FROM: Robin Proebsting, Senior Planner

DATE: October 10, 2018

RE: Critical Areas Code and Shoreline Master Program Updates (ZTR18-002): Best Available Science on Geologically Hazardous Areas and Critical Aquifer Recharge Areas (CARAs)

Summary

At its October 3rd meeting, the Planning Commission will review the best available science (BAS) for the remaining topics required to be addressed in the Critical Areas Code: Geologically Hazardous Areas and Critical Aquifer Recharge Areas (CARAs). In preparation for this meeting, please:

1. Review the attached BAS Report and Gap Analysis Matrix;
2. Note any questions that come up during your review; and
3. Identify major issues that the Commission would like to discuss at future meetings.

Background

Similar to the format used for the Planning Commission's review of the wetlands, watercourses, and fish and wildlife habitat conservation areas topics in August, staff plan to use the Oct 17th meeting for review of technical information contained in the BAS report and gap analysis matrix and the Nov. 7th meeting to receive policy direction from the Planning Commission. At the Oct. 17th meeting, the Planning Commission will receive a presentation and have the opportunity to ask questions of the City's consultant specializing in geologically hazardous areas and critical aquifer recharge areas.

In preparation for the Planning Commission's Nov. 7th meeting, staff will prepare an analysis summarizing the possible results of code update options. Issues expected to be addressed in this analysis include:

1. The addition of buffers and/or setbacks from geologically hazardous areas.
2. Activities that may take place in geologically hazardous areas and buffers

3. Refining of the definition of “steep slope” to include non-engineered slopes that were artificially created (for example, for steep slopes created by roads built prior to modern code stability requirements).

4. The addition of setbacks from fault lines.

Next Steps

Please review the attached best available science report and gap analysis matrix and capture any clarifying or technical questions you have. Staff and the project consultant will answer these at the October 17, 2018 Planning Commission meeting. I can be reached at robin.proebsting@mercergov.org or 206-275-7717.

Attachments:

1. 2018 Best Available Science Report for Geologically Hazardous Areas and Critical Aquifer Recharge Areas, prepared by Aspect Consulting dated October 2018
2. Best Available Science Review and Gap Analysis Matrix prepared by Aspect Consulting, dated October 2018

CITY OF MERCER ISLAND CRITICAL AREAS ORDINANCE (CAO) UPDATE

2018 Best Available Science Report for Geologically Hazardous Areas and Critical Aquifer Recharge Areas

Planning Commission Review Draft

Prepared for
City of Mercer Island

October 2018

Table of Contents

Figures

Attachments

ACRONYMS AND ABBREVIATIONS

ARPA	Aquifer Recharge Protection Area
Aspect	Aspect Consulting
BAS	Best Available Science
BMP	Best Management Practice
CAO	Critical Areas Ordinance
CAR	Critical Areas Report
CARA	Critical Aquifer Recharge Area
City	City of Mercer Island
CTED	Washington State Department of Community, Trade and Economic Development
DOGAMI	Oregon Department of Geology and Mineral Industries
DOH	Washington State Department of Health
DPM	Deep Percolation Model
DRASTIC	Depth to water, Recharge, Aquifer media, Soil media, Topography, Impact of Vadose zone media, and hydraulic Conductivity
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ESA	Environmental Science Associates
GIS	geographic information system
GMA	Growth Management Act
gpm	gallons per minute
I-90	Interstate 90
LiDAR	Light Detection and Ranging
MICC	Mercer Island City Code
NRCS	Natural Resources Conservation Service
RCW	Revised Code of Washington
SMP	Shoreline Master Program
SPU	Seattle Public Utilities
TOT	Time of Travel
USGS	U.S. Geological Survey
WAC	Washington Administrative Code
WDNR	Washington State Department of Natural Resources
WHPA	Wellhead Protection Area
WRE	Water Resources Explorer

INTRODUCTION

The City of Mercer Island (City) is in the process of updating its Critical Areas Ordinance (CAO) in accordance with the requirements of the Growth Management Act (GMA) (Revised Code of Washington [RCW] 36.70A). The CAO is adopted into the Mercer Island City Code (MICC) within Title 19 (Unified Land Development Code), Chapter 19.07. The GMA requires the use of Best Available Science (BAS) in the development of critical areas policies and regulations. The types of scientific literature and technical information that constitute the term "best available science" are defined in the Washington Administrative Code (WAC) Chapter 365-195-905. This 2018 BAS Report reviews the existing CAO, additions to BAS and regulatory changes since the last update, and recent changes to the Mercer Island setting in the context of updates to BAS since 2005.

Environmental Science Associates (ESA) and Aspect Consulting (Aspect) prepared this report to provide technical information to City staff regarding the efficacy of the City's current critical areas protection measures, and to provide recommendations for CAO updates that would improve consistency with BAS. This report focuses on the following critical areas: Geologically Hazardous Areas and Critical Aquifer Recharge Areas (CARAs).

In 2005, the City reviewed the BAS and updated its CAO to comply with the GMA. The 2005 update to the CAO was comprehensive for geologically hazardous areas, with BAS documented in the Review of BAS and Recommendations for Critical Areas Regulations Report (City of Mercer Island, 2005). More recently, the City completed a comprehensive update to its Shoreline Master Program (SMP), which the Washington State Department of Ecology (Ecology) approved on March 4, 2015. The SMP incorporates the provisions in the current CAO by reference (MICC 19.07.110.E.9).

Background

The City of Mercer Island is a 6.2-square mile island municipality in King County, Washington. The city includes approximately 14.7 miles of shoreline along Lake Washington (Figure 1). The nearest adjacent municipalities are Seattle to the west and Bellevue and Newcastle to the east. Interstate 90 (I-90) crosses the north portion of the island. Approximately 88 percent of the land on Mercer Island is zoned as single-family residential, 95 percent of which is developed in residential uses. Within the existing pattern of residential development, hillside slopes and ravines extend across private properties especially in the outer portions of the island (generally following the East Mercer Way, West Mercer Way, and North Mercer way corridors).

Mercer Island has 472 acres of park and open space lands, which range from small neighborhood parks to larger recreational areas such as Luther Burbank Park and Aubrey David Park. Approximately 115 acres of natural-forested land are set aside in Pioneer Park, and an additional 150 acres of public open spaces are scattered across the community. Many of these parks and open space areas also include forested ravines and slopes that are characteristic of the Mercer Island landscape.

Since 2000, the City of Mercer Island has experienced relatively low population growth compared to other areas of King County, increasing from 22,699 residents in 2010 according to the U.S. Census to an estimated 24,210 residents in 2017 (an average of approximately 240 new residents per year, or approximately 1 percent annually). The estimated growth rate in the last 7 years has more than tripled relative to the population change between 2000 and 2010, during which time the City added approximately 66 residents annually (2000 and 2010 U.S. Censuses). Even with the higher rate in recent years, the City's overall population growth between 2000 and 2017 has been 9 percent, compared to approximately 17 percent across all of King County. Between 2006 and 2012, 698 new housing units

were constructed across the city in a mix of single-family and multi-family units, accommodating residential population growth and further reducing the supply of vacant and sub-dividable properties across Mercer Island (City of Mercer Island, 2016).

METHODS

State Guidance for Consideration of BAS

The GMA (RCW 36.70A) requires Washington's counties and cities to continually review, evaluate, and update comprehensive land use plans and development regulations using BAS, with the intent of identifying, designating, and protecting critical areas. Critical areas include the following elements: wetlands, critical aquifer recharge areas, fish and wildlife habitat conservation areas, frequently flooded areas, and geologically hazardous areas (RCW 36.70A.030).

BAS is defined as scientific information about critical areas, prepared by local, tribal, state, or federal natural resource agencies, or qualified scientific professionals that is consistent with the following criteria:

- Scientific information is produced through a valid scientific process that includes:
    - Peer review,
    - A discussion of methods used to gather information,
    - Logical conclusions,
    - Data analysis,
    - Information used in the appropriate context, and
    - References of literature and other sources of information used.
- Scientific information is obtained through a common source such as:
    - Research,
    - Monitoring,
    - Inventory,
    - Survey,
    - Modeling,
    - Assessment,
    - Synthesis, or
    - Expert opinion.

In the context of critical areas protection, a scientific process is one that produces reliable information useful in understanding the consequences of regulatory decisions, and in developing critical areas policies and regulations that are effective in protecting the functions and values of critical areas.

This report relies on several regulatory guidance and BAS documents pertaining to critical areas. Current state guidance, including examples of effective regulatory language, pertaining to management of critical areas consistent with BAS and other GMA requirements can be found in *A Handbook for Reviewing Critical Areas Regulations* (Commerce, 2018). This guidance is an update of the previous *Critical Areas Assistance Handbook: Protecting Critical Areas Within the Framework of the Washington Growth Management Act* (CTED, 2007). Scientific documents summarizing the BAS specific to each critical area are described in the following sections.

Report Structure and Regulatory Gap Analysis

This report provides documentation of scientific literature and regulatory guidance for the management of Mercer Island's geologically hazardous areas and critical aquifer recharge areas. The focus is on relevant information and guidance updates since the City's 2005 comprehensive CAO review. For additional detailed inventory of soils and geologically hazardous areas across Mercer Island, the 2005 Review of BAS & Recommendations for Critical Areas Regulations is provided as Attachment B.

For geologically hazardous areas, this report provides a summary and references to BAS updates and a summary of the current CAO for the purpose of identifying areas of inconsistency with agency guidance and BAS. We also focused on specific areas of BAS consistency for geologically hazardous areas during an independent assessment of recent BAS.

To provide a detailed assessment across all sections focused on geologically hazardous areas, Aspect Consulting prepared a Gap Analysis Matrix to identify regulatory gaps and document consistency between CAO provisions and GMA regulations, relevant agency guidance, and BAS published since 2005. The Gap Analysis Matrix (Attachment A) provides an assessment of general consistency and the corresponding rationale and source for each gap identified. In addition to identifying provisions inconsistent with state law or recent science, the review identifies several areas where the protection of critical areas on Mercer Island could be improved by adding, removing, clarifying, and or rearranging sections and subsections of the code to make them clearer and easier to implement. We categorized our assessment as follows:

- **Gap or Missing Protection.** A new code provision should be added to ensure compliance with GMA and BAS.
- **Consistency with BAS.** The code provision either does or does not, in our opinion, meet BAS or state guidance. The existing provision would result in detrimental impacts to critical areas and their functions and values.
- **Clarity/ User Friendliness.** The code provision is difficult to administer due to clarity, readability, or understandability.
- **Internal Consistency.** The code provision is redundant (included in multiple sections) or is located in an inappropriate section.

The Gap Analysis Matrix does not cover CARA standards, as the current CAO does not include this type of critical area. Alternatively, Aspect will provide recommended CARA standards and CARA inventory mapping as part of the CAO Update effort.

Consideration of Neighboring Jurisdiction Approaches

In addition to BAS, the ESA and the Aspect team reviewed recently updated critical area codes from neighboring jurisdictions to support City staff, Planning Commission, and City Council in considering key update issues. We did not independently assess BAS documentation completed in support of standards adopted by neighboring jurisdictions. For each key update issue, review of BAS consistency is provided, followed by a summary of neighboring jurisdiction approaches, and Aspect's recommended for update options for City consideration. The recommendations also reflect our professional judgment and experience assisting numerous cities and counties with code interpretation and administration.

Below is a list of CAOs from neighboring jurisdictions that we reviewed. We focused on nearby Lake Washington and Puget Sound waterfront communities that have recently completed CAO updates.

Although some of these jurisdictions are more developed than others, they all include significant areas of largely established residential use patterns near lake or marine shorelines. We picked these jurisdictions based on similarities to Mercer Island, including landscape patterns, community, presence of critical areas, geology, and land use. We believe that this combination will present a range of critical areas management strategies that will be useful to consider for Mercer Island's update.

- Bainbridge Island (City of Bainbridge CAO, most recently updated in 2018).
- Medina (CAO, most recently updated in 2015).
- Edmonds (CAO, most recently updated in 2016).
- Lake Forest Park (Lake Forest Park CAO, most recently updated in 2017).
- Kirkland (City of Kirkland CAO, most recently updated in 2017).

We have also reviewed the City of Bellevue CAO and City of Seattle CAO to provide comparison regarding fault rupture hazards.

GEOLOGICALLY HAZARDOUS AREAS

Geologically hazardous areas are specifically identified as a critical area by GMA (WAC 365-190-120). Three geologic hazard areas are located in Mercer Island and defined by MICC Chapter 19.16 (the definitions chapter of the Unified Development Code): (1) landslide hazard areas, (2) erosion hazard areas, and (3) seismic hazard areas[1]. The current CAO provides standards for protection of safety of citizens from geologically hazardous areas in MICC 19.07.060, which includes standards for identification, report requirements for geologic hazard areas, and development and mitigation standards for geologically hazardous areas.

Overview of Geologically Hazardous Areas on Mercer Island

The City of Mercer Island completed a 2005 Review of BAS and Recommendations for Critical Areas Regulations Report (City of Mercer Island, 2005), which was focused on "Geologically Hazardous Areas and Wildlife Habitat." The 2005 BAS Report section on geologically hazardous areas was prepared with support from Lorilla Engineering, Inc. The 2005 BAS Report included a detailed inventory of soil conditions and geologic hazards across the island, highlighting the extent of known and/or potential erosion and landslide hazard areas both extending across approximately 50 percent of Mercer Island (by area). The large majority of these same areas are also designated as seismic hazard areas.

In addition to the 2005 BAS Report, the City contracted to complete inventory mapping and data for geologic conditions prepared in 2006 by K. Troost and A. Wisher (Geological Map of Mercer Island; Attachment C and available on the City Website). Using this mapping, K. Troost and A. Wisher additionally supported the City in preparing inventory maps for specific geologic hazards in 2009. These inventory maps include:

- Erosion Hazard Assessment – Attachment C and available on the City Website.
- Landslide Hazard Assessment – Attachment C and available on the City Website.
- Seismic Hazard Assessment – Attachment C and available on the City Website.

[1] The current definition included in MICC 19.16 - *Geologic Hazard Areas: Areas susceptible to erosion, sliding, earthquake, or other geological events based on a combination of slope (gradient or aspect), soils, geologic material, hydrology, vegetation, or alterations, including landslide hazard areas, erosion hazard areas, and seismic hazard areas.*

These data are available on the City's GIS Portal.

Landslide hazard areas across Mercer Island are associated with several site characteristics, including steepness of slope and underlying geologic structure. Areas with these characteristics are well inventoried in the 2005 BAS Report (Attachment B) and 2009 mapping by Troost and Wisher (Attachment C). Inventory mapping designates 51% of the Mercer Island land area as 'known or suspected' landslide hazard area (affecting approximately 66% of existing parcels), including the large majority of the Lake Washington shoreline and slopes and ravines extending inland. The extent of landslide hazard areas across the Island increases the importance of effective hazard management standards, as many properties are affected.

The 2005 BAS report discusses approaches for managing risk from landslide hazard areas (as well as other geological hazards), and notes that risk can frequently be significantly mitigated through engineering, design, and/or modified construction and development techniques. That said, while some landslide hazard risk may be reduced through engineered mitigation measures, it is also important to emphasize that where possible avoidance is the best approach, with avoidance focused on locating structures (especially habitatable structures) outside of identified landslide hazard areas. When mitigation alternatives cannot viably reduce risks to human health and safety to acceptable levels, modification and building in landslide hazard areas should not be permitted.

Erosion hazard areas are also extensive across Mercer Island, with soils identified with "severe" and "very severe" erosion hazard and other designated characteristics inventoried across 45% of land area (affecting approximately 64% of existing parcels). Compared to landslide hazard areas, where soil and rock movement occurs rapidly in mass events, erosion is a slow process. When not appropriately vegetated or otherwise stabilized, surface soils and rock become susceptible to transport from rain, runoff, and wind. Erosion hazard areas do not present acute human health and safety concerns, and as such are generally readily mitigated through construction best management practices (BMPs), engineered measures focused on stormwater, soil and vegetation retention, and appropriate landscaping.

Seismic hazard areas are those areas subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement, soil liquefaction or surface faulting. Many of the steep slopes that are also designed as landslide hazard areas are included in the existing seismic hazard area inventory (Attachment C); for these areas, there is increased potential for slope failure and landslides to occur during an earthquake. Seismic hazard areas are inventoried across 73% of the Mercer Island land area, and in addition to steep slopes also include relatively level areas in central portions of the city. In these areas, mapped surface soil units are generally more saturated with groundwater and prone to liquefaction during earthquakes, with increased risk of structure foundations and footings to be compromised (unless appropriately engineered). Seismic hazard areas present significant risk to human health and safety, with mitigation primarily provided through engineering, design, and/or modified construction and building techniques. Where overlapping with landslide hazard areas where mitigation cannot reduce risk to acceptable levels, avoidance may also be appropriate.

Updates to Scientific Literature

This section summarizes the limited new scientific literature and regional policy concerning geologically hazardous areas that have emerged in the last 13 years, provides an assessment of current CAO mapping of geologically hazardous areas and standards, and summarizes our recommendations for updates to ensure consistency with BAS and risk management policies.

The City's previous documentation of BAS relevant to geologically hazardous areas generally remains valid and consistent with (limited) subsequent updates to relevant BAS and guidance for management of

erosion, landslide, and seismic hazard areas. Further, geologic mapping and geologically hazardous areas maps completed by Troost and Wisher (2006 and 2009) provide excellent inventories and remain generally current to BAS.

Landslide Hazard Areas

Landslide hazard assessments from 2009 completed by Troost and Wisher included integration of LiDAR (light detection and ranging) imagery, which provides a high resolution means of identifying potential landslide hazard areas (steep slopes potentially subject to landslide). The Troost and Wisher (2009) Landslide Hazard Mapping is still considered relevant science for many factors affecting slope hazards including geologic units, the presence of groundwater seepage, and unfavorable geologic contacts that are landslide prone. Building on the Troost and Wisher hazards data is a recent new study of landslides hazards on Mercer Island completed by W. Grimm as part of his Earth and Space Sciences Applied Geosciences Master of Science degree work at the University of Washington (working under Troost). Grimm, now working for Aspect, provided this study and an overview of opportunities to improve landslide hazard mapping.

Recent LiDAR data show that Mercer Island has several historic (likely older than 150 years old), as well as abundant recent landslides. In 2009, Troost and Wisher used field mapping, geomorphic analysis, a geotechnical database, and geographic information system (GIS) to create a landslide inventory and hazard map of Mercer Island. The new Grimm (2018) study uses BAS-based delineation protocols adopted by the State of Oregon Department of Geology and Mineral Industries (DOGAMI), and landslide inventory methods slightly modified from DOGAMI by the Washington Department of Natural Resources (WDNR) to map landslide hazards on Mercer Island using GIS, geotechnical parameters, and field mapping.

The 2018 Grimm study and 2009 mapping by Troost and Wisher provide good correlation between areas that are modeled as "susceptible" to landslides and the locations of existing landslides on Mercer Island. The 2018 study includes improvements on landslide area mapping and hazard delineation including the use of newer (2016) high-resolution LiDAR topographic data and incorporation of soil geotechnical parameters to assess susceptibility to landslides. The Grimm study improvements include separate maps of shallow and deep landslide hazard areas, and identification of moderate and high hazard areas. This delineation of shallow vs. deep, and moderate vs. high hazard area will allow for more focused evaluation of areas with need for site-specific studies. Results of the Grimm study will more closely predict areas of landslides (95 percent of documented past slides fall within the moderate and high hazards areas predicted by the Grimm study, 87 percent fall within the hazard area defined by Troost and Wisher, and only 57 percent of slides occurred within the hazard zone that is based on the criteria of the current MICC). Based on the ability of the Grimm study to more accurately predict areas of elevated landslide hazards, it should be adopted as the new BAS landslide hazard area map for Mercer Island.

Erosion Hazard Areas

Troost and Wisher (2009) delineated erosion hazard areas using current BAS. The code indicates that the erosion hazard area is based on Natural Resources Conservation Service (NRCS) "severe" and "very severe" erosion hazard areas, but the Troost and Wisher (2009) data report that they used NRCS "severe" and "very severe" soil areas plus sandy geologic map units and LiDAR bases slope which combined was more accurate and predictive.

Seismic Hazard Areas

Numerous neotectonics studies associated with the seismic hazards of the Seattle fault have been completed since those detailed in the 2005 BAS Report, and all of Mercer Island lies within the Seattle Fault zone. Although none of these studies have identified "active" faults (meaning the fault strand has

potential to rupture again and is considered a hazard) on Mercer Island, this fault system has been shown elsewhere to be active, and advancements in the science suggest that evidence of Holocene fault ruptures will at some point be identified and mapped on Mercer Island.

The U.S. Geological Survey (USGS, 2018) has developed a database of active faults that is frequently updated with newly mapped faults. This resource shows faults ranging from regional approximations of fault trends, to closely located fault rupture traces based on local detailed studies. Geologic interpretation is therefore required to evaluate the relevance of mapped faults and determine whether they should be used to evaluate site-specific hazards.

Current Geologically Hazardous Areas Provisions and Key Update Issues

The geologically hazardous areas section of the City's CAO needs to be updated in a few key areas to improve its consistency with BAS and current agency guidelines. A summary of key issues and recommendations for updates to the geologically hazardous areas section are provided below.

Key Issue #1 for Geologically Hazardous Areas – Landslide Hazard Area Development Limits, including Standard Setback / Buffer

Current Code and BAS Consistency

MICC 19.07.060 requires a geotechnical review for any development within geologically hazardous areas, but does not appear to have a specific setback requirement for development near landslide hazard areas. The Landslide Hazard Map of Mercer Island (Troost and Wisher, 2009) includes a 25- to 50-foot buffer beyond mapped steep slopes or landslides, so Mercer Island CAO code pertaining to landslide hazard areas does not appear to be consistent with the Troost and Wisher 2009 mapping. The Grimm 2018 study uses newer methods that more accurately identify elevated hazard areas that extend beyond existing landslide areas, so they include buffered hazard areas. Most regional municipal codes include some minimum setbacks. New landslides often result in expansion of the area of older slides, so the current code is not protective against new or expanding landslides.

Based on the new BAS, we recommend that the code be updated to include specification of a standard horizontal setbacks from the top and bottom of those steep slopes identified as landslide hazard areas as follows:

- 25 horizontal feet for slopes less than 50 feet high and all directions around shallow landslide hazard areas, and
- 75 feet for the top and bottom of slopes over 50 feet high, and all directions around deep-seated landslide hazard areas.

Setback reduction should be based on site-specific analysis by a qualified geotechnical or geological professional, with a minimum no-build setback for habitable structures of 10 feet in shallow landslide hazard areas and 50 feet in deep-seated landslide hazard areas.

For non-habitable structures, such as driveways, stairways, and similar property improvements, additional allowances for development within landslide hazard areas and standard setbacks are appropriate, provided that engineering is provided by a qualified professional. The City may also consider limited allowances for expansion of existing development occurring within landslide hazard areas and associated buffers.

Alternatively, the City could maintain landslide hazard standards similar to those currently provided, allowing for habitable structures and other development activities within identified landslide hazard areas and associated buffers where hazard risk to the property and adjacent properties is eliminated or mitigated

such that the site is determined to be safe. Currently, MICC 19.07.060 (D)2 provides this flexibility, with the City relying on geotechnical evaluation and resultant project engineering, verified through peer review, to ensure that proposals are consistent with criteria (personal communication with D. Cole, City Building Official, October 9, 2018). The 2005 BAS Report states that "there are actions that can reduce the rate of future slope failures and improve the stability of the slope with respect to shallow failures and surface erosion." However, this same section continues "Deep-seated failures are more difficult to control" (page 12 of City of Mercer Island, 2005).

For any allowed development activities within identified landslide hazard areas, and especially for allowances providing opportunity for new and/or expanded habitable structures, we recommend that existing standards be augmented to further clarify geotechnical assessment expectations and risk reduction requirements. Updated criteria should clearly indicate avoidance as the preferred approach for reducing hazard risk, with engineered mitigation approaches only acceptable when avoidance is shown to be infeasible. Updated criteria could ensure adequate consideration of the type of landslide hazard (shallow vs. deep-seated), and/or could implement variable ***factor of safety*** requirements for any development activity proposed within a landslide hazard area or buffer, with the specific factor of safety tied to the type of development proposed (habitable structures; high-risk nonhabitable structures such as decks, patios, or driveways; or low-risk nonhabitable structures such as storage sheds, stairs, or pathways).

Factors of safety is a term describing the load carrying capability of a system beyond the expected or actual loads. Essentially, the factor of safety is how much stronger the system is than it needs to be for an intended load.

Except for permitted development, removal of existing vegetation from a landslide hazard area and standard setback should generally be prohibited. We recommend that minor vegetation management activities within landslide hazard areas and associated setbacks, that does not involve grading (such as the removal of invasive vegetation and replanting work) be allowed, provided it does not adversely impact slope stability or increase mass wasting hazards.

Neighboring Jurisdiction Approaches

The current approach on Mercer Island is not consistent with most other municipalities, which have some requirements for setback and/or buffers from the steep slope that are more protective of life safety and the environment, as summarized in the following table.

Landslide Hazard Area – Standard Setback / Buffer Width	Erosion Hazard Area – Standard Setback / Buffer Width (if any)	Notes
Bainbridge Island (CAO most recently updated in 2018)		
Varies based on use or activity: • Habitable structures and high-risk nonhabitable structures – At top of slope buffer is the height of slope up to 75 feet; at the bottom of slope buffer is height of slope. • Lower-risk nonhabitable structures or other structure buffer is height of slope up to 75 feet.	No specific standard setback for erosion hazards areas, but the proposed activity cannot create a net increase in geological instability on- or off-site.	May also use a reduced setback as determined by a geological hazards assessment. The assessment must be conducted by a licensed geologist/geotechnical engineer and must be reviewed by a third-party geologist/ geotechnical engineer. However, the absolute

Landslide Hazard Area – Standard Setback / Buffer Width	Erosion Hazard Area – Standard Setback / Buffer Width (if any)	Notes
• Tree / vegetation activities (pruning, etc.) – 25 feet from top of slope.		minimum setback for habitable structures is 20 feet.
City of Medina (CAO most recently updated in 2015)		
Recommendations for the minimum no-disturbance buffer and minimum building setback from any geologic hazard are based on a geotechnical analysis. The director may assign buffer and building setbacks based on this information. In addition, 50-foot buffer (which may be reduced to 10 feet when proven to be adequate by a qualified professional) is specified for landslide hazards that include steep slopes (40% or steeper and with a vertical relief of 10 or more feet)	Same as landslide hazard areas.	The size of the buffer shall be determined by the director to eliminate or minimize the risk of property damage, death, or injury resulting from erosion and landslides caused in whole or part by the development, based on review of a Critical Areas Report (CAR). Development may be allowed within landslide and erosion hazard areas, and any associated buffer, when maintaining long-term slope stability and meeting other criteria. Except for permitted development, removal of vegetation from an erosion or landslide hazard area or buffer is prohibited.
City of Edmonds (CAO most recently updated in 2016)		
Buffer and setback requirements are determined by the director consistent with recommendations provided in the geotechnical report.	Same as landslide hazard areas.	Unless otherwise provided or as part of an approved alteration, removal of vegetation from an erosion or landslide hazard area or related buffer is prohibited.
City of Lake Forest Park (CAO most recently updated in 2017)		
50-foot standard buffer, which can be reduced to a minimum of 25 feet if consistent with recommendations provided in the geotechnical report.	None.	Vegetated buffer required unless permitted by critical areas permit.
City of Kirkland (CAO most recently updated in 2017)		
Buffer and setback requirements are determined by the director consistent with recommendations provided in the geotechnical report.	Same as landslide hazard areas.	

Key Issue #2 for Geologically Hazardous Areas – Exclusion for Artificially Created Slopes and Rockeries

Current Code and BAS Consistency

There is an exclusion in "steep slopes" for artificially created slopes and rockeries. Not all existing artificial slopes were engineered or permitted, and many non-engineered slopes will not meet modern code requirements for static or seismic stability. The Mercer Island code should be amended to exclude only "engineered slopes and rockeries."

Neighboring Jurisdiction Approaches

- The City of Seattle excludes "engineered" slopes.
- The City of Bainbridge Island and City of Medina codes exclude only competent or consolidated rock slopes.
- The City of Edmonds excludes only "rockeries that have been engineered and approved by the engineer as having been built according to the engineered design," and includes all other modified slopes.
- The other jurisdictions have no exclusions.

Key Issue #3 for Geologically Hazardous Areas – Erosion Hazard Areas Designation and Development Standards

Current Code and BAS Consistency

Criteria for the designation of erosion hazard areas included in MICC 19.07 should be revised to reference the Troost and Wisher (2009) criteria, including slopes of 15 percent and greater combined with the presence of sandy surface soil units, and/or within the NRCS "severe" and "very severe" erosion hazards areas.

Currently, MICC 19.07 provides consistent standards for protection of all geologically hazardous areas. This approach should be updated to differentiate between the variable risk associated with these areas, and the mitigation measures that are appropriate for each. Key Issue #1 details recommended updates for landslide hazard areas, and Key Issue #4 details recommended updates for seismic hazard areas. For erosion hazard areas, development standards should be updated to ensure that appropriate application of MICC Chapter 15.09 (Storm Water Management Program), including use of BMPs to minimize potential for erosion during construction and appropriate drainage for the developed site. The code should include a standard that any new development or activity occurring within an erosion hazard area cannot create a net increase in geological instability on- or off- site. Currently, MICC 19.07.060.D provides seasonal limitations on site construction, which are appropriate for land clearing and grading activities within erosion hazard areas. Applying a development setback or additional limits on development within erosion hazard areas are not necessary.

Neighboring Jurisdiction Approaches

Neighboring jurisdiction approaches for erosion hazard areas are summarized in the table above (under Key Issue #1). Several neighboring jurisdictions treat erosion hazard areas similarly to landslide hazard areas. That said, Bainbridge Island and Kirkland have updated their respective CAOs to primarily rely on stormwater management standards and other development standards to manage identified erosion hazard areas.

Key Issue #4 for Geologically Hazardous Areas – Seismic Hazard Areas Updates

Current Code and BAS Consistency

Currently, MICC 19.07.060 does not provide specific standards for development within seismic hazard areas. To provide consistency with BAS, the code should be updated to require study by a qualified

professional to evaluate the magnitude of seismically induced settlement that could occur during a seismic event for any project involving development within a seismic hazard area. Evaluation should be provided consistent with the International Building Code requirements for seismic engineering and design, either demonstrating that risk associated with the proposed development is within acceptable limits, or that appropriate construction methods are provided to mitigate the risk of seismic settlement such that there will be no significant impacts to life, health, safety and property.

MICC 19.07.060 should include a minimum setback from Holocene fault rupture traces; although none have been mapped on Mercer Island, faults will likely be identified on the island at some time in the near future. Regions that regulate or advise fault rupture setbacks generally recommend a minimum 50-foot setback and/or site-specific studies to assess hazards for reduced setback for some hazard settings, or other mitigation of hazards.

We recommend a change in the City code to include a recommendation for applicants to check for active faults as identified by the U.S. Geological Survey in its Active Faults Database. If Holocene fault rupture surfaces are identified through this source or other BAS, or by site-evaluations, a setback of 50 feet should be required, or other mitigation strategies implemented to meet design standards for the protection of life safety.

Neighboring Jurisdiction Approaches

- The City of Bellevue does not have defined seismic hazards or setbacks for faults.
- The City of Seattle includes seismic hazards as a geologic hazard, although only broadly defines them as liquefaction-prone areas and areas mapped as the Seattle Fault Zone (Seattle Municipal Code, Section 25.09.012.A.6.b). No fault rupture setback is defined.
- The City of Bainbridge Island defines fault rupture hazard areas within the definition of Seismic Hazards (Bainbridge Island Municipal Code, Section 16.20.190.71) and includes a minimum 50-foot setback from surface-deforming faults. Where fault hazards are located in a development area, analysis and mitigation are required to meet geologic hazards development standards.
- Medina broadly includes Seismic Hazard Areas in the Geologically Hazardous Areas section (Medina Municipal Code, Chapter 20.50.200.B.3), but has no specifics regarding setbacks from faults, although they do require faults within 200 feet of the project area to be shown on the site map, and that general Geologically Hazardous Areas General Development Standards be followed (20.50.200.I.10).

CRITICAL AQUIFER RECHARGE AREAS

***Aquifers* are geologic formations that are permeable to subsurface water, and that are capable of yielding a significant**

Critical ***aquifer*** recharge areas (CARAs) are specifically identified for protection as a critical area by GMA (WAC 365-190-100). CARAs are those areas, as defined by the GMA, that have a critical recharging effect on aquifers used for potable water. Protection of CARAs is necessary to maintain both the quality and quantity of water withdrawn through drinking wells, and emerging from hillside seeps. The current Mercer Island CAO does not identify or address CARAs as critical areas, despite the fact that CARAs do occur on the island.

Relevant Scientific Literature and Guidance

The two basic components of a CARA ordinance are to define: (1) the mapped extent of critical aquifer recharge areas, and 2) development standards for land use within those areas. Critical aquifer recharge areas are typically defined by the following:

- **Susceptibility** of the aquifer to surface spills.
- Potential to impact known **sensitive or high-value groundwater sources,** such as wellhead protection areas.

Defining Susceptibility

Susceptibility may be determined based on soil types (for example, surface soils with high infiltration rates make underlying aquifers more susceptible to land use activities); surficial geologic conditions; depth to groundwater; topography; and other factors. As described further below, for purposes of Mercer Island, the initial approach suggested by Aspect is to develop a susceptibility map based on existing surficial soils, geologic mapping, and new mapping of depth to groundwater.

Sensitive/High Value Sources

CARA ordinances typically provide more protection to groundwater areas that are more sensitive. These include wellhead protection areas, sole source aquifers, and areas with higher concentrations of wells. The only identified sensitive sources on Mercer Island is the City's Emergency Well.

Although the City's source of drinking water (provided by Seattle Public Utilities [SPU] via two pipelines from Bellevue) is located in eastern King County in the headwaters of the Cedar River watershed, the City maintains and tests water quality at an Emergency Well. In the early 2000s, the need for an emergency alternate water supply source was determined to be substantial and unique because of the City's island characteristic and the absence of emergency connections with other systems. An Emergency Water Supply Feasibility Analysis (Phase I) study was completed in 2005 (Roth Hill et al., 2005). This study investigated the viability of an emergency groundwater supply system to support City residents during an interruption of primary SPU supply, and recommended two potential sites for locating this Emergency Well (or locating two wells, if deemed warranted). After drilling a test well in 2007 and coordinating with Ecology, the City chose Rotary Park for the location of the Emergency Well, with construction completed in 2010 (City of Mercer Island, 2018 – City webpage link).

In 2009, Robinson Noble supported the City with completion of a Wellhead Protection Plan for the Emergency Well, which provided an assessment of where the water produced (or that would be produced in the face of an emergency) by the City's Emergency Well comes from. Defined as a "wellhead protection area" (WHPA), the study identified those zones that contribute water to the well location in a given period of time. Typically, a WHPA assessment is provided for time-of-travel periods of 1/2, 1, 5,

and 10 years. Each of these WHPAs was defined as a fixed-radius zone surrounding the well (Robinson Noble, 2009). The Wellhead Protection Plan also assessed specific uses and federal and state databases to complete a contamination source inventory within the largest WHPA; this effort identified existing and potential contamination hazards to groundwater supplies (Robinson Noble, 2009).

The Emergency Well has a WHPA 10-year time of travel boundary that extends in a radius of 1,250 feet around the well location. Although it is not regularly used as a source of domestic water supply, the well is maintained to ensure ongoing potable water even in the face of a major disaster (e.g., earthquake or otherwise) that disrupts the two SPU water main pipelines that reach Mercer Island via crossings from Bellevue.

Neighboring Jurisdiction Approaches

Review of neighboring and nearby jurisdictions indicated a range of approaches to defining and managing CARAs. Results of the review are summarized in Table 2.

Peer Jurisdictions

The City of Bainbridge has defined the entire island as a critical aquifer recharge area. The island was designated as a sole source aquifer in 2013. New residential development activities are generally required to develop an Aquifer Recharge Protection Area (ARPA) to maintain 100 percent of the predevelopment aquifer recharge, with a general requirement that the ARPA maintain 65 percent of existing vegetation. A Critical Area Permit and hydrogeologic assessment are required for activities with potential sources of groundwater contamination. Typical of most CARA ordinances, land uses with potential for significant adverse impacts (for example, landfills and hazardous waste facilities) are prohibited within the CARA.

The City of Lake Forest Park has defined CARAs as those areas within the WHPA 10-year time of travel to the well for Group A water system2 public supply wells, as well as those areas identified through susceptibility mapping. Development within the CARA is limited to uses allowed under single-family residential zoning. Other activities require a hydrogeologic assessment.

The Cities of Medina, Edmonds, and Kirkland do not have specific provisions for CARA in their CAOs.

King County

King County has developed an approach to CARA that defines categories for land use management. Susceptibility of aquifers to impact from overlying land uses is determined by hydrogeologic conditions. Sensitive or "high-value" areas such as WHPAs and sole source aquifers are also included in the CARA delineation. Three categories are classified for land management purposes. Category I is the highest risk and includes highly susceptible soils that overlie sole source aquifers (e.g., Vashon Island) or that are within WHPAs. Category I also includes all areas within a Group A WHPA 1-year time of travel to the well. Category II includes areas of lower risk such as areas of medium susceptibility overlying sole source aquifers or WHPAs, and highly susceptible areas not overlying sole source aquifers or WHPAs. Similar to Bainbridge Island and other CARA ordinances in the region, specific activities with a high potential for significant impacts to groundwater quality are excluded. Exceptions may be granted through a demonstration report.

[2] The Washington Department of Health (DOH) defines a Group A water system as having 15 or more service connections or having the ability to serve 25 or more people, 60 or more days a year.

Table 2. Neighboring Jurisdiction Approaches to Regulating CARAs

Recharge/Sensitive Areas Delineation	Recharge Area Classification Strategy	Development Requirements
City of Bainbridge Island (Bainbridge Island Municipal Code, Chapter 16.20.100)		
Entire Island	Based on criteria listed in WAC 365-190-100. Entire island functions as recharge area.	Critical area permit generally required for non-residential activities with potential to impact groundwater. Prohibits specific activities due to potential impact. 2 acres of denser residential zoning shall maintain 100% annual average recharge through designation as an ARPA. ARPA general requirement is to maintain 65% of site area as existing native vegetation.
City of Medina		
No CARA ordinance		
City of Edmonds (Edmonds City Code and Community Development Code, Chapter 23.60)		
No areas meeting criteria for CARAs exist in vicinity of the City of Edmonds. No specific provisions for CARA provided in CAO.		
City of Lake Forest Park (Lake Forest Park Municipal Code, Chapter 16.16.410-440)		
Areas within 10-year time of travel (TOT) for Group A public supply wells, and additional areas defined through susceptibility mapping.	WHPA 10-year TOT and susceptibility mapping.	Development limited to uses allowed under single-family residential zoning. Other activities (regulated activities) require hydrogeologic assessment.
City of Kirkland		
No CARAs have not been documented and are not included in CAO (The Watershed Company, 2016).		
King County (King County Code, Section 21A.24.311-314)		
Recharge areas mapped as highly susceptible to contamination based on hydrogeology. Incorporates high-value areas such as WHPA and sole source aquifers.	Category I: highly susceptible areas overlying sole source aquifer or WHPA. Areas within WHPA 1-year TOT for Group A. Category II: medium susceptible areas overlying sole source aquifer or WHPA. Highly susceptible and not overlying sole source or WHPA. Category III: low susceptibility areas on marine islands.	Restricts specific development activities with potential to contaminate Category I, II, and III areas. Exceptions to restrictions may be approved through critical areas report demonstration. New residential development incorporate best management practices (BMPs) to maximize stormwater infiltration

Summary of Groundwater Use on Mercer Island

Groundwater use on Mercer Island is fairly limited. Groundwater use was identified from the following sources:

- Listing of lots served by groundwater provided by the City.
- Washington State Department of Health (DOH) database for wellhead protection areas.
- DOH database for groundwater-sourced water systems.
- Ecology's Water Resources Explorer (WRE) database (for permitted and certificated groundwater rights).
- Ecology's well log database.

The locations of active water supply wells (domestic and irrigation) from the above search efforts are presented on Figure 2. Other active wells may be present on Mercer Island. Well locations were not field checked and rely on the accuracy of the data source (i.e., the parcel for City-identified wells and generally ¼, ¼ Section location for other sources). The City's Emergency Well was the only WHPA identified. The DOH database for groundwater-sourced water supply systems listed the Shore Ridge Water Cooperative and the City's Emergency Well. The City's listing of lots served by wells indicated that 10 lots are served by individual wells. A search of the WRE database for groundwater rights on Mercer Island identified 10 certificates, one permit (held by the City), and approximately 50 claims. The sum of all certificated quantities is 1,285 gallons per minute (gpm) and 1,030 acre-feet per year, but the extent of water right claims was not evaluated, and many claims have likely been vacated and/or absorbed within the City's water service area. With the exception of one irrigation well, no wells were identified in Ecology's well log database that were not identified in other sources (several logs were found in Ecology's database that the City indicated as no longer in use). Liesch et al. (1963) identified several wells on Mercer Island, but these wells are assumed to be no longer in use unless identified by the above process. In some cases, conflicting information on points of withdrawal were found between various sources. These discrepancies were resolved in the following hierarchy: specific addresses provided by the City, WRE database, and DOH database.

Development of CARA Protection Areas

A common approach to developing CARA is to categorize areas by combined risk of susceptibility and sensitive source criteria to define Category I and II CARA protection areas, similar to the process adopted by King County. For example, a Category I CARA may be an area where permeable soils such as Advance Glacial Outwash are exposed at ground surface with no intervening ***aquitard*** between ground surface and a relatively shallow water table (high susceptibility) and also within a 10-year time of travel in a WHPA. A Category II example may be an area with the same hydrogeologic conditions (Advance Outwash at surface) but that is outside the WHPA.

An *aquitard* is a zone within the Earth that restricts the flow of groundwater from one aquifer to another.

Critical Aquifer Recharge Area Guidance Document

Ecology has published guidance to assist local jurisdictions with developing protection measures in their CAO that includes an eight-step process for identifying, characterizing, and managing groundwater withdrawals and recharge impacts (Ecology, 2005). The guidance also includes BAS sources for protecting CARAs, and is considered current BAS for designating critical aquifer recharge areas and recommending strategies for their protection. This guidance document helps local jurisdictions and the public understand what is required for the protection of local groundwater resources under the GMA.

The eight-step process outlined by Ecology (2005) provides guidance for identifying where groundwater resources are important to the community (Steps 1–5) and how to protect them (Steps 6–8), as follows:

- **Step One:** Identify where groundwater resources are located.
- **Step Two:** Analyze the susceptibility of the natural setting where groundwater occurs.
- **Step Three:** Inventory existing potential sources of groundwater contamination.
- **Step Four:** Classify the relative vulnerability of groundwater to contamination events.
- **Step Five:** Designate areas that are most at risk to contamination events.
- **Step Six:** Protect by minimizing activities and conditions that pose contamination risks.
- **Step Seven:** Ensure that contamination prevention plans and BMPs are followed.
- **Step Eight:** Manage groundwater withdrawals and recharge.

An overview of hydrogeologic conditions is presented below, followed by a discussion of approaches to developing a CARA following Ecology's (2005) guidance. Specific recommendations for CARA development are presented at the end of this section.

Hydrogeologic Considerations for Mercer Island CARA

Step 1 of Ecology's guidance is to identify the locations of groundwater resources. BAS as it pertains to CARAs includes documenting the occurrence and movement of groundwater (Ecology, 2005). Occurrence and movement of groundwater are characterized by the ***hydrostratigraphic units*** associated with underlying geologic conditions.

A *hydrostratigraphic unit* is defined as a geologic unit or group of geologic units with similar hydraulic characteristics.

Hydrostratigraphic units may be broadly divided into:

- aquifers and
- aquitards (a low permeability unit that retards groundwater flow). A surficial geologic map is provided on Figure 3.

An overview of the five principal hydrostratigraphic units identified by Roth Hill et al. (2005) or Liesch et al. (1963) underlying Mercer Island are presented below, followed by a summary of groundwater flow.

Recessional Outwash (Qvr) is mapped on the interior portions of Mercer Island. Liesch et al. (1963) reports one well that was completed in the Qvr sediments at a depth of 60 feet with a capacity of 600 gpm. The Qvr was not considered a major hydrostratigraphic unit by Roth Hill (2005), and it may, therefore, have limited extent on Mercer Island.

Vashon Till (Qvt) – typically acts as an aquitard, retarding groundwater flow. Aquifers underlying till mantled areas are generally less susceptible to impacts from land use activities.

Vashon Advance Outwash (Qva) – where saturated, this unit serves as a shallow aquifer likely providing water to most shallow wells on the island. Precipitation can directly recharge the Qva aquifer where it is exposed at land surface. While some recharge from this unit seeps vertically into underlying units, the probable predominant discharge from this unit is through perennial springs.

Lawton Clay (Qvlc)/Pre-Fraser Fine-grained Deposits – low permeability deposits that act as an aquitard, retarding the downward vertical flow of groundwater.

Pre-Fraser Deposits – these older, undifferentiated deposits were deposited in a range of depositional environments and, therefore, include both aquitards and aquifers. The City's Emergency Well is completed at a depth of 505 to 540 feet in Pre-Fraser deposits. Where coarse-grained deposits of this unit are exposed at land surface, direct recharge may occur, resulting in high susceptibility of contamination for any contaminants released.

Recharge to Mercer Island's aquifers occurs from direct precipitation on the land surface and, for deeper wells, from a possible hydraulic connection with Lake Washington (Roth Hill, 2005). Precipitation may directly infiltrate into the Qva aquifer and provide recharge, while precipitation upon lower permeability glacial till is more likely to run off but may become recharge where topography and engineered stormwater systems permit. The predominant groundwater flow path is likely from upland areas toward the shorelines where discharge to Lake Washington occurs via springs and seeps. The majority of discharge from the shallow Qva aquifer may occur to the island's many perennial springs and streams. Groundwater also moves vertically downward with seepage into deeper soil units (Roth Hill, 2005).

Approach to Developing Critical Aquifer Recharge Areas Provisions

An entirely new CARA section is needed for the City's CAO, with standards provided consistent with BAS and current agency guidelines. The recommended approach consistent with BAS is to:

- Develop an aquifer **susceptibility map.**
- Identify **sensitive/high value areas.**
- **Categorize and map CARAs** by combining susceptibility mapping with sensitive/high value areas.
- Develop **land use policies** consistent with CARA designations.

This approach recognizes that aquifer susceptibility varies spatially and targets the most susceptible areas for protection. Each of these tasks are discussed below.

Susceptibility Mapping

Step 2 of Ecology's guidance is to analyze the susceptibility of the natural setting where groundwater occurs. Aquifer susceptibility refers to the natural condition while vulnerability is the risk from natural susceptibility and contamination sources. The U.S. Environmental Protection Agency (EPA) (1985) developed a method referred to as DRASTIC (Depth to water, Recharge, Aquifer media, Soil media, Topography, Impact of Vadose zone media, and hydraulic Conductivity) to evaluate the susceptibility of groundwater resources to contaminants based on hydrogeologic parameters. The model presents a relatively straightforward method for evaluating aquifer vulnerability based on readily available data (King County 2004). Parameters considered in the model are:

D-Depth to groundwater
R-Net recharge
A-Aquifer media
S-Soil media
T-Topography/slope
I- Vadose zone media
C-Aquifer hydraulic conductivity

Parameters are assigned a rating and a weighting factor. For example, a gravel soil medium with high infiltration capacity would receive a higher rating than an area of clay soil. Each of the parameters is weighted based on predetermined weights provided in the method. Some studies have evaluated the validity of DRASTIC method and evaluated the predetermined weighting criteria to better predict aquifer susceptibility (for example Jang et al., 2017). The DRASTIC model can be performed using GIS tools.

Various modifications of the DRASTIC method have been used to determine aquifer susceptibility. For example, King County's susceptibility map uses the parameters depth to groundwater (D), soil media (S), and Vadose zone media (I) (King County, 2004). As described below, the approach to determining aquifer susceptibility on Mercer Island would rely on soils and surficial geologic mapping. depth to groundwater, and slope.

Ecology (2000) developed a rating system based on the following parameters:

- Overall permeability of Vadose zone material (surficial soil and underlying, unsaturated geologic strata).
- Thickness of Vadose zone material (depth to groundwater).
- Available recharge.

The Ecology (2000) model is now superseded by more general guidance provided in Ecology (2005), which does not preclude the use of existing rating systems. Island County used the Ecology (2000) model for development of a susceptibility map (Island County, 2005). The Lake Forest Park Water District recently performed a susceptibility evaluation using the Ecology (2000) rating system that was adopted into the City's CARA ordinance (AESI, 2016).

The U.S. Geological Survey (USGS) (Bauer and Vaccaro, 1987; Bauer and Mastin, 1997; Vaccaro, 2007) has developed a deep percolation model (DPM) to identify areas of recharge. The DPM identifies a daily water budget for estimating groundwater recharge from precipitation and irrigation. The model computes water passing beneath the root zone based on precipitation, evapotranspiration, direct runoff, and changes in soil moisture. The model is developed by dividing the land into cells and computing recharge for the individual cells. While this model has been used extensively for computing groundwater recharge for numerical groundwater models, we are not aware of widespread use of this model in developing susceptibility maps. Island County incorporated results of a previous DPM model by USGS to estimate groundwater recharge for the recharge component of its susceptibility mapping using the Ecology (2000) model (Island County, 2005).

Identify Sensitive/High Value Areas

Steps 3, 4, and 5 of the Ecology (2005) guidance include the identification of potential contaminant sources and assessing aquifer vulnerability to existing contaminant sources to identify the groundwater sources most at risk. Priorities and risks are also set in these steps and include items such as WHPAs and densely populated areas that rely on groundwater. For Mercer Island, a recommended priority would be the protection of the WHPAs for Group A systems (i.e., the City's Emergency Well).

Categorize and Map CARAs

Susceptibility mapping will be combined with the identification of sensitive/high value areas to determine the final CARAs for management. Categories of CARA areas ranked by risk would be determined at this stage.

Develop Land Use Policies

Step 6 of Ecology's guidance includes the jurisdiction making decisions regarding land use within a designated CARA, which may include defining prohibited and conditioned uses for high-risk activities (for example, landfills, tank farms, and hazardous waste facilities). Since most of Mercer Island is built-out, primarily with residential uses that do not include these high risk activities, the new CARA land use standards are not anticipated to have significant implications on predominant uses and activities across the city. In fact, evaluation of uses and activities allowed within residential zones across Mercer Island does not include any activities that would warrant hydrogeologic evaluation.

Hydrogeologic reports may be required for non-residential activities in higher risk areas (e.g., Category I and II areas) or determined on a case-by-case basis. Hydrogeologic reports typically include a characterization of the area's hydrogeology and water use, expected impacts from the proposed project, and recommendations for BMPs and/or other mitigating measures. These reports are submitted to the governing agency for review. CARA ordinances may also allow for an applicant to declassify an area through a supporting technical analysis. This is generally allowed because of the regional approach taken in development of the CARAs. Some CARA ordinances restrict certain activities that are high risk within a Category I CARA, although a waiver process may be incorporated that considers potential impacts from the proposed action.

Step 7 is ensuring that contamination prevention plans and practices are implemented.

Step 8 of Ecology's guidance includes managing aquifer recharge areas to maintain drinking water sources and stream base flow, particularly for salmon-bearing streams. Effectively, this would be incorporated into land use decisions by encouraging methods that will maintain recharge, such as low impact development and rain gardens.

Summary of Recommendations for Development of City of Mercer Island CARAs

1. Determine aquifer susceptibility based on a modified DRASTIC approach that considers depth to groundwater, surficial soils and geology, Vadose zone characteristics, and slope. The approach is similar to that of Ecology (2000) but would also incorporate slopes, which can have a significant effect on runoff and recharge. Existing soils and geologic mapping would be incorporated. A depth to groundwater map would need to be developed. Consideration would also be given to existing infiltration mapping (Herrera, 2010). This approach makes use of the best available data for determining aquifer susceptibility.

2. Overlay high-value wellhead protection areas (e.g., the City's Emergency Well WHPA and any other WHPAs provided by DOH for private water systems) onto susceptibility maps.

3. Develop categories for aquifer protection based on susceptibility and wellhead protection area.

4. Develop CARA standards so that future development is consistent with the CARA designation. This may include the following:

- Restrict development activities with the potential for significant contamination within high susceptibility CARAs and WHPAs. This may be accomplished by limiting land use to residential activities within designated CARAs.

    - Provide for non-residential activities with the potential to contaminate or adversely affect recharge through submittal of an approved demonstration of site conditions and adequate mitigation through a hydrogeologic report. Activities with the potential to contaminate may be designated based on Appendix A of Ecology's Critical Aquifer recharge document (Ecology, 2005[3]) or other system, similar to the Bainbridge Island CARA ordinance. Non-residential activities included in Appendix A that may occur in Mercer Island include, but are not limited to: above-ground and underground storage tanks, automobile body shops and repair shops, dry cleaners, manufacturing facilities, bus facilities and other fleet operations facilities, funeral services, taxidermy services, furniture repair and manufacturing, medical and veterinary offices, office developments, retail developments, photo processing and printing services, gas main pipelines, and utility facilities.

- Include an allowance to declassify a designated CARA through an approved hydrogeologic assessment.

- Encourage residential development within CARAs to employ BMPs to maximize stormwater infiltration and manage household hazardous waste. Infiltration should be performed in accordance with provisions for geologic hazard areas. Ecology guidelines include restrictions on areas where stormwater infiltration is considered infeasible (Ecology, 2014), including within landslide hazard and erosion hazard areas, and within 50 feet of slopes greater than 20 percent and over 10 feet high.

[3] Ecology's 2005 CARA Guidance, including Appendix A available: https://fortress.wa.gov/ecy/publications/documents/0510028.pdf

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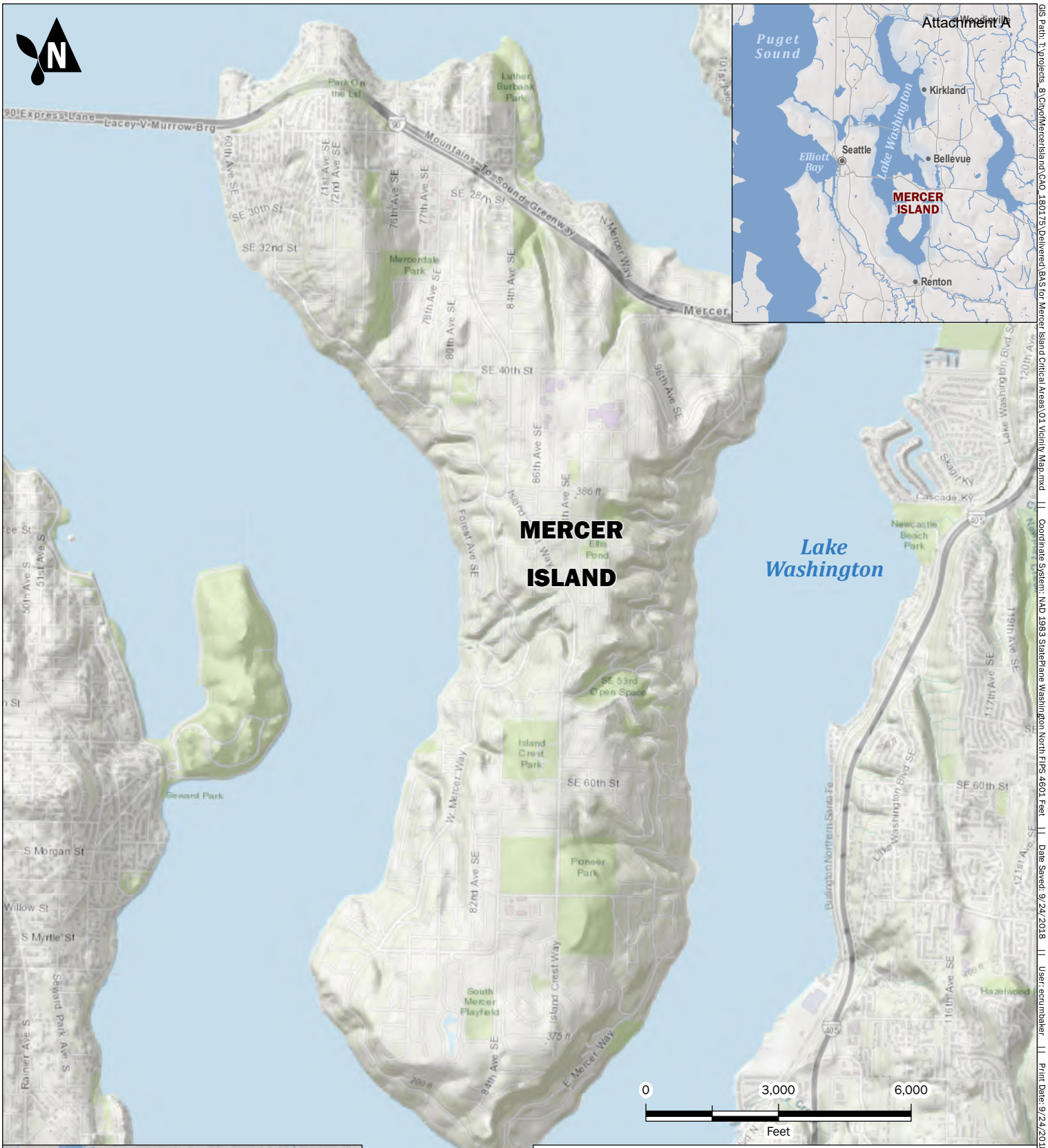
FIGURES AND ATTACHMENTS

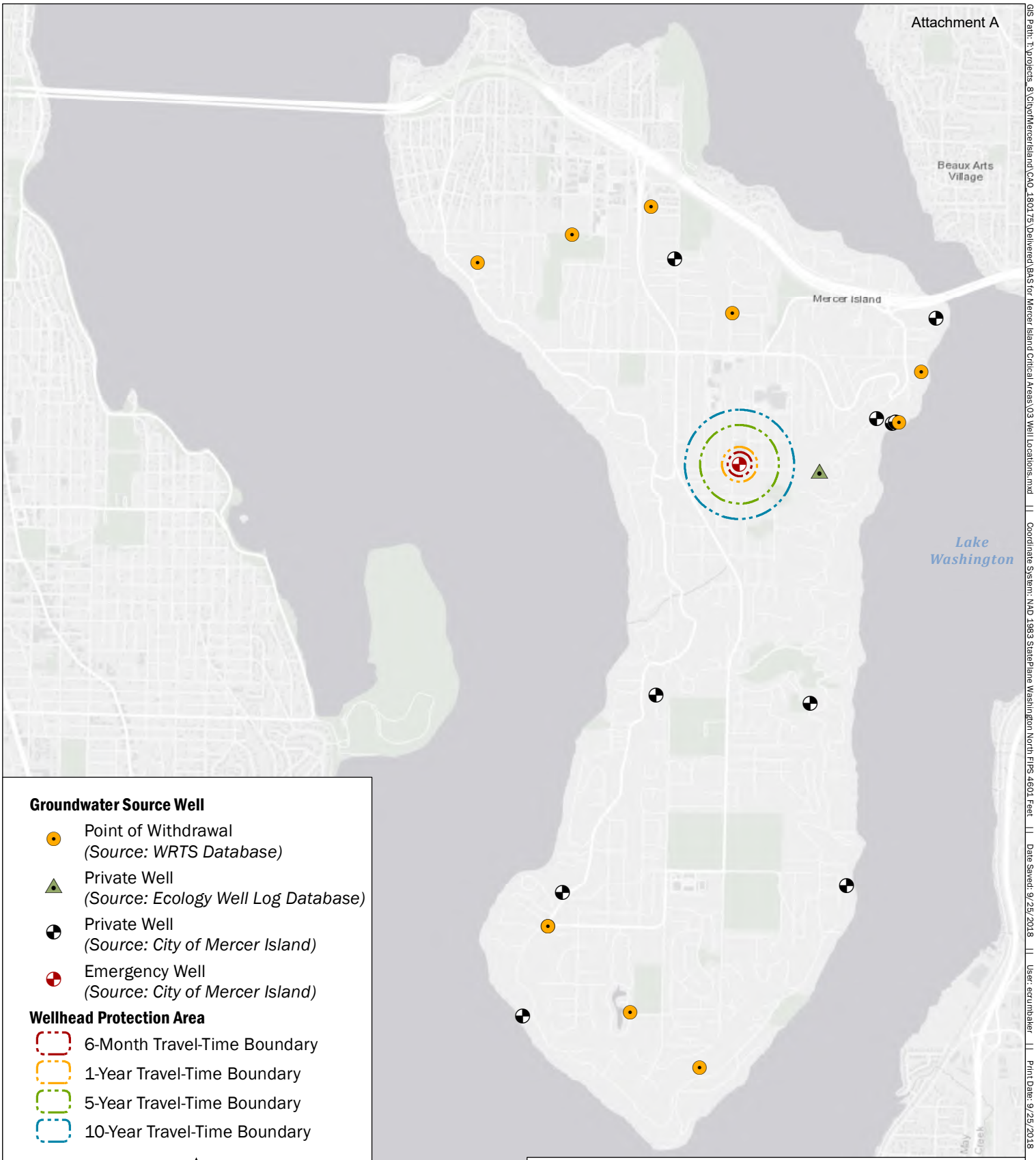


Vicinity Map

BAS for Mercer Island Critical Areas
Critical Areas Ordinance Review
Mercer Island, Washington

Aspect CONSULTING	SEP-2018	BY: EWM / EAC	FIGURE NO. 1
	PROJECT NO. 180175	REVISED BY: ---	

GIS Path: T:\projects_8\CityofMercerIsland\CAO_180175\Delivered\BAS for Mercer Island Critical Areas\01 Vicinity Map.mxd || Coordinate System: NAD 1983 StatePlane Washington North FIPS 4601 Feet || Date Saved: 9/24/2018 || User: ecrumbaker || Print Date: 9/24/2018



Groundwater Source Well

- Point of Withdrawal *(Source: WRTS Database)*
- Private Well *(Source: Ecology Well Log Database)*
- Private Well *(Source: City of Mercer Island)*
- Emergency Well *(Source: City of Mercer Island)*

Wellhead Protection Area

- 6-Month Travel-Time Boundary
- 1-Year Travel-Time Boundary
- 5-Year Travel-Time Boundary
- 10-Year Travel-Time Boundary

N

0 3,000 6,000

Feet

Well Locations

BAS for Mercer Island Critical Areas
Critical Areas Ordinance Review
Mercer Island, Washington

Aspect Consulting	SEP-2018	BY: EWM / EAC	FIGURE NO. 2
	PROJECT NO. 180175	REVISED BY: ---	

Geologic Map of Mercer Island, Washington

Troost, K. G. and Wisher, A. P., 2006, Geologic map of Mercer Island, Washington: City of Mercer Island, scale 1:12,000, 1 sheet.

Nonglacial Deposits (Holocene)

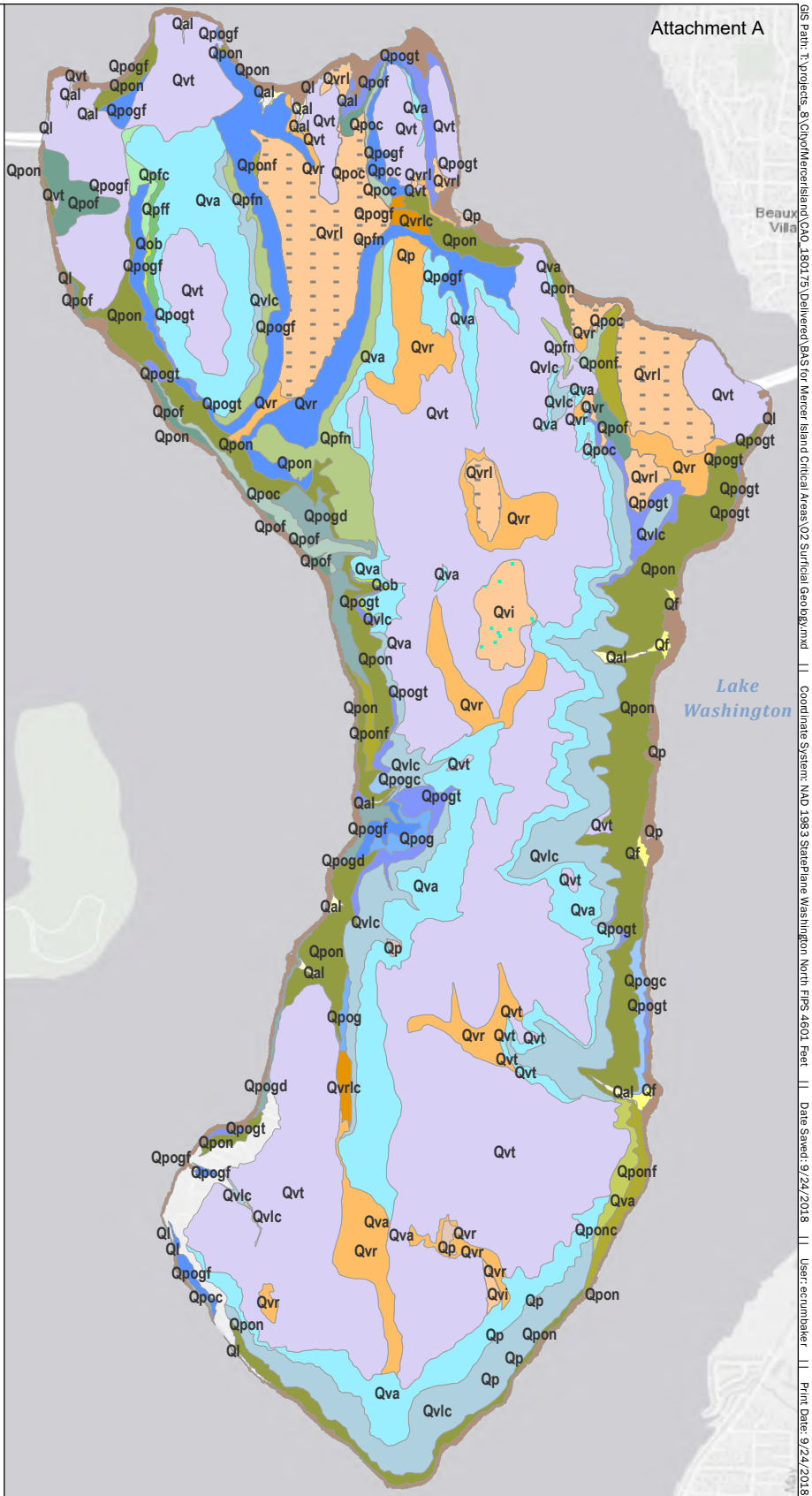
- Qp - Peat
- Qal - Alluvium
- Ql - Lake deposits
- Qf - Fan deposits

Younger Glacial Deposits (Fraser Glaciation, Pleistocene)

- Qvr - Vashon recessional outwash deposits
- Qvrl - Vashon recessional lacustrine deposits
- Qvrlc - Vashon recessional course-grained lacustrine deposits
- Qvi - Vashon ice-contact deposits
- Qvt - Vashon subglacial till
- Qva - Vashon advance outwash deposits
- Qvlc - Lawton Clay member of the Vashon Drift

Older Glacial and Nonglacial Deposits (Pleistocene)

- Qpfc - Pre-Fraser coarse-grained deposits
- Qpff - Pre-Fraser fine-grained deposits
- Qpfn - Pre-Fraser nonglacial deposits
- Qob - Olympia beds
- Qpoc - Pre-Olympia coarse-grained deposits
- Qpof - Pre-Olympia fine-grained deposits
- Qpog - Pre-Olympia glacial deposits
- Qpogc - Pre-Olympia coarse-grained glacial deposits
- Qpogf - Pre-Olympia fine-grained glacial deposits
- Qpogt - Pre-Olympia glacial till
- Qpogd - Pre-Olympia glacial diamict
- Qpon - Pre-Olympia nonglacial deposits
- Qponc - Pre-Olympia coarse-grained nonglacial deposits
- Qponf - Pre-Olympia fine-grained nonglacial deposits



N

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Feet

Surficial Geology

BAS for Mercer Island Critical Areas
Critical Areas Ordinance Review
Mercer Island, Washington

Aspect Consulting	SEP-2018	BY: EWM / EAC	FIGURE NO. 3
	PROJECT NO. 180175	REVISED BY: ---	

City of Mercer Island
Critical Areas Ordinance (CAO) Update
Best Available Science Review and Gap Analysis Matrix for Geohazards, Planning Commission Review Draft – October 11, 2018

Existing CAO Provision MICC Chapter / Section	Recommendation for Update	Reason For Lack of BAS Consistency	Suggested Change	Basis for Suggested Change	Direction from City	Code Update Tracking
19.07.060 Geologic Hazard Areas						
19.07.060 A Designation **Definitions of Geologic Hazard Areas, Landslide Hazard Areas, Steep Slopes, Erosion Hazard Areas, and Seismic Hazard Areas included in MICC 19.16.010**	☐ Consistent w/ BAS ☐ Inconsistent w/ BAS ☒ Opportunity for improved BAS consistency ☐ Clarity / Ease of use ☐ Consistency of code sections	Designation of Geologic Hazard Areas, and assessments by Troost and Wisher (2009) providing detailed inventory of potential hazard areas across the Island, are generally consistent with BAS. Landslide hazard area assessment does not integrate recent additional LiDAR data from 2018 Grimm study, or new BAS protocols for landslide mapping and landslide hazard area delineation. Landslide hazard area designation criteria relies on definition of "Steep Slope", which excludes artificially created slopes and rockeries, which is too broad and could include many slopes that do not meet modern code stability requirements. Definition and designation criteria for erosion hazard areas are inconsistent with Troost and Wisher 2009 data and methods.	Update landslide hazard assessment (inventory mapping) to integrated additional data from W. Grimm study (2018). *See BAS Report for details.* Update "Steep Slope" definition to only exclude "engineered slopes and rockeries", and potentially areas of competent consolidated rock. Update assessments and designation criteria / definitions to provide consistency with Troost and Wisher (2009) methods for erosion hazard areas.	W. Grimm, 2018 Burns and Mickelson, 2016 Burns et al., 2012 Slaughter et al., 2017 Seattle Code 25.09.090.B.2.b. Medina Code 20.50.200.B Troost and Wisher, 2009		
19.07.060 B Buffers	☐ Consistent w/ BAS ☒ Inconsistent w/ BAS ☐ Opportunity for improved BAS consistency ☐ Clarity / Ease of use ☒ Consistency of code sections	There are no standard buffers or setbacks provided for any geologic hazard areas per code, but setbacks are included in Mercer Island Landslide Hazard Map	Delineation of elevated landslide hazard areas per Grimm 2018, and erosion hazard area by Troost and Wisher, 2009. Include 25-foot setback for steep slopes up to 50 feet high and shallow landslide hazard areas, and 75-foot setback for slopes over 50 feet high and for deep-seated landslide hazard areas. Reduction or increase by geotechnical/geological professional, but not less than 10-foot setback for erosion hazard areas and shallow landslide hazard areas, and 50 feet for deep landslide hazard areas. See BAS Report for details on recommended updates for landslide hazard area development standards.	State Guidance (Berryman & Henigar, 2000; CTED, 2007) Troost and Wisher 2009 Landslide Hazard Assessment and Map Grimm, 2018 City of Bainbridge Island Code, City of Medina Code		

Existing CAO Provision MICC Chapter / Section	Recommendation for Update	Reason For Lack of BAS Consistency	Suggested Change	Basis for Suggested Change	Direction from City	Code Update Tracking
	☐ Consistent w/ BAS ☒ Inconsistent w/ BAS ☐ Opportunity for improved BAS consistency ☐ Clarity / Ease of use ☒ Consistency of code sections	Development standards for seismic hazard areas should be updated to address hazard associated with Holocene fault ruptures, even though none are currently mapped on Mercer Island.	No active faults have been identified or mapped with precision appropriate for site-specific hazards evaluation or designation within an inventory map. Aspect recommends standard be provided to require that applicants check the U.S. Geological Survey Quaternary Faults and Folds Database to check for new information regarding active faults (https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=db287853794f4555b8e93e42290e9716). If Holocene active (younger than 11,600 years before present) fault rupture surfaces are identified in hazards maps or from other studies, provide 50-foot minimum setback from rupture traces, or implement other structural or geotechnical strategies so that life safety risks are mitigated.	State Guidance (Berryman & Henigar, 2000; CTED, 2007) Seattle BAS 5.1.3 Regional Seismicity – Evidence for larger events in the Seattle Fault zone over the past 16,000 years Bainbridge 16.20.190 Definitions #71 Seismic Hazard Areas Medina 20.50.200.B.3 Seismic Hazard Areas U.S. Geological Survey Quaternary Faults and Folds Database: https://usgs.maps.arcgis.com/apps/webappviewer/index.html?id=db287853794f4555b8e93e42290e9716		
19.07.060 C Geotechnical Review	☐ Consistent w/ BAS ☒ Inconsistent w/ BAS ☐ Opportunity for improved BAS consistency ☒ Clarity / Ease of use ☐ Consistency of code sections	Current code structure provides uniform standards across all geologic hazard areas, with no recognition of varying hazards and associated level of risk .	Expand code section to provide general Geotechnical Review requirements, as well as requirements specific to each geohazard type (landslide, erosion, and seismic). See BAS report Key Issues for specific recommendations.	State Guidance (Berryman & Henigar, 2000; CTED, 2007) Bainbridge, Medina, Edmonds, and other neighboring jurisdiction approaches.		
19.07.060 D Site Development	☐ Consistent w/ BAS ☐ Inconsistent w/ BAS ☒ Opportunity for improved BAS consistency ☐ Clarity / Ease of use ☐ Consistency of code sections	As with Subsection C, Site Development Standards are generally provided uniformly for all geologic hazard areas.	Expand code section to provide general Site Development requirements applicable to all geological hazard areas, as well as requirements specific to each geohazard type (landslide, erosion, and seismic). See BAS report Key Issues for specific recommendations.	State Guidance (Berryman & Henigar, 2000; CTED, 2007) Bainbridge, Medina, Edmonds, and other neighboring jurisdiction approaches.		

Existing CAO Provision MICC Chapter / Section	Recommendation for Update	Reason For Lack of BAS Consistency	Suggested Change	Basis for Suggested Change	Direction from City	Code Update Tracking
NEW SECTION - Critical Aquifer Recharge Areas						
N/A – No existing provisions	☐ Consistent w/ BAS ☒ Inconsistent w/ BAS ☐ Opportunity for improved BAS consistency ☐ Clarity / Ease of use ☐ Consistency of code sections	Critical aquifer recharge areas (CARAs) are not designated or protected in the current CAO.	Add section that designate and protect CARAs, pursuant to the GMA and its implementing regulations. Please see detailed recommendations for CARA provisions in the BAS Report. For CARA recommendation (in BAS Report) encouraging stormwater infiltration associated with stormwater infiltration restrictions per Ecology SWMWW where infiltration is not considered feasible in the following areas: • Where land for bioretention is within area designated as an erosion hazard, or landslide hazard. • Within 50 feet from the top of slopes that are greater than 20 percent and over 10 feet of vertical relief.	Ecology 2005; Ecology guidance for protection of wellheads. Ecology, 2014 Stormwater Management Manual for Western Washington		

Attachment B - 2005 City of Mercer Island BAS, *selected report sections for Geologically Hazardous Areas*

DRAFT – January, 2005

Review of Best Available Science & Recommendations for

Critical Areas Regulations

Geologic Hazards & Wildlife Habitat
City of Mercer Island, WA

Prepared By:

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Development Services Group
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With Contributions by:

Michele Lorilla, PE, Lorilla Engineering, Inc. PS
Paul Ingrham, AICP, Berryman & Henigar, Inc.

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I. Introduction

The Washington State Growth Management Act (GMA) requires cities and counties to designate and classify critical areas, and to adopt policies and regulations to protect the functions and values of critical areas. The state regulated "critical areas" include:

- wetlands,
- frequently flooded areas,
- geologically hazardous areas,
- aquifer recharge areas, and;
- fish and wildlife habitat conservation areas (WAC 365-190-080).

Designation and classification of the five critical areas must be consistent with Community, Trade & Economic Development (CTED) agency minimum guidelines (WAC 365-190-040). The GMA, as amended in 1995, requires that cities include best available science in the development of such policies and regulations [RCW 36.70A.172(1); WAC 365-195-900].

Consideration of "best available science" as the basis for locally appropriate policies and regulations must be balanced with the many other substantive goals and mandates of the GMA. Further, cities "shall give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries" (RCW 36.70A.172). Nonscientific information (e.g., social, legal, cultural, economic, or political) resulting in departures from scientifically valid critical areas recommendations must be identified and justified. Any potential consequential impacts resulting from departures from best available science must also be identified as findings, with the associated risks of any deviations identified.

This report is also intended to provide compliance with applicable requirements of RCW 36.70A.130 for adoption of an ordinance that is based on findings of fact and the result of a public participation process.

II. Report Purpose

The report is intended to document how the City of Mercer Island (City) has included best available science in the development of regulations intended to designate and protect critical areas, consistent with state requirements. Two of the five topics (aquifer recharge areas, frequently flooded areas) are not applicable to City of Mercer Island, because there is no municipal water supply production and no mapped flood zone areas on Mercer Island. Two of the five topics are addressed in a report prepared by The Watershed Company in 2004 - watercourses, including aquatic habitat and wetlands. This two part report addresses the remaining two topics of the above listed five topics:

1) Part I addresses geologically hazardous areas,

2) Part II addresses non-aquatic area wildlife habitat, particularly birds.

The two part report contents are highlighted as follows:

Part I – Geologic Hazards - Part I of the report describes the general inventory of existing geologic hazard conditions within the City. The scope of Part I includes an analysis and evaluation of the existing geologic hazard regulations. Part I also includes provision of recommendations for suggested revisions to

code chapter MICC 19.07 for geologic hazards. The existing regulatory designations in the current code are "critical slopes" and "geologic hazard areas". A summary of the literature supporting the regulatory recommendations for geologic hazards is included at the end of Part I section of the report.

Part II – Wildlife Habitat - Part II includes best available science findings for wildlife and priority habitats that have been assembled from Washington Department of Fish & Wildlife (WDFW). There is also information from Washington Department of Natural Resources (WDNR) for plants. Excerpts from major findings from scientific documents are included under Appendix A. The current code section MICC 19.07.010 (E)(4) (b) regulates and protects all listed species and habitats under the current WDFW Priority Habitats and Species programs. Regulations require the applicant to provide a priority species and habitat study recommending appropriate protections based on WDFW management recommendations, as well as proposed mitigation measures that are considered appropriate for protection of the species identified.

The maidenhair fern was dropped from WDNR's list in 2003, yet the plant may be added in the future as a listing for the state agencies to monitor, based on more study of the abundance of distribution and several related species of the plant. It's likely that the City of Mercer Island will not continue to regulate the maidenhair fern until such time as it may be added to a state list of threatened, endangered or sensitive status or added to the priority habitat list.

III. Background on 2004 critical area code updates by Mercer Island

The City of Mercer Island's critical areas regulations are contained in Title 19, *Mercer Island City Code (MICC)*, Chapter 19.07, currently titled *Critical Lands.*

The code section MICC 19.07 is suggested to be renamed *Critical Areas* to be consistent with GMA so this report references the proposed code section as the "critical areas code". The existing code is referenced as the "critical lands code".

In early 2002, the City began to analyze and update the inventory of watercourses (MICC 19.07.030) and wetlands (MICC 19.07.040). The draft document "Best Available Science Report: Proposed Streams and Wetlands Critical Areas Regulations for Mercer Island, The Watershed Company, 2002" includes the documentation of aquatic habitats associated with wetlands and watercourse features, so that topic is excluded from this report.

Mapping and designation efforts began in mid-2002 for erosion hazards, landslide hazards and seismic hazards (MICC 19.07.020) as critical areas. The applicable best available science was used for the geologic hazard mapping effort, under the direction of Michele Lorilla, PE.

Mapping efforts were completed in early 2004 for wildlife habitat areas for species specific regulation under the current code. The applicable best available science in state guidelines for buffers together with direct field observations for bald eagle nest locations and shoreline areas was mapped by City of Mercer Island staff.

In mid-2004, the City started additional best available science documentation for existing and proposed development regulations related to the full range of geologic hazard areas and wildlife habitat conservation areas consistent with state law. During 2002 to 2004, the City also addressed the relevant definitions included in MICC 19.16, and considered minor changes to other related code sections - MICC 19.01 general provisions, MICC 19.07.100 environmental procedures under SEPA, and MICC 19.15 administration.

In July 2004, the City converted to the International Building Code family of codes, to meet state law enacted in 2003. The state mandated update included code changes to MICC 17 – Construction Codes as well as minor changes to MICC 19.01 - Administration, including many seismic design requirements affecting site development on Mercer Island. Two examples of seismic design requirements that increased under the International Building Code are commercial building design requirements for 5 story structure in wood or steel frame construction type over a single floor of concrete construction type and higher specified design loads for waterfront structures such as piers and docks.

The Planning Commission and staff have conducted the overall critical areas code review. During 2004, the City of Mercer Island also formed a stakeholders group as a review process that included review of existing and proposed comprehensive plan policies and development regulations by a group of Mercer Island citizens representing various groups such as environmental interests, contractors, council members, business, architects and residents.

Part I - Geologic Hazards for City of Mercer Island

A. Inventory of Geologic Hazards

1. Soils

Soil types form the basis for determining the various types of hazardous earth processes. The City of Mercer Island has identified six major different soil type areas from USGS maps for the 4,034 acres of total land area. The major soil groups and types found on Mercer Island include:

- Sedimentary Deposits
- Recessionals
- Glacial Till (Alderwood series)
- Unnamed and named Sands (Quarternary Older Sands)
- Upper Clay
- Lower Clay (Older Clay)

The mapped major soil areas are shown on Figure 3.

2. Erosion Hazard Areas

There are approximately 2,448 acres (61% of the total 4,034 acres) in erosion hazard areas on Mercer Island with variable soils and gradients all greater than 15% slope. The definition of erosion hazard is not included under the current code. The current policy is to consider slopes over 15% slope gradient as susceptible to erosion, based on the term "erosion" defined as the wearing away of rock or soil and the movement of the resulting particles by wind, water, ice or gravity, excluding mass movements (WDOE Pub. 93-30, May, 1993). The areas mapped as Erosion Hazard areas are shown on Figure 4.

3. Seismic Hazard Areas

The City of Mercer Island has identified approximately 547 acres (13.5%) in seismic hazard areas with variable slopes. The definition of seismic hazard is not included under the current code. The current policy is to consider potentially unstable areas that are susceptible to seismic events, based on the term "seismic" defined vibrations in the earth produced by earthquakes (Keller, 1992), or naturally induced shaking of the ground (Mercer Island Hazard Mitigation Plan Report, May, 2004). The areas mapped as Seismic Hazard areas are shown on Figure 5.

4. Critical (Steep) Slope Areas

There are approximately 150 acres (3.7% of land area) in steep slope areas greater than 40% slope. The code currently refers to "critical slopes" as 30% or greater calculated by measuring the vertical rise over any 40-foor horizontal distance. The current critical slope hazard area is defined as the critical slope and

the land that extends for 10 feet past the top and toe of the slope (MICC 19.16.010). The mapped areas of critical slopes greater than 30% slope is approximately 500 acres (12.3% of land area) under current regulations. The city maintains a reference map series as an atlas with defined ranges of several slope categories: 15% to 30%, 30% to 40%, 40%+ etc.

The areas mapped as Steep Slope Hazard areas are shown on Figure 6.

5. Potential Landslide Areas

There are several basic site conditions that cause landslides within the overall category of potential landslide areas. As an example, steep slope areas are defined as gradients greater than 40% slope provided its height is at least 20 feet measured on the 40% slope portions. Engineers often use 40% slopes that approach the natural angle of repose ratio of 2:1 (horizontal to vertical) as a point that engineering generally determines that soils fail to stand vertically (M. Lorilla, 2004). Under the current code, lots with unstable slopes may be conditioned to not be built upon (MICC 19.08.030 C.1. or 19.08.030 F.2.). Slopes with 40% slope with 10 feet of vertical rise are considered a type of landslide hazard, yet not clearly defined in the code as a subcategory of potential landslide hazards.

A second type of landslide hazard is based on the underlying geologic structure. The typical geologic sequence conducive for potential landslide conditions found elsewhere in the Puget Sound is also present on Mercer Island. The compact clays and silts underlying the Unnamed or Older Sand were deposited in a preglacial lake that existed before the ice advance into the Puget Sound area. The name "Lawton Clay" is applied to this thinly and parallel-bedded clay and silt unit. The Lawton Clay perches ground water, forming the slippery surface on which the Unnamed or Older Sand can slide. Deep-seated failures can occur where a failure surface extends into the clay unit.

The City of Mercer Island has identified approximately 1,948 acres (48% of land area) that includes all types of potential landslides – areas that are greater than 15% slope with other factors, or sites with greater than 80% slope or sites of past landslide events that qualify as potential landslide hazard areas, etc. The code currently refers to "critical slopes", a term that will be "steep slopes" in the proposed code. The steep slopes are a subcategory of the "landslide hazard areas". The areas mapped as potential Landslide Hazard Areas are shown on Figure 6.

The amount of land area in the landslide hazard area has significance for natural hazard mitigation planning. Because 48% of Mercer Island total land area is designated in landslide hazard area, the City of Mercer Island is rated High (more than 15% of land area) on the USGS federal landslide hazard rating scale (USGS Open File Report 00-450, 2000). By comparison, most of the other nearby Puget Sound area communities are rated Moderate (between 1.5% and 15% of land area) while most of the rest of the country is rated Low (less than 1.5% of land area).

***6. Classification*:** The minimum suggested state guidelines under WAC 365-190-080 provide direction for designation and classification of geologic hazard areas, including landslide, seismic and erosion hazard areas.

The regulations under 365-190-080 WAC state that:

"Geologically hazardous areas"...pose a threat to the health and safety of citizens when incompatible commercial, residential or industrial development is sited in areas of significant

hazard. Some geological hazards can be reduced or mitigated by engineering, design, or modified construction practices so that risks to health and safety are acceptable. When technology cannot reduce risks to acceptable levels, building in geologically hazardous areas is best avoided. This distinction should be considered by counties and cities that do not now classify geological hazards as they develop their classification scheme.
(b) Counties and cities should classify geologically hazardous area as:
(i) known or suspected risk;
(ii) no risk; or
(iii) risk unknown data are not available to determine the presence or absence of a geological hazard.

B. Science

Basis to Regulate Hazardous Earth Processes

This report also addresses the basic question – "Why regulate earth processes?" The short response is that regulation provides life safety by keeping residents from harm's way. Regulation also reduces property damage caused by catastrophic events. However, the degree of catastrophic potential varies for each of the three major geologic hazard categories.

Erosion hazards have a low catastrophic potential and can also be readily influenced by human activity. Landslides hazards have a medium catastrophic potential event yet can be somewhat influenced by human activity. Landslides cause on average 25 deaths per year, based on a 150 year period of study, plus $2 billion per year in property damage, with largest single event causing $400 million in damage (Thistle, Utah). Seismic hazards have a high catastrophic potential event and an occurrence of the hazard that can be influenced by human activity yet the category causes on average 50 plus deaths per year. (White and Haas, 1975, Table 5.1 on page 73 *in* Keller, 1992). Based on City of Mercer Island public works maintenance records from the past 20 years, no one has been killed on Mercer Island due to any recorded landslide or seismic events. However, there have been fatalities from a waterfront bluff landslide on Bainbridge Island within the past 10 years.

The extent of property damage from two of the three worst types of major geologic hazard categories can be potentially quite high. Seismic events and landslides (including landslides caused by seismic events) are the two categories most likely to cause the highest amount of public and private property damage on Mercer Island (Eidinger, 2004; Mercer Island Hazard Mitigation Plan, 2004).

There is a moderate probability of high impact events due to landslides, primarily due to the high value of existing structures and improvements located in affected hazard areas. There are also records for significant public and private property damage on Mercer Island from the February 28, 2001 Nisqually earthquake (Table II-5, page II-10 in Mercer Island Hazard Mitigation Plan Draft Report, 2004). In 1997-98, King County experienced $9 million in losses from three severe winter weather events due to landslides tracked by FEMA (King County draft report, Natural Hazard Mitigation Plan, Table 5-7).

After the February 2001 event on Mercer Island, there were 163 claims under two FEMA programs totaling $166,381 in distributed reimbursements, plus four other utility (culvert, water main and power supply at water pumps) and street damage areas in excess of $100,000 in repairs from damage.

A single future landslide event could range from $500,000 to $1 million in potential property damage costs on Mercer Island if a landslide event were to completely destroy only one typical shoreline or hillside view home and it's contents. The average single family home value on Mercer Island is $813,000 in 2003 (Hebert Research, 2003 Eastside Economic Forum Report, page 19) while shoreline and hillside view homes would be above average.

Landslide potential from seismic vulnerability of the potable water supply system for Mercer Island was studied extensively (Eidinger, 2004). The report findings reflect that the municipal water system could sustain high impact damage from modeled medium and large earthquakes (Table 4-2, Eidinger, 2004). The water supply system with some additional specified

improvements could be restored under most scenarios within a few days to a few weeks, following interruption from major seismic events including anticipated related damage from landslides. Portions the overall Mercer Island water supply system already exist within seismic hazard areas (liquefaction) and landslide hazard areas on Mercer Island. Any restoration work to damaged portions of the water system (or other utilities) that are located within critical areas would be subject to the critical area code.

State law under GMA requires the enactment of local ordinances that govern the development of unstable coastal bluff areas. RCW 36.70A.170 requires that each city shall designate critical areas. These include geologically hazardous areas with susceptibility to erosion, sliding, earthquake, or other geological events. Such areas are not suited to the siting of commercial, residential, or industrial development consistent with public health or safety concerns (RCW 36.70A.030). Mercer Island has elected to inventory the existing critical areas, determine suitable uses and regulations for geologic hazards, to comply with state law.

Landslide Hazard Buffer Sizes – Scientific Basis

Risk reduction through the establishment of appropriate setbacks distances from landslide prone areas can be problematic (Canning, 1991 from WDOE Pub. 94-81 page 5-7). However, setting construction setbacks is conceptually straightforward. First, one decides the functional life of the structure proposed (Generally 25 years is used, based on residential construction types and mortgage time spans for typical single family residences that vary from 15 to 30 year period). Next, an estimate of slope retreat or landslide failure rate and the distance from structure is made over the 25 year time period. Finally, the setback distance is set as the safe position located behind the projected position of the retreating slope crest or advancing slope toe caused by landslide (Shipman, 1993 from WDOE Pub. 94-81 page 5-7).

The long term slope failure (from sliding, erosion) for lost soil rates from existing slopes range from 2 to 8 inches per year for shoreline areas of the Puget Sound area (Keuler, 1979 from WDOE Pub. 94-81 page 5-8). The long term soil loss rate from slopes equates to a range 2 to 8 feet per decade, or 5 to 20 feet over the span of 25 years. An assumption of faster rates of soil loss, or a safety factor contingency or a longer lifespan of a structure (most streets and utility improvements have expected lifespans longer than 25 years) will create typical proposed setbacks wider than 20 feet for a landslide prone area.

As a result of applying the above described scientific process, 50-foot buffers are commonly required and also recommended for landslide areas in the many Puget Sound area communities. It is common to find nearby examples of municipal regulations of critical (or steep) slopes over 40% slope gradient, with various provisions to reduce the buffer widths to 10-feet, 15-feet or 25-feet or increased buffer widths under a recommendation by geotechnical professional (See King County; City of Sammamish, City of Edmonds geologic hazards and critical area codes). For example, King County maintains a 15-foot building setback from all slope buffers. Where there have been designated erosion hazard area near a ravine (For example, SO-190 overlay area for specified soil groups and slopes) the required 50-foot standard buffer can be reduced, yet the building setback also applies.

Landslides Caused By Storms

Several different mechanisms contribute to the instability of coastal bluffs in the Puget Sound region, including Mercer Island. The resulting landslides can range in size from small, shallow soil slips to large, deep-seated rotational slump-earth flows. Most of those resulting from the February 1996 and holiday

1996/97 storms were some variation of the basic types. (Gerstel, Burning, Langley, Logan, Shipman, and Walsh article in *Washington Geology*, vol. 25, no. 1, March 1997)

The typical undisturbed stratigraphy in the central Puget Sound area consists (from the top down) of a thin soil layer overlying relatively impermeable till (hard pan), permeable sands, and/or nearly impermeable clays and silts. However, in many areas, the stratigraphy can be less uniform.

On Mercer Island, glacial till of Vashon age (approximately 13,000 years old), approaching thicknesses of up to 30 ft, forms a relatively strong and resistant cap that covers much of the highlands and protects softer underlying layers from erosion. Although till is in many places impermeable to ground water, fractures and gullying in the till surface allow percolation into the lower sedimentary layers. Till commonly overlies advance outwash deposits locally known as the Unnamed or Older Sand.

The Unnamed or Older Sand was deposited by streams issuing from the ice sheet while it was located some distance to the north. It is highly permeable (well-drained) and poorly consolidated. In typical Unnamed or Older Sand deposits, the upper part may be dry, even in winter, whereas ground water flows rapidly through its basal zone, where the water is perched on underlying clays and silts. Water saturation builds pore pressure, which in turn reduces soil strength and allows the sand to mobilize and slide along the surface of the clay. In some places, the sand is so poorly consolidated that it collapses on itself and flows like a fluid. Permeability within the Unnamed or Older Sand varies laterally and vertically, and ground water piping can occur along weak zones. Gullies form where piping intersects the surface.

The compact clays and silts underlying the Unnamed or Older Sand were deposited in a proglacial lake that existed before the ice advance into the Puget Sound area. The name "Lawton Clay" is applied to this thinly and parallel-bedded clay and silt unit. The Lawton Clay perches ground water, forming the slippery surface on which the Unnamed or Older Sand can slide. The clay unit, generally more competent, remains in place, with only minimal seasonal retreat. With each passing winter, the sand portion of the bluff retreats at a faster rate than the clay and the resulting landform is the characteristic stepped or benched bluff. Deep-seated failures can occur where a failure surface extends into the clay unit. (For relations between ground water and landslides, see Tubbs, 1974; Dunne and Leopold, 1978; Freeze and Cherry, 1979; Thorsen, 1987; and Evans, 1994.)

Any of these Pleistocene units may overlie knobs and fault blocks of impermeable Tertiary bedrock. The upper surfaces of these bedrock protrusions may also perch water and act as glide planes for landslides.

The characteristic stratigraphy in the Mercer Island area that is responsible for landsliding includes the condition described in the preceding paragraph. The soil units are not necessarily laterally continuous over long distances, and soil units can be more complex, with several water-perching layers. However, the general geologic and hydrologic principles are similar. The Esperance Sand and Lawton Clay are unit names in the Seattle area, but similar sequences are present elsewhere in the Puget Lowland, including Mercer Island. (Adapted from Tubbs, 1974.)

The GMA state law when implemented under the recommended guidelines in WAC 365-190-080 clearly states that "avoidance" is the best approach in areas of unstable slopes, after

reduction, mitigation or technology has been applied. The guidelines in WAC 365-190-080 state: *"Some geological hazards can be reduced or mitigated by engineering, design, or modified construction or mining practices so that risks to health and safety are acceptable. When technology cannot reduce risks to acceptable levels, building in geologically hazardous areas is best avoided."* However, on Mercer Island development has already encroached on potentially unstable slopes. There are some actions that can reduce the rate of future slope failures and improve the stability of the slope with respect to shallow failures and surface erosion. Deep-seated failures are more difficult to control, but it is clearly beneficial to reduce infiltration and surface runoff from roofs and driveways and to fix clogged or leaking storm drains. (Gerstel, Brunengo, Lingley, Logan, Shipman, and Walsh, 1997)

The following list provides landslide identification criteria and prevention and mitigation techniques applicable to Mercer Island, beginning with identification of hazards, followed by safeguard measures that are typically recommended by professionals, based on an evaluation.

Identification of Landslide Hazard Areas

These are some physical characteristics that may be indicative of a landslide hazard area:

- Active bluff retreat--Continuing sloughing or calving of bluff sediments, resulting in a vertical or steep bluff face with little to no vegetation.
- Pre-existing landslide--Landslide debris within an arcuate head scarp.
- Tension cracks--Ground fractures along and/or near the edge of the top of a bluff or ravine.
- Structural damage--Settling and cracking of building foundations near edge of a bluff or ravine; also separation of steps or porch from the main structure.
- Toppling, bowed, or jackstrawed trees--Disruption of the ground surface by active movement causes trees to lean and/or fall in different directions or to grow in a curve instead of straight.
- Gullying and surface erosion--Dissection of the bluff edge by natural drainage or discharge from pipes, culverts, and ditches.
- Springs--Mid-slope ground-water seepage from the bluff face; particularly noteworthy are increases in flow.

Safeguarding Against Landslide Hazards

The following are some recommended measures from the best available science that can be taken to mitigate or avoid landslide hazards:

- Use setbacks--Expect natural slope processes to continue, and provide adequate construction setback for structures in landslide hazard areas.
- Reduce surface erosion--Keep drains and culverts clear. Avoid discharge onto the slope-direct surface water/ runoff (especially from impermeable surfaces) to the base of the slope in nonperforated pipe. This is called tightlining.
- Reduce ponding and infiltration--Limit opportunities for water to pond on the surface by draining or regrading.
- Maintain and improve vegetation--Trees and shrubs provide root strength to hold the soil in place and help dewater the slope. If they are removed, root strength will be gone within 2 to 12 years and will not be easily restored.
- Protect bluff from surface erosion--Apply erosion mats, plastic sheeting, or other erosion-control material where vegetation will not take hold.

The Mercer Island slopes have experienced landslides for many years. Slope retreat is a normal process. Some of the small-scale, but still potentially destructive, retreat occurs as continuous raveling and sloughing. The larger landslides tend to be more episodic. When heavy winter precipitation is added to slope sediments, unstable parts of the slope tend to fail. (Thorsen, 1987) The frequency over time and space of these failures increases during and after particularly heavy precipitation. In some places, human activities (such as poor construction practices) have exacerbated the rate of slope retreat by landsliding. (Gerstel, Brunengo, Lingley, Logan, Shipman, and Walsh, 1997).

C. Existing Regulations

Erosion Hazard Areas – Classification and Regulation

The largest change needed in this section of the current code is a better and more concise definition the term erosion hazard.

The current code under MICC 19.07.020 identifies erosion hazard areas, yet does not define the term under the designation The current code allows City of Mercer Island the option to require a geotechnical report, yet does not provide scientifically based rationale on when to request a report. There are published guidelines for geotechnical report requirements, yet not all report requirements are included in the current code text. Recent erosion and sedimentation events on Mercer Island have occurred at sites that are subject to the current code and state regulations, yet there instances where permit applicants are not in compliance, for one or more reasons. However, most permit applicants are typically voluntarily exceeding the current code in provision of measures that prevent erosion in concert with building code and storm water code provisions through best management practices within erosion hazard areas, despite identified shortcomings of the current code for a clear definition and application of the term erosion hazard. Mercer Island has a wet season moratorium on development located within erosion hazard areas. To work during the wet season, an applicant must assess the adequacy of the proponent's ability to control all factors most likely to induce erosion.

The current code requires applicants to generally seek geotechnical advice from a professional geologist and/or geotechnical engineer, for proposals within erosion hazard areas. The requirement for a geotechnical report can be waived by city engineer for sites up to 20% slope under current code under MICC 19.07.010 A.2.c.i. that pertains to subdivisions under MICC 19.08.020 D.10. However, the current code does not clearly provide the decision criteria that the city engineer must apply for sites with gradients greater than 15% slope yet less than 20% slope in order to waive the geotechnical study. Quantitative analysis developed by Tubbs in 1974 & 1975 (shown in Fig. 4-3 and Fig. 4-21 in WDOE Pub. 94-81) based on study of landslides in the Seattle area may provide the quantitative factors for city engineer to use to administratively require or waive a geotechnical report for a given site.

Seismic Hazard Areas – Classification and Regulation

No major changes to the current code are planned for the seismic hazard areas, except refinement to the definition.

The current code under MICC 19.07.020 identifies seismic areas as geologically hazardous areas yet does not define the term "seismic". Of the recent seismic events on Mercer Island, very few have caused damage and there has been no loss of life under the current code and state regulations. There have been very few events to test the current regulations. The current code may be providing a certain level of safeguard against seismic hazards within the limits that seismic events have been modeled and addressed by the adopted building code, for projects that meet the code. However, many older existing structures that do not meet the current code would likely be damaged. Mercer Island has limitations on development in seismic areas based on site specific assessment and the ability of the proponent to control the factors associated with seismic damage at a given site.

The current code requires applicants to seek geotechnical advice from a professional geologist and/or geotechnical engineer, for proposals within seismic areas. The current requirements include a statement of risk, design requirements to meet site specific risk, and any site specific construction requirements.

Landslide Hazard Areas – Classification and Regulation

Significant changes to the current code are needed for the landslide hazard areas, including refinement to the definition.

The only subcategory of geologic hazards category that is relevant for setbacks (or buffers) are landslide hazards and steep slopes, referenced in Mercer Island code as "critical slopes". The potential landslide hazard area category is the only category with substantial changes proposed for 2004 code update. The proposed changes include adding a definition of the term "landslide hazard", as well as the addition of subcategories for designation including steep slopes prone to eventual failure (40% slope with 20 feet vertical rise).

Few recorded landslides have occurred at a site developed solely under the current ordinance, perhaps due to favorable weather conditions or the lack of large seismic events. Many landslide events happened during the 1970's prior to the current state and local regulations. There has been no formal scientifically controlled study or records that prove that the current code is providing a demonstrated safeguard against landslide hazards. Buffers really are not proven to be essential in the control of landslides, yet clearly for certain sites buffers can and do prevent landslides or reduce harm from landslides. Mercer Island currently has a wet season moratorium preventing site development within landslide hazard areas (as well as erosion hazard areas) to assess the adequacy of the proponent to control the factors most likely to induce landslides.

The existing regulations apply a 10-foot buffer to critical slopes in the current code, measured from the top or toe of slope, for new subdivisions only, yet the buffer requirement does not apply to existing lots. It is standard practice for several cities located within King County to measure buffers (or setbacks) horizontally from the top and toe of the slope, because these agencies have determined that avoidance is a policy implemented by setbacks from top and toe of steep slopes. The basis for the dimensions is the fact that steep slopes eventually fail and the setback addresses the failure rates of slopes through a setback to protect the structures above or below the slope. A few cities also require setbacks (or buffers) from side edges of slopes as well as top and toe of slopes. Also, a review of the best available scientific literature suggests that a 10-foot buffer from top and toe of slope will not adequately protect from potential damage to property or life for most steep slopes on Mercer Island (Harp, 1997; Kockleman, 1986; Miller, 1991; Slossen, 1995; Tubbs, 1974 & Turner, 1996).

Use of an analysis zone for a closer inspection of a potential landslide area by a qualified professional is supported by the science. The driving force of the slide mass, the likelihood of slope failure, as well as resultant slide debris mass, increases as the slope angle increases (Pestrong, 1974; Terzaghi, 1950 *cited in* Keller, 1992). When an analysis zone is identified, this requires more detailed information to be assembled, before a City determination is made to require a buffer or not. Given a tall sized (For example, 100 feet vertical) and a steep slope (For example, 70% slope), with a standard buffer requirement for a 10 feet width at the toe of slope, it's unlikely that a 10 feet buffer would prevent the steep slope from failing, nor would it remove the homeowner from harm or injury, if there were a sudden mass wasting event, if the home structure is located 10 feet from the toe of slope. If a larger buffer (For example, 25 feet) is required, then the qualified professional's analysis of the site specific conditions would enable a proper calculation to be made for harm avoidance, or an alternative recommendation to place the mass of the structure foundation deeply into the slope face to actually stabilize the slope face.

Analysis of Existing Regulations

1. Approach

The following analysis in this section of the report identifies gaps and weaknesses in the City's existing regulations as revealed by comparison with CTED's guidelines and Best Available Science requirements.

The Planning Commission reviewed and commented on proposed changes to the current critical areas ordinance between January 2004 to October 2004. During early 2004, the City of Mercer Island City Council also formed a stakeholders group as a review process that included review at seven meetings. The stakeholders' group process included presentations and discussion on the four state critical area topics applicable to Mercer Island, including geologic hazards.

2. Review Process

Discussion from Critical Areas Stakeholders (CAS) group meetings held on July 13 and July 27, 2004 addressed scientific basis for potential changes to geologic hazards code text. The group included elected, appointed officials, professionals, community leaders and building industry representatives. The process was facilitated by staff and consultants. Here are some highlights of the major policy issues defined during the stakeholders group forum that face the City of Mercer Island in the 2004 critical areas update:

- *Are current landslide hazard designations adequate for continued protection of property and life?* The CAS group heard from staff that there is currently no adopted definition of potential landslide hazard areas, based on science, in the adopted code. Clearly, there is a need to establish a clear definition as well as regulations for categories of landslide types supported by science. The proposed code compares favorably to the CTED model code text for landslide area designation and regulation, based on best available science.

- *Should a change be made to revise steep slopes designation to 40% slope with 20 feet vertical, rather than the current threshold at 30% slope over 40 feet horizontal (same as 12 feet vertical) in competent soil types?* Generally, the available science for landslides show that 40% slopes start to experience gullies from storm water runoff after vegetation removal (Keller, 1992). The science supports the designation of critical area slopes at the 40% slope threshold, since Mercer Island steep slopes become the most vulnerable to potential slides when uncovered. While landslide frequency can be quantifiably predicted, as well as damage cost probability under one of several models, records of past landslide events are the basis (Coe, 2000). Since the records are limited, the any usefulness of modeling will be limited and none was performed. The generally accepted natural angle of repose is 2:1 slope ratio for most of the existing soil found on Mercer Island (Eidinger, 2004; WLA, 2004; M. Lorilla, 2004). Most existing soil is fairly stiff glacial till soils, designated as "Type C" under building code classification system. By comparison, a 40% slope is equal to 2.5:1 slope ratio, a slope ratio slightly less than the angle of repose slope of 2:1 ratio. The natural angle of repose is the maximum slope found to maintain vertical height, under controlled and specified conditions, rather than actual site conditions with moisture, lack of homogeneity, etc. In the field, slope failures can occur at 30% slopes for local soils, yet the 30% slope would be too restrictive a threshold for Mercer Island given the degree of development that already exists on 30% slope sites.

Here is a major topic discussed by the stakeholders group and Planning Commission during the period June through September, 2004, including public hearing comments:

- *Should new subdivisions with existing designated steep slopes (over 40% slopes) be eligible as buildable lots?* Generally, the code should prevent creation of new lots in these problematic areas. There should be provisions that an applicant may provide proof of no risk or harm for construction of a new home, in order to establish a buildable pad for a proposed new lot. The best available science supports using 40% slope as the gradient to require greater geotechnical review

to avoid potential impacts. The potential impacts to be avoided are gullies from normal rainfall patterns on slopes without vegetation and root structure for stability. A case by case approach for regulation will enable a professional to evaluate the risk or harm, in the event that a particular site would not meet the general rule of no new building pads on proposed lots on 40% slope areas, yet have attributes which make the site stable.

3. Definitions

The current code includes definitions that will need to be updated to include additional definitions and revised existing definitions. Some current definitions need to be removed entirely.

4. Reports and Surveys

Currently MICC 19.07.060 (Reports and Surveys) contains most of the necessary elements. However, this code section lacks the appropriate level of detail to provide clear direction to the public and to the City staff that review development application submittals. There is also uncertainty under the current code as to which designated areas (landslide, seismic and erosion areas) require reports. Currently there is an allowed exemption from providing a geotechnical report is enabled for sites with slopes up to 20% slope gradient within erosion hazard areas (MICC 19.07.010 2.c.), yet the discretionary criteria for granting the exemption is not clear. There is no recommendation is to change the 20% slope exemption limit for waiving required studies. Granting the exemption should be made based on several factors – presence of competent soils, retention of existing slope vegetation, tighter temporary erosion and sediment controls proposed during construction and greater use of BMP's.

5. Subdivision Application Requirements

Currently the Subdivision Application section (MICC 19.08.020 D.7.) requires that applicants show existing 30% slopes as critical slopes on topographic maps for lot line adjustments, plats and short plats. This section is proposed to change to require that 40% slopes (instead of 30% slopes) be shown highlighted on the application materials. Limitations for building pads during the subdivision process may be established if there are geologic conditions present that are conducive to slope instability. (MICC 19.08.030 C.1.)

Use of an analysis zone for existing lots, rather than a standard buffer requirement from top and toe of steep slopes could be part of subdivision related proposed code. Based on a site inspection, a potential landslide area would need a report, risk statement and design factors, prepared by a qualified professional to replace the standard buffer approach. When an analysis zone is designated at a given site, this requirement provides city staff with much more detailed information assembled by applicant's professional, before any City determination is made to require a buffer. Site specific buffers may be required, if the qualified professional's analysis of the site specific conditions within the analysis zone supports the conclusion for a buffer need. The analysis zone approach requires investigation for harm potential, minimization of impacts, avoidance of impacts, or some mitigation under an alternative technological approach, rather than a buffer.

D. Proposed Regulations

Recommended Changes to the Current Regulations

The draft proposed code with suggested changes is provided under Appendix C.

Here is an overview of proposed code revisions in 2004 based on the public participation process and scientific analysis from the code update:

A. Intent and Purpose: This section would be more appropriately placed in the beginning of the Chapter, and expanded to encompass all of the listed critical areas.

B. Critical Areas Delineations: One modification that may be necessary to this section is to better define "top of slope" and "toe of slope".

C. Site Development: The content of this section needs new regulations for landslide and seismic hazards and a clarification that erosion hazards require temporary sediment and erosion control.

D. Site Coverage: The site coverage limits within landslide areas is a current feature of the current code that is proposed to be eliminated, seismic hazards have no site coverage limitations in the code since all recommendations are based on professional expert reports in current or proposed code and erosion hazards areas will no longer have site coverage limitations in the proposed code.

E. Stormwater and Erosion Control: The content of this section is adequate and proposed 2004 updates will provide references to the Washington Department of Ecology Stormwater manual currently in use.

F. Alterations: This section requires some revisions. The variance criteria will no longer be used, and the restoration plan requirements, monitoring requirements, and mitigation standards discussions need to be better developed.

Here are the generally described proposed changes to the current code.

1. Reasonable Use Exception – The code revision proposal would create a new process to address situations where strict application of the standards would deny all reasonable use of private property as the reasonable use exception.

2. Public Agency and Utility Exception – The code revision proposal would create a new process similar to reasonable use exception process to address proposals for utilities or public agency municipal uses where strict application of the standards would deny all public purpose use of public property as the public agency and utility exception.

3. Allowed Uses – The current code does not clearly indicate what uses are currently allowed as permitted uses within designated areas. For example, existing Streets, Roads, Driveways and Bridges developed within rights of way within designated areas may need to be further modified. Also, utility features may need to be listed as allowed as permitted uses within landslide, erosion and seismic hazard areas, respectively.

4. Performance Standards - Mitigation Sequencing. Applicants shall demonstrate that all reasonable efforts have been examined with the intent to avoid and minimize impacts to critical areas and

buffers. When an alteration to a critical area and/or buffer is proposed, such alteration shall be avoided, minimized, or compensated for in the following order of preference:

1. Avoiding the impact altogether by not taking a certain action or parts of an action;
2. Minimizing impacts by limiting the degree or magnitude of the action by using appropriate technology, or by taking affirmative steps to avoid or reduce the impact;
3. Rectifying the impact by repairing, rehabilitating, or restoring the affected critical area(s) and/or buffer(s);
4. Minimizing or eliminating the impact or hazard by restoring or stabilizing the hazard or impact area through engineered or other methods;
5. Reducing or eliminating the impact or hazard over time through preservation and/or maintenance operations during the life of the action;
6. For non-hazard critical areas, compensating for the impact by replacing, enhancing, or providing substitute critical areas and/or buffers; and
7. Monitoring the impact and/or hazard and making appropriate corrective measures when necessary.

5. Performance Standards - Mitigation Plan Requirements. When mitigation is required, the applicant shall submit, for approval by the City of Mercer Island, a mitigation plan as part of, or in addition to, the critical area report.

A professional must review all mitigation plans that include landslide, seismic or critical slope work.

In addition to those items listed under Mitigation Requirements (MICC 19.07.010(K)), mitigation plans should include alterations that maintain or improve the stability of a site, including hydrologic conditions; create an equivalent or improved slope condition; and restore or improve native vegetation.

Use of a standard analysis zone of the lesser of 50 feet or the height of the slope for existing lots, rather than a standard buffer requirement from top and toe of steep slopes is recommended to be part of the proposed code. Based on a site inspection, a potential landslide area would need a report, risk statement and design factors, prepared by a qualified professional to replace the standard buffer requirement. When an analysis zone is designated at a given site, this requirement will provide city staff with detailed information assembled by applicant's professional, before any City determination is made to require a buffer. Site specific buffers may ultimately be required, if the qualified professional's analysis of the site specific conditions within the analysis zone supports the conclusion for a buffer need. The analysis zone approach requires investigation for harm potential, a determination of how to minimize impacts, or avoid impacts, or provide mitigation under an alternative technological approach, rather than to provide a buffer.

6. Definitions (proposed section MICC 19.16)

The following definitions should be modified in or added to MICC 19.16. All of the suggested items are not necessarily required by the GMA and the implementation guidelines under WAC 365-190-080, although the suggestions do provide more clarity in the revised regulations for readers and users of the code.

- Add "Qualified professional: For purposes of proposed section MICC 19.07, a qualified professional must have obtained a B.S. or B.A. or equivalent degree in geologic hazards studies, and the qualified professional must hold a current state license in geology, hydrogeology or as a professional engineer with geotechnical and/or seismic expertise.
- Add "Buffer or Buffer Zone": "An area contiguous to a critical area that is required for the continued protection, maintenance, functioning and/or structural stability of a critical area."
- Modify "Critical Areas": add designated protection tracts, delete "publically and privately owned passive open space".
- Modify "Critical Slope": add 40 percent with 20-feet vertical, delete 30 percent measured over any horizontal 40-foot area.
- Make minor changes to the terms "Geologic Hazard Areas" and "Hazard Analysis Area"
- Add "Top and toe of Slope": The points at which a critical slope decreases to less than 40% slope. The upper edge is the top of slope and the bottom is the toe.
- Clarify that "Utilities" for the purpose of being exempt from critical areas requirements does not include wireless communication facilities separately regulated by other code.
- Add definitions for key terms "Landslide Hazard Area", "Seismic Hazard Area" and "Erosion Hazard Area" that are more closely follow state guidelines contained in WAC 365-190-080 provisions for geologically hazardous area regulation.

The recommendation is to regulate steep slopes as a subcategory of landslide hazard area. The rationale for including steep slopes over 40% slope as a subcategory of landslide hazard areas is that the existing soils on Mercer Island form gullies over 40% slope, when vegetative cover is removed or compromised. More importantly, all of the existing soils erode at a varied rate based on certain soil combinations, yet 40%+ slopes become unstable under normal rainfall patterns as well as during seismic events, either at slow rates of failure from repetitive applications of water to toe and top of slope or as mass wasting events.

E. Bibliography

Literature Review for Geologic Hazards

In addition to scientific research citations provided above in the body of this report, City of Mercer Island also relies on a substantial body of science assembled by King County in 2004 that has been found to be applicable to City of Mercer Island site conditions.

The City of Mercer Island plans to adopt excerpts from Geologic Hazard Areas, from Chapter 5, Best Available Science: Volume 1 - A Review of Science Literature, Report Feb., 2004. The document was prepared by King County for findings and scientific references. The applicable portions of Chapter 5 are:

Pages 5-1 through 5-7 through second paragraph on differential compaction topic and pages 5-8 beginning with paragraph on seismic hazards though page 5-14 on landslide hazards. These two text sections presents a general overview of the full range of geologic hazards found on Mercer Island.

Starting at the bottom of Page 5-22 in Section 5.2.6. with overall conclusions and continuing to page 5-23 thru 5-25, the document presents the list of scientific references that apply to Mercer Island.

On page 5-9, for the erosions hazards topic, the recommendation to upgrade the erosion hazard evaluation mentioned by Houghton and Charman, 1986 does not create any additional evaluation that might increase the level of erosion protection currently provided to sites on Mercer Island.

On page 5-5 & 5-6, the landslide hazard assessment section is adopted by Mercer Island, except for the discussion of water ponds in seismic events is not particularly relevant to Mercer Island.

The references shown on pages 5-22 thru 5-25 are intended to supplement the landslide hazards and erosion hazard references provided below in this report. The seismic references provided below in this document are more current than those citations presented in the 2004 King County document.

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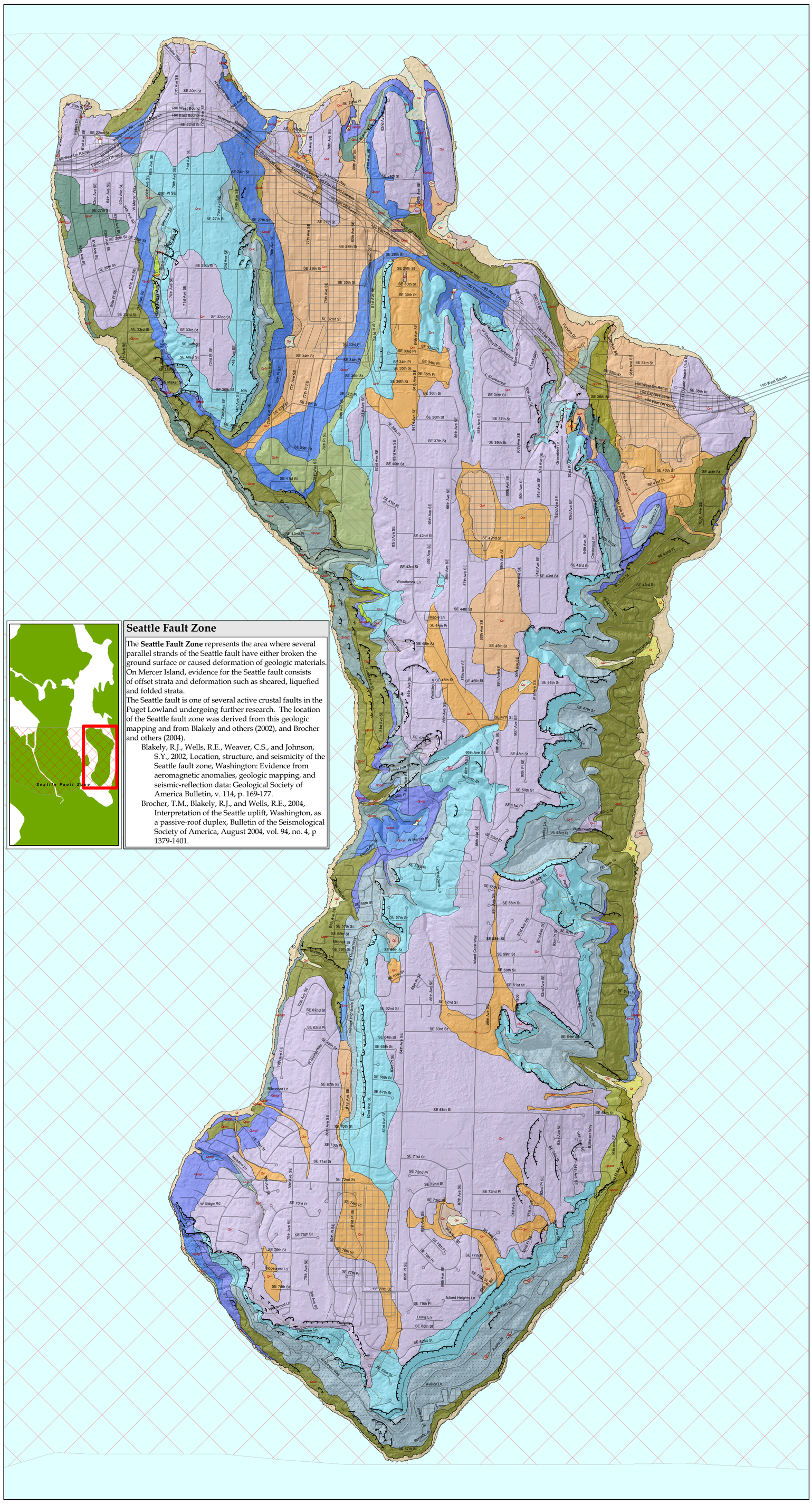
Attachment C - Existing Geologic Mapping (Troost and Wisher, 2006 & 2009)



Age & Geologic Unit	Name	Summary Description	Thickness	Density/ Hardness	Permeability Factors
Holocene	NONGLACIAL DEPOSITS				
m	Modified land	Fill and/or graded natural deposits that obscure or alter the original deposit. Locally divided into:			
af	Artificial fill	Gravel, sand, silt, concrete, garbage, wood, and other materials, placed as a direct result of human activity, of substantial areal extent or thickness. Some rockery stones and boulders present. Mapped where boring data provide suff icient information to delineate extent or where topography and overlying development suggests likelihood of fill, and generally where greater than ~ 2 m in thickness. Thin deposits of fill are commonly present elsewhere throughout the map area but not mapped due to lack of information or control. Fill beneath most roadways not mapped. Locally divided into:	Mapped where >2 m; but 1m of fill common across most of the City; 2 m to > 9 m beneath roadways, in gullies, ravines, on peat and former lake beds, in other low-lying places, at upland edges, and on slopes.	Very soft to stiff or very loose to dense; variable degree of compaction during placement	Voids common; variable and unpredictable grain size; angular and large particles common; variable degree of compaction
gr	Graded land	Land substantially altered by excavation or grading, may include substantial thicknesses of fill too subtle to map or where boring data are insufficient to delineate extent. Gradational with unit "af"	Large areas for I-90 (other roadways not mapped)	Very soft to hard or very loose to very dense; variable degree of compaction	Depends on thickness of material removed, grain size, and degree of compaction of fill or native deposits
Qmw	Mass-wastage deposits	Colluvium, soil, landslide debris, and organic matter with indistinct morphology. Common below springs where peaty deposits are also present. Mapped on steep slopes, notably around the south end of the island, along the east -central side of the island, and around First Hill . Numerous unmapped areas of mass-wastage deposits occur elsewhere on the island along ravines and streams. Deposits, both mapped and unmapped, include abundant discrete landslides up to 150 m (500 ft) in lateral extent. Locally subdivided into:	Typically about 3 m, locally >10 m; along steep slopes	Loose to dense and soft to stiff; variable degree of consolidation depends on material in colluvium and its coherency	Intermixed fine and coarse-grained deposits, variable degree of consolidation
Qls	Landslide deposits	Diamict of broken to internally coherent surficial deposits transported down slope *en masse* by gravity. Blocks of native material are commonly fractured, have rotated or deformed bedding, and have abundant slickensided surfaces. Numerous unmapped areas of both landslide and related mass-wastage deposits occur along slop es and ravines draining west, south, and east to Lake Washington, particularly where coarse-grained deposits overlie fine-grained deposits and springs exit the slopes. Vegetation, such as trees and roots, is commonly incorporated into the deposit . Landslide terrain often includes benches that slope back into the hillside and host wetlands and peat deposits.	Variable, commonly 2 to 18 m; along steep slopes	Very loose to very dense or soft to hard; variable degree of consolidation depends on material coherency	Intermixed fine and coarse-grained deposits, voids common; variable degree of consolidation, slide planes and other shear zones offer preferred pathways
Qp	Peat	Predominantly organic matter consisting of plant material and woody debris , accumulated in bodies greater than about 1 m in thickness and of mappable extent. Accumulations are greatest in the floors of recessional-outwash channels, at the heads of some streams, and where lowering of Lake Washington has exposed extensive lake -floor deposits. From former wetlands, bogs, and lakes. Commonly interbedded with silt an d clay. Gradational with units Ql, Qal, and Qvrl	>1 to 4 m	Very soft to medium stiff or very loose to medium dense	Commonly saturated
Qw	Wetland deposits	Organic-rich silt, sandy silt, peat, and fine-grained alluvium, poorly drained and intermittently wet. Areas identified from Mercer Island GIS Wetlands layer which was based on; not all such deposits have been delineated	1 to 5 m; typically 2 to 3 m	Very soft to medium stiff or very loose to medium dense	Commonly saturated
Qal	Alluvium	Sand, silt, gravel, and cobbles deposited by streams and running water. May include landslide debris and colluvium at margins. Locally contains soft peat lenses. Locally subdivided into:	One m to 7 m; in river and stream valleys	Loose to dense or soft to stiff	Predominantly sandy and horizontally bedded, fine- and coarse-grained lenses
Ql	Lake deposits	Silt and clay with local sand layers, peat, and other organic sediments, deposited adjacent to Lake Washington. Most mapped areas are lake -bottom sediments exposed when Lake Washington was lowered in 1916. At many locations, the lake deposits are thin and overlie a d ense substrate. Commonly capped by fill to improve building sites. Locally gradational with units Qvrl, Qal, and Qp	One to 10 m adjacent to Lake WA	Very soft to medium stiff or very loose to medium dense	Predominantly fine grained and horizontally bedded
Qf	Fan deposits	Sand, silt, gravel, and cobbles deposited in lobate form where streams emerge from confining valleys and reduced gradients cause sediment loads to be deposited. Present at base of streams on east side of island. Gradational with units Qal and Ql	3 to 5 m	Loose to dense or soft to stiff	Variable grain size
Pleistocene	YOUNGER GLACIAL DEPOSITS				
Qv	Deposits of Vashon stade of Fraser glaciation of Armstrong and others (1965) , not used as a map unit				
Qvr	Recessional outwash deposits	Stratified sand and gravel, moderately sorted to well sorted, and less common silty sand and silt. Deposited in outwash channels that carried south -draining glacial meltwater during ice retreat away from the ice margin. Also i ncludes deposits that accumulated in or adjacent to recessional lakes. Discontinuous. May include thin lag on glacial till uplands although d eposits less than about 1 m (3 ft) thick not shown on map. Locally divided into:	~1 to 5 m; typically in channels	Loose to dense	Horizontally bedded to cross bedded, uniformly to well graded, channelized, coarse lag deposits common
Qvrl	Recessional lacustrine deposits	Laminated silt and clay, low to high plasticity, with local sand layers, peat, and other organic sediments, deposited in slow-flowing water and ephemeral lakes. Locally includes high -plasticity clay with swell potential. Lenses and layers of ash and diatomite may be present. Gradational with units Qvr, Qvrlc, Qp, and Ql	One to 4 m on uplands; as much as 10 m in city center area	Very soft to stiff	Horizontally bedded; sandy channels may breach the lacustrine deposits
Qvrlc	Recessional lacustrine sandy deposits	Predominantly sand, clean to silty, horizontally to cross bedded, deposited in recessional lakes	1 to 8 m	Loose to dense	Interspersed silt and gravel layers
Qvi	Ice-contact deposits	Intercalated till and outwash, irregularly shaped bodies of till and outwash. Outwash consists of sand and gravel, clean to silty, horizontally bedded to steeply dipping. The till consists of matrix supported gravelly sandy silt that may or may not have been glacially overridden. Deposits present at the highest area on the island (SE 44 th St and 89th Ave SE) and at the southeast corner of the island. Gradational with units Qvr and Qvt	1 to 30 m; in patches on the upland	Loose to very dense; variable	Intermixed irregularly-shaped bodies of till and coarse-grained deposits, may have steep dips
Qvt	Vashon till	Compact diamict of silt, sand and subrounded to well-rounded gravel, glacially transported and deposited under ice. Contains large, often tabular, sand and gravel bodies, cobbles common. Coarse-grained layers may exceed 50% of the volume of the deposit. Commonly fractured and has i ntercalated sand lenses. Generally forms undulating, elongated surfaces. Often capped by +/- 1 meter of medum dense clean to silty, gravelly sand. Upper 1 meter of till generally weathered and only medium dense to dense. Locally gradational with unit Qva	Typically 3 to 10 m, locally 17m , locally absent	Dense to very dense; sand is commonly less dense	Vertical fractures, sand lenses, sand bodies, irregular bedding, crude sub-horizontal bedding common; commonly capped by +/- 1m of gravelly sand
Qva	Advance Outwash Deposits	Well-sorted sand and gravel deposited by streams issuing from advancing ice sheet. May grade upward into till. Silt lenses locally present in upper part and are common in lower part. Generally unoxidized to only slightly oxidized. May be overlain by Vashon till in area s too small to show at map scale. Includes Esperance Sand Member of the Vashon Drift of Mullineaux and others (1965). Grades downward into unit Qvlc with increasing silt content	Locally over 60 m thick; wide-spread, locally absent	Dense to very dense	Predominantly medium grained sand, horizontally to cross bedded, hard silt beds common throughout
Qvlc	Lawton Clay of Mullineaux and others (1965)	Laminated to massive silt, clayey silt, and silty clay with scattered dropstones deposited in lowland proglacial lakes. Marks transition from nonglacial to earliest glacial time, although unequivocal evidence for glacial or nonglacial origin may be absent. Deposits of correlative age and texture may be included in older fine -grained units where evidence of age and/or depositional environment is absent. Locally may include fine -grained sediment of unit Qob or distal deposits from the Cascade Mountains where indistinguishable from Qvlc	0 to > 27 m; generally present in pre-Vashon valleys below 240 ft in elevation	Very stiff to hard	Vertical fractures; fine sand partings common near top and bottom of unit
Pleistocene	OLDER GLACIAL AND NONGLACIAL DEPOSITS				
Qpf	Deposits of pre-Fraser glaciation age	Not used as a map unit. Locally divided into:			
Qpfn	Nonglacial deposits	Sand, gravel, silt, clay, and organic deposits of inferred nonglacial origin, based on the presence of peat, paleosols, and tephra layers; or a southern Cascade Range provenance for sedimentary clasts . Mapped around the recessional lake valley east of First Hill and near the northeast edge of the map	10 to 20 m, discontinuous	Very dense and hard	Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers
Qob MIS 3 18-70 ka	Olympia beds of Minard and Booth (1988)	Sand, silt (locally organic -rich), gravel, and peat, discontinuously and thinly interbe dded; may contain tephra and/or diatomaceous layers. Sand and gravel clast lithology varies depending on source area, from volcanic to reworked northern lithologies. Assigned to the Olympia interglaciation of Mullineaux and others (1965) on the basis of stratigraphic position, correlation, and anticipated radiocarbon dates. Distinguished from Qvlc on the basis of coarser grain size and presence of orga nics. Mapped on the west side of the island	7 to 10 m, discontinuous	Very dense and hard	Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers
Qpo	Deposits of pre-Olympia age	Not used as a map unit. Locally divided into:			
Qpof	Fine-grained deposits	Silt and clay, may have sandy interbeds, laminated to massive. Mapped on the north half of the island	10 to 27 m, discontinuous	Hard	Localized iron-oxide cemented layers and sandy partings
Qpoc	Coarse-grained deposits	Sand and gravel, clean to silty, with some silt layers, lightly to moderately oxidized . Mapped on the west side of First Hill and on the north half of the island. Likely present at more locations in the subsurface	6 to 20 m, discontinuous	Very dense	Localized iron-oxide cemented layers and channels
Qpog	Glacial deposits	Silt, sand, gravel and till of glacial origin. Weakly to strongly oxidized. Underlies Vashon-age deposits and thus must also be of pre -Olympia age. Sediment is of inferred gl acial (northern) origin, based on presence of clasts or mineral grains requiring southward ice -sheet transport. Mapped on the west central side of the island. Locally divided into:	7 to 10 m, discontinuous	Very dense and hard	Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers
Qpogc	Coarse-grained glacial deposits	Sand and gravel, clean to silty, with some silt layers , moderately to heavily oxidized , mapped at two locations in the center part of the island at low elevation	10 to 17 m, discontinuous	Very dense	Localized iron-oxide cemented layers and channels
Qpogf	Fine-grained glacial deposits	Silt and clay, may have sandy interbeds, laminated to massive. Mapped at several locations along the west side of the island , including around First Hill	10 to 33 m, discontinuous, as much as 58 m in channels in the subsurface	Hard	Localized iron-oxide cemented layers and sandy partings
Qpogt	Till deposits	Till thick enough to show at map scale. Most extensive on southern west slopes of the island	Discontinuous, 1 to 17 m	Very dense and hard	Localized iron-oxide cemented layers, sandy partings, and lenses
Qpogd	Glacial diamict	Silt and clay, slightly sandy, with few dropstones and shells, till-like, but finer grained and with fewer gravel clasts than most Puget Lowland tills . Partly to wholly glaciomarine in origin. Mapped on west central part of island	Discontinuous, 3 to 27 m	Very dense and very hard	Localized iron-oxide cemented layers, sandy partings and lenses
Qpon	Nonglacial deposits	Sand, gravel, silt, clay, and organic deposits of inferred nonglacial origin, based on the presence of paleosols, and tephra layers; or a southern Cascade Range provenance for sedimentary clasts . Present near lake level	7 to 50 m, discontinuous	Very dense and hard	Localized iron-oxide cemented layers, interbedded and intermixed fine- and coarse-grained layers
Qponc	Coarse-grained nonglacial deposits	Sand and gravel, clean to silt, with silt layers and peat, moderately to heavily oxidized. Mapped at one location, south end of the east -central side of the island. More prevalent in the subsurface	10 to 13 m, discontinuous	Very dense	Localized iron-oxide cemented layers, and channels
Qponf	Fine-grained nonglacial deposits	Silt and clay, may have sandy interbeds, and peat, laminated to massive.	7 to 17 m, discontinuous	Hard	Localized iron-oxide cemented layers and sandy partings

Geologic Map of Mercer Island, Washington

by Kathy G. Troost & Aaron P. Wisher
October 2006

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geomapnw.ess.washington.edu

Geologic Units

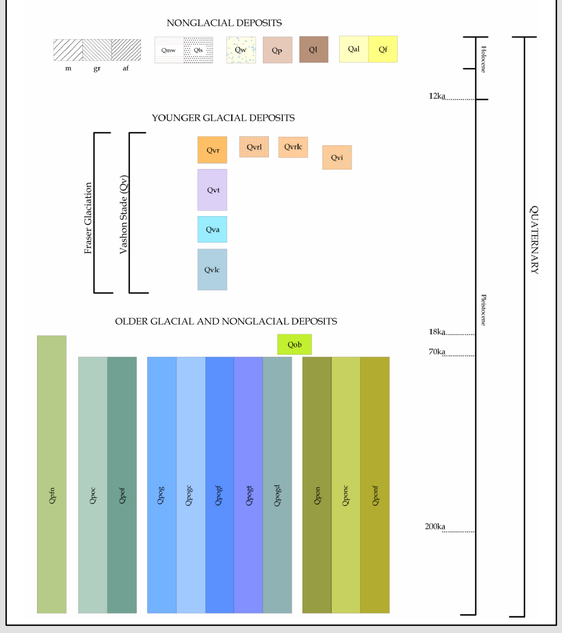
Nonglacial Deposits (Holocene)
- Qp - Peat
- Ql - Lake deposits
- Qw - Wetlands
- Qf - Fan deposits
- Qal - Alluvium

Deposits of Fraser Glaciation (Pleistocene)
- Qvr - Vashon recessional outwash deposits
- Qvrl - Vashon recessional lacustrine deposits
- Qvrlc - Vashon recessional course-grained lacustrine deposits
- Qvi - Vashon ice-contact deposits
- Qvt - Vashon subglacial till
- Qva - Vashon advance outwash
- Qvlc - Lawton Clay

Older Glacial and Nonglacial Deposits (Pleistocene)
- Qpfn - Pre-Fraser nonglacial deposits
- Qob - Olympia beds
- Qpof - Pre-Olympia fine-grained deposits
- Qpoc - Pre-Olympia coarse-grained deposits
- Qpog - Pre-Olympia glacial deposits
- Qpogc - Pre-Olympia coarse-grained glacial deposits
- Qpogf - Pre-Olympia fine-grained glacial deposits
- Qpogt - Pre-Olympia glacial till
- Qpogd - Pre-Olympia glacial diamict
- Qpon - Pre-Olympia nonglacial deposits
- Qponc - Pre-Olympia coarse-grained nonglacial deposits
- Qponf - Pre-Olympia fine-grained nonglacial deposits

- Scarps
- Qmw - Mass wastage deposits
- Qls - Landslide deposits
- m - Modified land
- af - Artificial fill
- gr - Graded Land
- Seattle Fault Zone

Correlation of Geologic Units



Mercer Island Landslide Hazard Assessment

by Kathy G. Troos & Aaron P. Wisher
April 2009

Attachment A

geomapnw.ess.washington.edu

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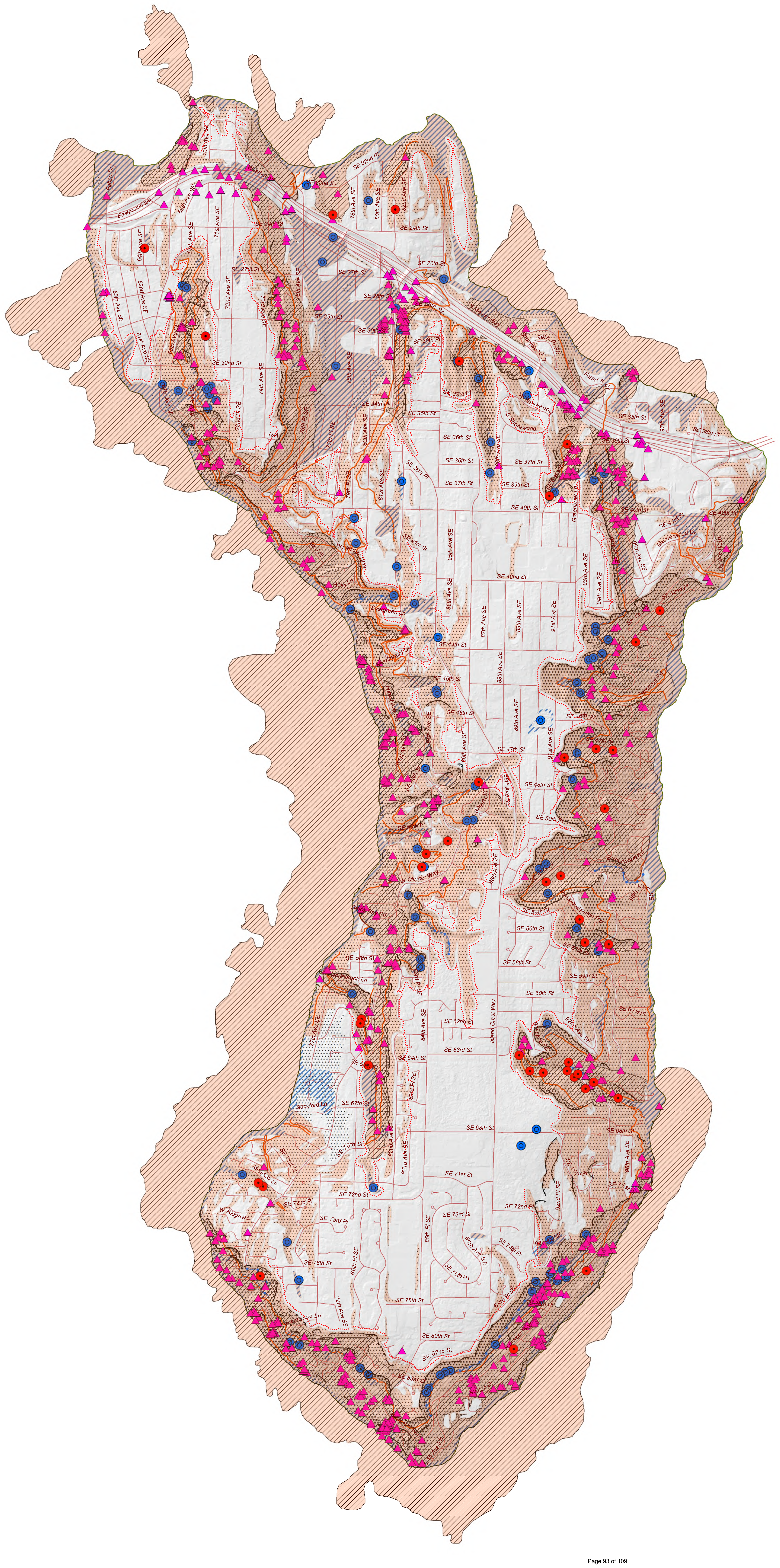


LANDSLIDE HAZARD AREAS
(WAC 365-190-080 4d and MICC 19.16.010)

Landslide hazard areas include areas potentially subject to landslides based on a combination of geologic, topographic, and hydrologic factors. They include areas susceptible because of any combination of bedrock, soil, slope (gradient), slope aspect, structure, hydrology, or other factors.

Areas susceptible to landsliding on Mercer Island include:

i. Areas of historic failure or that have been documented on published maps; *See mapped known landslides below*;
ii. Slopes steeper than 15%, intersecting a geologic contact of relatively permeable deposits over relatively impermeable deposits, and with springs or groundwater seepage; *See mapped potential slide areas below*;
iii. Areas that have shown movement during the Holocene epoch (last 10,000 years) or which are covered by Holocene-age mass wasting deposits; *See mapped known landslides below*;
iv. Slopes parallel or sub-parallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials; *None identified on map, but may be locally present;*
v. Slopes having gradients steeper than 80% subject to rockfall during seismic shaking; *See slope classification below*;
vi. Areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action; *See mapped erosion locations below*;
vii. Areas that show evidence of, or are at risk from snow avalanche; *None identified on Mercer Island*;
viii. Areas located in a canyon or on an active alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding; *None identified on Mercer Island*;
ix. Any area with a slope of 40% or steeper and with a vertical relief of ten or more feet except where composed of consolidated rock; *See slope classification below*.

Landslide hazard areas include the following mapped areas:

Landslide Hazard
- Landslide Hazard Area (Known or Suspect)
- Landslide Hazard Assessment Setback

For all other areas hazard is unknown or unquantified

Supplemental Data

Known Landslides (i,iii)
- Identified Landslide Location
- Scarp
- Landslide and Mass Wasting Deposits; subaerial and subaqueous

Slope (v) Class (ix)
- Slope 80% and higher
- Slope 40-79%

Potential Slide Area (ii)
- Slope 15% and higher, and
- Geologic contact of coarse-grained deposits over fine-grained deposits where slope >= 15%, and
- Area where water less than 10 feet below ground surface based on limited data set (other areas of shallow water present), or
- Spring Locations, or
- Spring lines.

Areas of Rapid Stream Incision (vi)
- Areas of moderate to rapid stream incision/erosion; may result in unstable slopes and/or stream banks

GENERAL NOTES FOR GEOLOGICAL HAZARDS MAPS

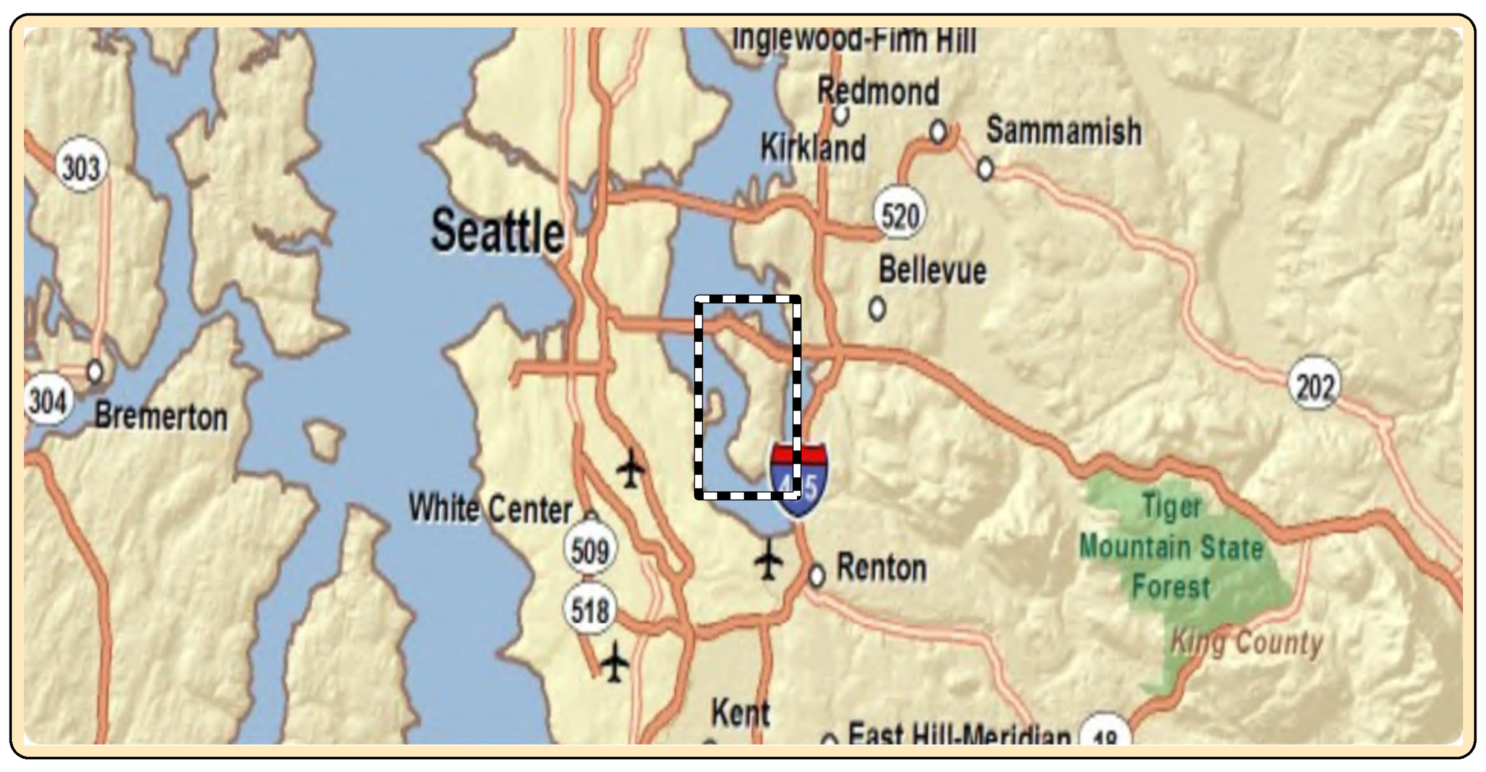
This map is one of a suite of revised Geological Hazard Maps for the City of Mercer Island. This suite includes maps showing Seismic Hazards, Landslide Hazards, and Erosion Hazards.

Other geological and/or natural hazards may exist and geological events may occur on Mercer Island that are not specifically identified on these maps. Examples of geologic hazards and hazardous events that are not identified on these maps include, but are not limited to, tsunamis and seiches in Lake Washington.

These maps are for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. These maps provide DSG staff a general assessment of known or suspect geological hazard areas for which the City will require site and project-specific evaluation by a Washington State-licensed engineer, geologist or engineering geologist prior to issuing a permit for site development. All areas have not been specifically evaluated for geologic hazards and there may be locations that are not correctly represented on these maps. It is the responsibility of individual property owners and map users to evaluate the risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island by these maps.

The City of Mercer Island is using guidance provided by the State of Washington regarding the definition of geologically hazardous areas in accordance with WAC 365-190-080 and the Growth Management Act. "Geologically hazardous areas", by State definition, "include areas susceptible to erosion, sliding, earthquake, or other geological events. They pose a threat to the health and safety of citizens when incompatible commercial, residential, or industrial development is sited in areas of significant hazard."

This new set of maps represents an update of the 2002 Geologic Hazard Map Series and is based on a review of Best Available Science for the Seattle Fault and related events, a new Geological Map of Mercer Island by Troost and Wisher (2006), and a geologic database of Mercer Island compiled by GeoMapNW at the University of Washington. Information about data used for the maps, references, and data limitations are all described in an associated "Read Me" document. The digital version of these maps is accompanied by a meta data file containing pertinent information about map construction. These data and maps are all available on the City of Mercer Island website.



Mercer Island Erosion Hazard Assessment

by Kathy G. Troost & Aaron P. Wisher
April 2009

geomapnw.ess.washington.edu

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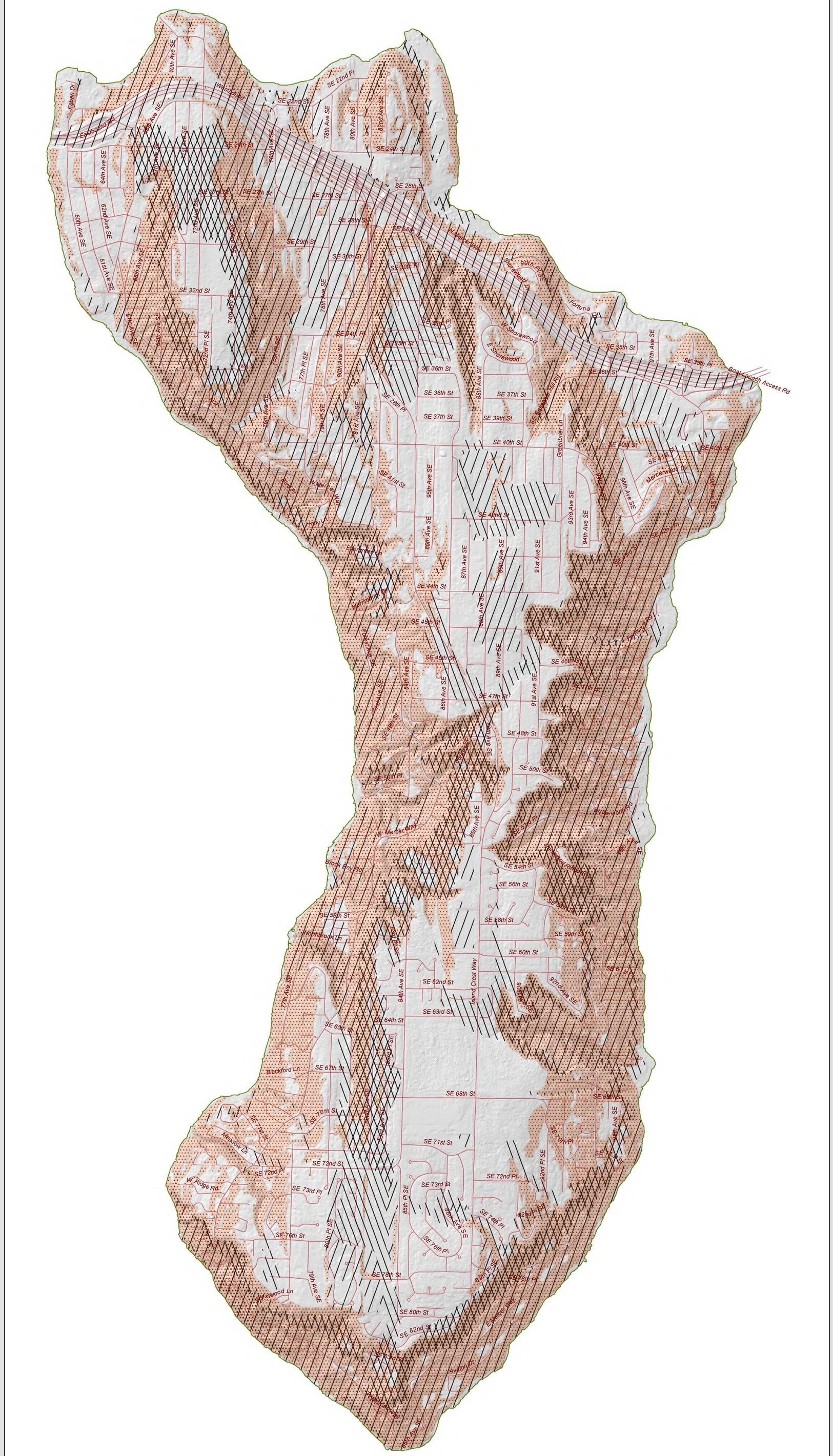

EROSION HAZARD AREAS (MICC 19.16.010)

Erosion hazards areas include those areas greater than 15% slope and subject to a severe risk of erosion due to wind, rain, water, slope and other natural agents including those soil types and/or areas identified by the U.S. Department of Agriculture's Natural Resource Conservation Service as having a "severe" or "very severe" rill and inter-rill erosion hazard.

Another factor in evaluating erosion potential is infiltration potential. If sandy material is present at the ground surface, rain water can infiltrate and loosen material for removal by erosion. Therefore the areas of sandy material have also been added to this hazard map for consideration along with the slope and erodible soils subclass.

Contributing factors not shown on the map include rainfall, areas of shallow groundwater, ground cover, wind, impervious surfaces, and changes to the ground surface. These factors and all the categories shown on the map should be used together to assess erosion potential. Individual areas less than 0.3 acres in size have been excluded.

Erosion Hazard

- Erosion Hazard Area (Known or Suspect)

For all other areas, hazard is unknown or unquantified

Supplemental Data

Infiltration Potential

- High - Coarse-grained deposits; e.g. gravel and clean sand
- Medium - Silty, sandy deposits
- Mixed - Interbedded or mixed fine and coarse-grained deposits

Slope Class

- Slope 80+%
- Slope 40-79%
- Slope 15-39%

GENERAL NOTES FOR GEOLOGICAL HAZARDS MAPS

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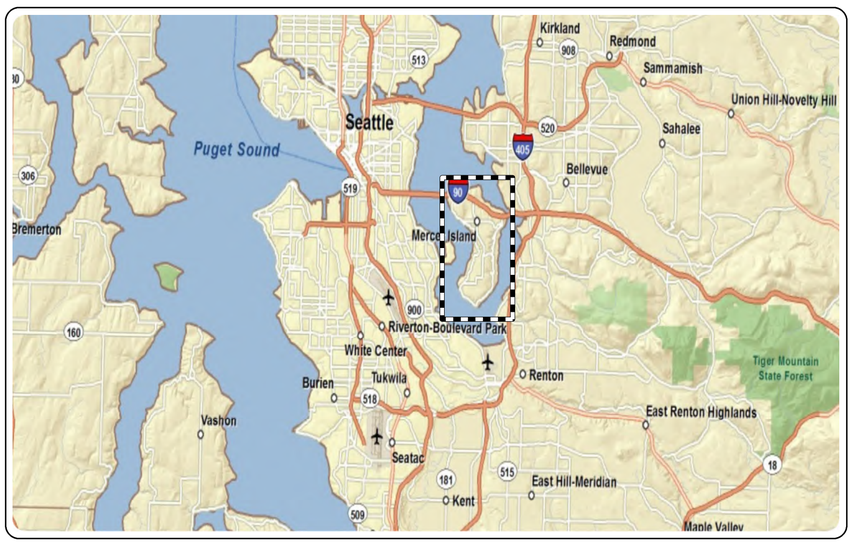

Mercer Island Seismic Hazard Assessment

by Kathy G. Troost & Aaron P. Wisher
April 2009

geomapnw.ess.washington.edu

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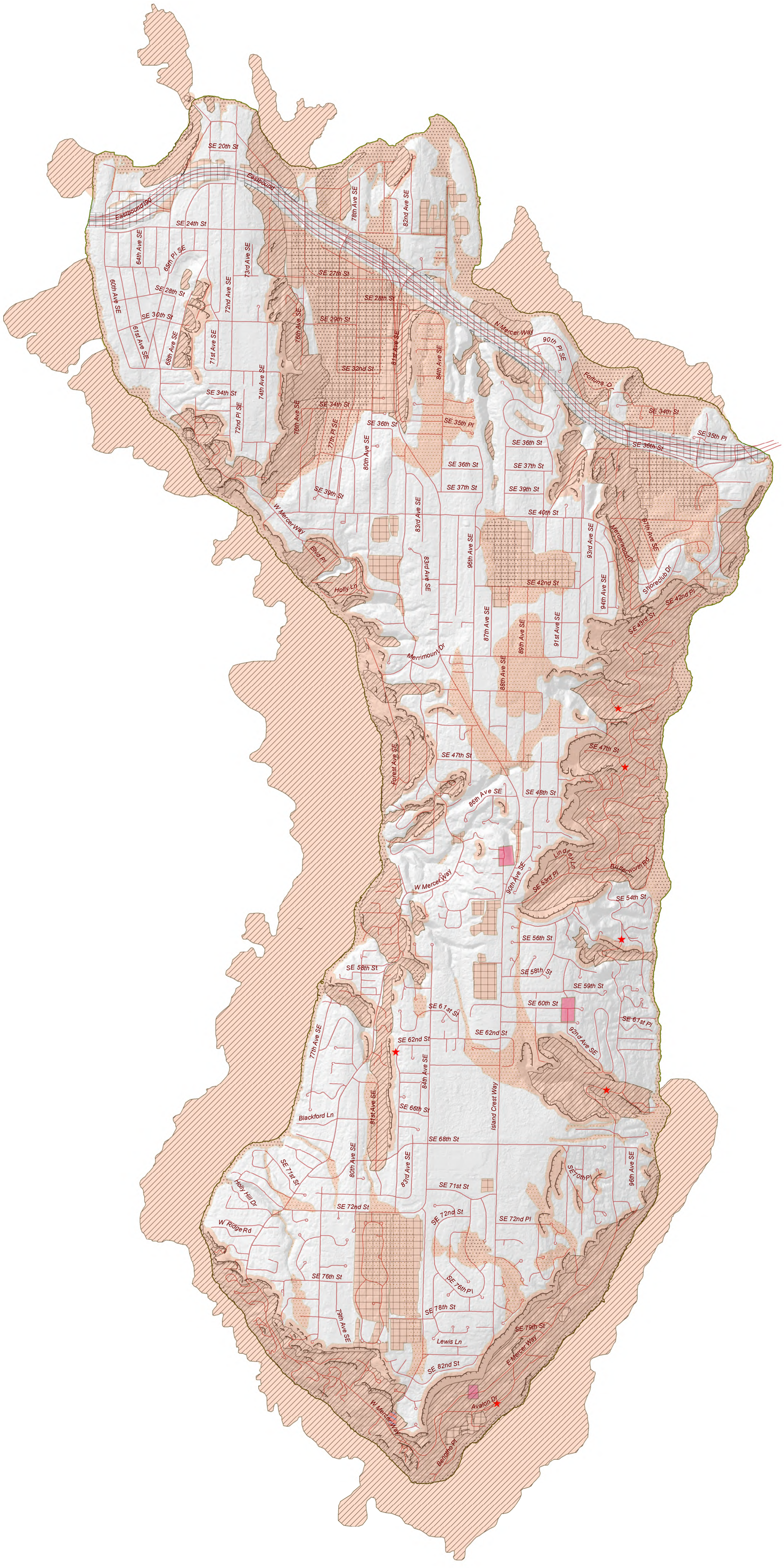


SEISMIC HAZARD AREAS (MICC 19.16.010)

Seismic Hazard areas are those areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement, soil liquefaction or surface faulting.

Seismic Hazard

- Seismic Hazard Area (Known or Suspect)

For all other areas risk is unknown or limited to ground shaking

Supplemental Data

Seismically Hazardous Areas

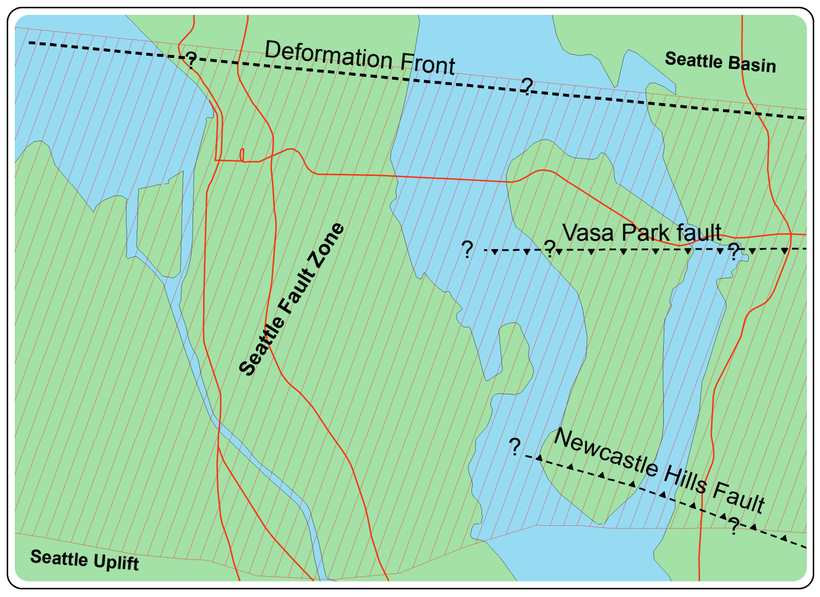
Potential for seismically induced ground failures including settlement, cracking, lateral spreading, liquefaction due to ground shaking.
Seismically hazardous areas include the following:

- High Potential for seismically induced ground failures (Poorly consolidated, see note below)
- Moderate Potential for seismically induced ground failures (Moderately consolidated, see note below)
- Scarp
- Landslide and Mass Wastage Deposits (subaerial & subaqueous)
- Modified land

Documented Earthquake Ground Effects

- Miscellaneous Ground Effects of the 2001 Nisqually Earthquake (Approx. Area)
- Ground Settlement from the 1965 Earthquake (Approx. Area)
- Miscellaneous Ground Effects of the 1949 Earthquake (Approx. Area)

ACTIVE FAULTS



Mercer Island falls within the Seattle fault zone and at least two stands of the Seattle fault cross the island. No direct evidence of surface fault rupture has yet been documented for Mercer Island (Troost and Wisher, 2006).

The Seattle Fault Zone is the area where several parallel strands of the Seattle fault have either broken the ground surface or caused deformation of geologic materials. Earthquakes of magnitude M7 or greater have occurred on some of these fault strands within the Holocene (last 10,000 years) and will likely occur again (Blakely, et al., 2002; Sherrod 2002, 2005). The Seattle Fault Zone is one of several active crustal faults zones in the Puget Lowland currently undergoing research.

On Mercer Island, evidence for movement along these fault strands consists of exposures of deformed sedimentary strata and geophysical images of folded and faulted strata (Troost and Wisher, 2006; Stephenson et al., 2007). Elsewhere in the Puget Sound lowland, evidence for movement on the fault strands consists of uplifted beach deposits, down-dropped tidal marshes, offset strata, fault scarps, and deformation such as sheared and tightly folded strata. Evidence of the Seattle fault zone in the subsurface consists of aeromagnetic, gravitational, and seismic reflection anomalies (Liberty and Pratt, 2008).

East of Mercer Island, the Vasa Park fault and Newcastle Hills fault each have surface expression in the form of fault scarps and subsurface expression in the form of magnetic and seismic linear anomalies (Liberty and Pratt, 2008; Sherrod, 2002). The magnetic and seismic anomalies may be continuous with similar features to the west of Lake Washington, but those continuities are not firmly established (Liberty and Pratt, 2008). The locations of these faults are not well defined on Mercer Island (Pratt, 2009, pers. comm.)

The Deformation Front is an east-west-trending, convex-upward fold in geologic strata, where those strata drape over the northern-most thrust fault in the Seattle Fault Zone. North of the Deformation Front is the Seattle Basin, where strata lie nearly flat; south of the Deformation Front the strata dip down toward the north beneath the Seattle Uplift (Pratt, 2009). The location of the Deformation Front was moved northward from previous interpretations (Brocher, et al, 2004) following detailed evaluation of seismic lines by Pratt (2009).

Notes: Degree of consolidation

Geologic materials were assessed then classified as either strongly, moderately, or poorly consolidated. Degree of consolidation is a direct translation of geologic unit based on geologic history and predominant lithology. Because considerable variability exists within each geologic unit, more detailed analysis is needed for site-specific evaluations or to evaluate the degree of consolidation at a larger scale than provided. Slope and degree of saturation also affect the degree of consolidation, but have not been factored into this map. This qualitative assessment should be used to evaluate and understand the character of the island as a whole. These data should not be used for purposes of site-specific land-use planning or site-specific geologic evaluations. The classification shown on the map does not account for the built environment and impervious surfaces.

GENERAL NOTES FOR GEOLOGICAL HAZARDS MAPS

This map is one of a suite of revised Geological Hazard Maps for the City of Mercer Island. This suite includes maps showing Seismic Hazards, Landslide Hazards, and Erosion Hazards.

Other geological and/or natural hazards may exist and geological events may occur on Mercer Island that are not specifically identified on these maps. Examples of geologic hazards and hazardous events that are not identified on these maps include, but are not limited to, tsunamis and seiches in Lake Washington.

These maps are for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. These maps provide DSG staff a general assessment of known or suspect geological hazard areas for which the City will require site and project-specific evaluation by a Washington State-licensed engineer, geologist or engineering geologist prior to issuing a permit for site development. All areas have not been specifically evaluated for geologic hazards and there may be locations that are not correctly represented on these maps. It is the responsibility of individual property owners and map users to evaluate the risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island by these maps.

The City of Mercer Island is using guidance provided by the State of Washington regarding the definition of geologically hazardous areas in accordance with WAC 365-190-080 and the Growth Management Act. "Geologically hazardous areas", by State definition, "include areas susceptible to erosion, sliding, earthquake, or other geological events. They pose a threat to the health and safety of citizens when incompatible commercial, residential, or industrial development is sited in areas of significant hazard."

This new set of maps represents an update of the 2002 Geologic Hazard Map Series and is based on a review of Best Available Science for the Seattle Fault and related events, a new Geological Map of Mercer Island by Troost and Wisher (2006), and a geologic database of Mercer Island compiled by GeoMapNW at the University of Washington. Information about data used for the maps, references, and data limitations are all described in an associated "Read Me" document. The digital version of these maps is accompanied by a meta data file containing pertinent information about map construction. These data and maps are all available on the City of Mercer Island website.

GeoMapNW

The Pacific Northwest Center for Geologic Mapping Studies

April 6, 2009

Mr. Donald Cole
Building Official, Development Services Group
City of Mercer Island
9611 SE 36th Street
Mercer Island, WA 98040

Dear Mr. Cole,

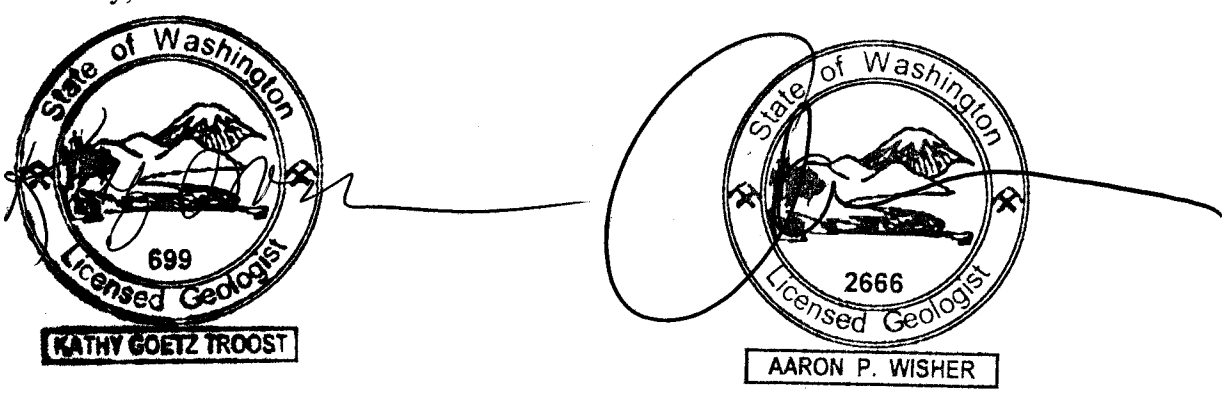
We are pleased to provide you with your new geological hazard maps of Mercer Island. Our work was done in accordance with our contract dated October 1st, 2008.

This package contains electronic and hard copies of the following: a Read Me document and the following maps: Erosion Hazard Assessment, Landslide Hazard Assessment, and Seismic Hazard Assessment. The CD contains pdfs of each map, metadata files, and document files, as well as individual shapefiles of the layers needed for your GIS department to reconstruct or change the layout of the maps, as appropriate.

The work was completed by the undersigned, both Licensed Geologists in the State of Washington. Another geologist provided assistance under our direct supervision. All work was done in accordance with standard practice for hazard assessment, the Washington Administrative Code, and the Mercer Island City Code.

If you have any questions, please feel free to contact either of us by phone or e-mail.

Sincerely,



Kathy Goetz Troost, LPG
Director

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(206)-616-9769 http://geomapnw.ess.washington.edu
Kathy G. Troost (206-616-9769, *ktroost@u.washington.edu*); Aaron P. Wisher (206-685-2821, *wisher@u.washington.edu*)

Read Me

Geological Hazard Maps for Mercer Island, WA
April 6, 2009
By GeoMapNW, University of Washington

Introduction

This "Read Me" document accompanies the new suite of Geological Hazard maps prepared for the City of Mercer Island (City) by The Pacific Northwest Center for Geological Mapping Studies (GeoMapNW) at the University of Washington. The maps were completed under contract between the City and GeoMapNW.

This "Read Me" document contains descriptions of the methods used to prepare each of the hazard maps, the file names for the electronic files, data sources, references, and map limitations.

Definitions for geological hazards and related terms were obtained from the Mercer Island City Code (MICC 19.16.010) and from the Washington Administrative Code (WAC 365-190-080). According to these definitions, geologically hazardous areas are those areas susceptible to erosion, sliding, earthquake, or other geological events based on a combination of slope (gradient or aspect), soils, geologic material, hydrology, vegetation, or alterations, including landslide hazard areas, erosion hazard areas and seismic hazard areas.

From this definition, the City decided to develop three hazard maps: Erosion Hazard Assessment, Landslide Hazard Assessment, and Seismic Hazard Assessment. This new set of maps, an update of the 2002 Geologic Hazard Map Series, is based on a review of best available science for the Seattle fault and related events, the new Geological Map of Mercer Island (Troost and Wisher, 2006), and a geologic database. The geologic database, at GeoMapNW includes a database of landslides, springs, and subsurface data from 3054 boreholes.

File names

The accompanying CD contains the electronic files for the hazard map deliverable dated April 6, 2009. The files include geodatabase files, shapefiles, pdfs of the maps, this Read Me document, and a copy of the transmittal letter.

The two geodatabase files are:
mercerisland_hazard_assessment.gdb (preferred geodatabase) and
mercerisland_hazard_assessment _compatible.mdb (for version 9 or 9.1 ArcGIS)

The shapefiles are:
Seismic\Seismic_Hazard_Assessment_MasterLayer.shp
Seismic\Degree_of_Consolidation.shp
Seismic\Documented_1949_Earthquake_Ground_Affects.shp
Seismic\Documented_1965_Earthquake_Ground_Affects.shp
Seismic\Documented_2001_Earthquake_Ground_Affects.shp
Seismic\Modified_Lands.shp
Seismic\Seattle_Fault_Lines.shp
Seismic\Seattle_Fault_Zone.shp
Erosion\Slope.shp
Erosion\Erosion_MasterLayer.shp
Erosion\Infiltration_Potential.shp
Landslide\Springs_Mapped.shp
Landslide\Depth_to_Water.shp
Landslide\Geologic_Contacts.shp
Landslide\Landslide_Assessment_50ft_Setback.shp
Landslide\Landslide_MasterLayer.shp
Landslide\Landslides_Identified_Inventory.shp
Landslide\Landslides_Mapped.shp
Landslide\Scarps.shp
Landslide\Springs_Identified_Inventory.shp
Landslide\CIP_Projects.shp

Erosion Hazard Map Methodology and Limitations

The erosion hazard map shows slope and infiltration potential as two of the many factors to consider for erosion hazard.

Erosion hazard is defined by WAC and MICC as at least those areas identified by the United States Department of Agriculture Soil Conservation Service as having a “severe” rill and inter-rill erosion hazard. The Natural Resources Conservation Service (NRCS, aka SCS) now describes erosion hazard in more general terms within each subclass assigned to each soil class on a soil map. The most recent NRCS soil map was evaluated for Mercer Island to determine erosion potential for mapped soil units. Within subclass, soils are described as having a slight, moderate, severe, very severe, or range of erosion hazards. The NRCS soil layer was found to be less accurate than currently available information such as LiDAR data to calculate slope and the 2006 geologic map to determine the relative permeability of underlying soil materials. After discussion with Mercer Island officials, these current elements were used in lieu of the 1973 NRCS soil layer for Mercer Island.

The other aspect that affects erosion hazard is slope. Slopes with a 15% or steeper gradient have an impact on erosion potential. Therefore, slopes are added to this hazard map, although not specifically delineated in the WAC. Slope and erodability are the 2 components mapped by NRCS.

The infiltration potential of a geologic material is an important component of that material's erosion hazard. Infiltration potential of the geologic materials on Mercer Island is directly related to grain size and degree of consolidation. For the purpose of this map, the grain size of geologic materials was assumed to be uniform within geologic units. Therefore, the outlines of zones of different infiltration potential follow the outlines of zones of similar grain size, which in turn follow the outlines of the geologic units from the 2006 geologic map of the island. Assessment of infiltration potential for this map did not take into account the affects from the built environment and impervious surfaces (e.g., buildings, streets, and parking lots).

Considerable variability in grain size can exist within a geologic unit over a short distance, but on this map, grain size was only assessed at a scale appropriate for a map of the entire Mercer Island. Degree of consolidation also affects infiltration, but has not been factored into this map. More detailed analysis is needed for site-specific evaluations or to evaluate infiltration at a larger scale than provided.

This is not a groundwater map, nor aquifer susceptibility map since it does not address depth to water and other parameters.

Landslide Hazard Map Methodology and Limitations

This map consists of a compilation of many data sets, each with its own set of limitations. The combination of those datasets produces the known and suspect landslide hazard areas. The following paragraphs describe the sources used to create the various datasets.

Known landslides. The locations of known landslides included on the map were derived from the following principal sources:

1. Internal City documents including a spreadsheet of recent landslides.
2. "Recorded slide locations" from the City map "Landslide Hazards", 27 Aug 2002.
3. Reports produced by geotechnical engineering firms.
4. Publications in the public domain such as articles in newspapers and scientific journals.
5. GeoMapNW database of landslides.
6. Geological mapping, Troost and Wisher, 2006.

This dataset is biased towards *reported landslides* and hence towards more recent landslides and landslides that adversely impacted public or private property. More landslides are present at the ground surface than are represented by this dataset. Furthermore, as time passes, landslides are

less distinctive on the landscape as weathering, erosion, and landscaping help diffuse the once classic landslide geomorphic signature.

Mass wastage and landslide debris. The polygons defining landslide and mass wasting deposits were derived from the following sources:

1. Subaqueous landslide deposits from Karlin et al., 2004
2. Buried trees in large landslides related to an earthquake on the Seattle fault, Jacoby, et al., 1992.
3. New mapping of the NOAA Lake Washington bathymetric data.
4. Geological mapping, Troost and Wisher, 2006.
5. Geomorphic analyses of Lidar data.

Like landslide features, mass wastage deposits become less distinctive over time, thus potentially biasing this dataset towards geologically recent deposits. Individual landslides are often included in polygons of landslide debris, thus reducing the number of "known landslides".

This dataset includes subaqueous landslide deposits modified from Karlin et al., 2004 and from geomorphic analyses of the most recent multi-beam bathymetry (data source: NOAA, unpublished data) of Lake Washington. Not all of the Karlin et al., 2004 landslides were included on this map. Mass wastage deposits were identified by shape, roughness, and adjacency to on-shore mass-wastage or landslide scarp. After evaluation of their mapping and comparison to the current bathymetric data, a new landslide data set was generated.

Along the central part of eastern Mercer Island, close to the shore, bathymetry data are missing, and further offshore, the bathymetry does not show obvious deposits of mass wasting. Therefore, in those locations, no mass wastage was mapped, although it could be reasonably inferred, from the proximity of up-slope landslides, that mass wastage deposits should be in that location. It is surmised that, if ancient landslides deposited material in these locations, Pleistocene rivers or Holocene lake currents removed those mass wastage deposits.

At other locations where there are no bathymetry data near the shore, but where mass wastage deposits are clearly depicted onshore and further offshore, a continuous mass wastage deposit was depicted.

In some locations on the west and north sides of Mercer Island, high-resolution bathymetry data in the shallow water very near shore were available (Sewer outfall bathymetry data, from the City). These data allowed more accurate mapping of mass wastage deposits, or lack thereof, in those areas.

On this map, in contrast with previous mapping of Mercer Island subaqueous mass wasting (Karlin, et al., 2004), deposits are NOT mapped as mass wastage in most portions off the north shore of Mercer Island. The convex bathymetry there is interpreted as the now-drowned stoss slopes of drumlins, not as mass wastage. The bathymetry along the north shore of Mercer Island does not show the characteristic roughness and lobate shapes characteristic of mass-wastage deposits (confirmed by side-scan sonar, as in Karlin and Abella, 1996).

Contacts between coarse-grained deposits overlying fine-grained deposits. Coarse-grained deposits overlying fine-grained deposits often cause a barrier to further vertical groundwater transmission and where this change intersects a slope, springs commonly occur. This setting is known to enhance landslide potential in the Puget Lowland. Such geologic contacts were identified for the Landslide Hazard Map by querying all the geologic contacts on the geological map and evaluating the grain size characteristics of the overlying and underlying units. These contacts occur within different ages of materials, for example within the post-Vashon-age, Vashon-age, Olympia-age, Possession-age, Whidbey-age deposits, and so on. These contacts are marked and assume that the grain size is somewhat uniform within the geologic unit. In reality, grain size varies within each geological unit and within some of the coarse-grained units, layers and lenses of fine-grained material are locally present. Likewise within the underlying fine-grained units, layers and lenses of coarse-grained materials are locally present. This suggests that *the contact* may warrant site-specific evaluation.

Slope calculations (>15%, >40%, >80%). Slope was calculated using ArcGIS spatial analysis which evaluates the average incline of land calculated by subtracting the lowest elevation from the highest elevation, and dividing the resulting number by the shortest horizontal distance between these two points. Steep slope is defined by MICC as any slope of 40 percent or greater calculated by measuring the vertical rise over any 30-foot horizontal run. Steep slopes do not include artificially created cut slopes or rockeries and these were manually removed from the computer generated slope files.

Areas with rapid stream incision. Some streams on Mercer Island are experiencing rapid incision. These streams typically exhibit steep and narrow channels cut within an otherwise flat channel. Other streams experiencing rapid erosion show steep cut banks in unstable conditions. The locations included on this map are from a report by R.W. Beck, 2008; describing areas of rapid erosion.

Spring data. The mapped locations were compiled by Troost and Wisher during preparation of the Geologic Map of Mercer Island in 2006. Mapped springs include those observed in the field, those noted by City utility department personnel, and those shown on City drawings. Not all of the springs on the island are shown on the map. Many springs were captured by drainage works decades ago or are hidden by aspects of development. Information regarding springs is better in areas where vegetation is light and development is only now occurring.

Groundwater data. Groundwater data were obtained from monitoring wells and boring logs as reported predominantly in geotechnical reports. More groundwater data exist along the steeper slopes of Mercer Island than on the upland areas because of the requirement for geotechnical investigations in potentially unstable ground. Likewise, more groundwater data are available in the soft soil areas of the island where additional drilling is needed to obtain information for foundations. Spring locations and surficial geologic unit helped inform the shallow groundwater mapping, although areas of shallow groundwater (less than 10 feet below ground surface) were not extended far beyond a reliable data point. Areas of shallow groundwater are no doubt distributed more extensively than shown across the island, but are not shown on the map due to a lack of data. Areas of perched water, on the Vashon till (and older, but shallow fine-grained units) are also present across the island. These perched water bodies have not been eliminated

from the mapped shallow water polygons. Groundwater data are from different times of the year and from different years, so the data do not provide a "map" view of an aquifer or water table.

Landslide hazard assessment setback. The City evaluated various widths and the usefulness of a setback for landslide scarps and steep slopes. Based on available landslide data, conditions on the island, and standard practice, a setback line was added to the map. At scarps and steep slopes (>/= 40% slope) higher than 50 feet, the horizontal setback is 50 feet. For scarps and steep slopes less than 50 feet high, the horizontal setback is 25 feet.

Seismic Hazard Map Limitations

This map consists of a compilation of many data sets, each with its own set of limitations. The combination of those datasets produces the known and suspect seismic hazard areas. The following paragraphs describe the sources used to create the various datasets.

Seismically hazardous areas consist of known earthquake-related failure areas and those areas that have a potential for seismically-induced ground failures.

Known earthquake-related failures. Documented ground effects from the 1949 and 1965 earthquakes were obtained from the City map of "Seismic Hazards", 27 August, 2002. For the 2001, Nisqually earthquake ground effects, City personnel were interviewed and newspaper articles were scanned. Another source of good information for the 28 Feb 2001 "Nisqually" earthquake is the article "Island fared well in quake" in the Mercer Island Reporter, 7 March 2001.

Areas with potential for seismically induced ground failures. These include areas susceptible to settlement, cracking, lateral spreading, and liquefaction. For Mercer Island, susceptible deposits include the young geological units, poorly to moderately consolidated geological units, some areas of shallow groundwater, areas of landslide and mass wastage debris, deposits with scarps, and modified land (fill and graded land).

Landslide and mass wastage deposits were derived as described above for the Landslide Hazard Map. Historical and geological records show that these types of deposits are indeed reactivated during earthquake shaking.

For the purposes of the map, areas with potentially liquefiable deposits (poorly consolidated deposits, some fill) are assumed to have a shallow water table for the following reasons: the liquefiable deposits in the City occur along the shore of Lake Washington, in Town Center, and along the crest of the island. Water is shallow in much of these locations. Site-specific evaluations are needed for further evaluation of liquefaction potential and water depth.

Degree of Consolidation. Geologic materials were assessed then classified as either strongly, moderately, or poorly consolidated. The primary bases for the classification were geologic

history, depositional environment, lithologic properties, in situ density/ consistency, and degree of saturation. Geologic materials that were glacially overridden and consolidated are classified as strongly consolidated; materials that were not overridden are either moderately or poorly consolidated. To further distinguish between moderately and poorly consolidated, depositional history and in situ properties were of paramount importance. For example, post-glacial peat-rich lacustrine deposits with a shallow water table are mapped as poorly consolidated; whereas post-glacial outwash sandy gravel deposits with a shallow water table are mapped as moderately consolidated. Poorly consolidated deposits are determined to have a high potential for seismically-induced ground failures.

Variations exist within each geological unit that render it more or less susceptible to earthquake-induced ground-failures. Directivity and nonlinearity factors within earthquake waves can have a profound effect on the distribution of and variability of earthquake-induced ground failures.

General Limitations

Other geological and/or natural hazards may exist and geological events may occur on Mercer Island that are not specifically identified on these maps. Examples of geologic hazards and hazardous events that are not identified on these maps include, but are not limited to, tsunamis and seiches in Lake Washington.

These maps are for the sole use of the staff of the City of Mercer Island's Development Services Group (DSG) for the purposes of permit application evaluation. These maps provide DSG staff a general assessment of known or suspect geological hazard areas for which the City will require site and project-specific evaluation by a Washington State-licensed engineer, geologist or engineering geologist prior to issuing a permit for site development. All areas have not been specifically evaluated for geologic hazards and there may be locations that are not correctly represented on these maps. It is the responsibility of individual property owners and map users to evaluate the risk associated with their proposed development. No site-specific assessment of risk is implied or otherwise indicated by the City of Mercer Island, by GeoMapNW, or by the University of Washington by these maps.

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DEVELOPMENT SERVICES GROUP
9611 SE 36TH ST., MERCER ISLAND, WA 98040
(206) 275-7605

TO: Planning Commission

FROM: Evan Maxim, Interim Director

DATE: October 18, 2018

RE: Preliminary Docket – 2019 Comprehensive Plan Amendments

Summary
On October 3, 2018, the Planning Commission and staff discussed possible Comprehensive Plan amendments for review in 2019. This discussion followed an overview of the public process used to solicit Comprehensive Plan amendment ideas from the Mercer Island community. As part of that discussion, staff noted that the 2019 work plan for the Planning Commission was significant; staff anticipates that the Planning Commission will have time for a review and discussion on three or possibly four Comprehensive Plan amendments in 2019.

The Planning Commission identified ten possible amendments to the Comprehensive Plan, that might warrant further analysis in 2019 or later. The Planning Commission directed staff to review the amendments, consult with City leadership, and provide a recommended preliminary docket for review on October 17, 2018. One of the amendments, proposed by a citizen (Suzanne Skone) was closely related to a Planning Commission identified amendment. Following consultation with the City, Suzanne Skone has withdrawn her proposed amendment.

Attachment A to this memo contains the staff recommended 2019 Comprehensive Plan amendment docket for Planning Commission review and recommendation on October 16, 2018. The remaining items not included in the staff recommended docket are summarized here:

1. Goals and policies to implement an urban forest management plan. The City's Parks Department has this on their workplan, tentatively scheduled for 2019 / 2020. Staff anticipates that at the earliest, this may result in additional Comprehensive Plan amendment work in 2020.
2. The use of the public right of way for public benefit. This appears to be an item that can be addressed through the ongoing management and programming of the public right-of-way.
3. Goals and policies to manage commercial noise in residential neighborhoods. This item is better addressed through an amendment to the City's nuisance regulations or through the adoption of a noise control ordinance.
4. Reconstruction of the land use map to further simplify the map. This item may be addressed in

a future Comprehensive Plan amendment but does not appear to warrant immediate action by the Planning Commission.

5. Establish a City Tree program. This item may be addressed in a future Comprehensive Plan amendment, in particular following adoption of an urban forest management program but does not appear to warrant immediate action by the Planning Commission.
6. Require a pre-design for Accessory Dwelling Units (ADUs). This item is better addressed through an amendment to the City's residential development regulations.

The docketing process requires that the Planning Commission review the preliminary docket of proposed Comprehensive Plan amendment and make a recommendation to the City Council. The threshold question for the Planning Commission is whether the items on the preliminary docket should be further analyzed and considered by the Planning Commission, City Council, and community in 2018. Following adoption of a final docket by the City Council in November or December of 2018, the docket will serve as part of the work program for the Planning Commission for 2019.

Docket Criteria

The City has established criteria for the evaluation of the preliminary docket, which should be considered by the Planning Commission in making their recommendation to the City Council. These criteria are contained in subsection 19.15.050(E)(1) MICC:

1. The request has been filed in a timely manner, and either:

- *a. State law requires, or a decision of a court or administrative agency has directed, such a change; or*
- *b. All of the following criteria are met:*
  - *i. The proposed amendment presents a matter appropriately addressed through the comprehensive plan;*
  - *ii. The city can provide the resources, including staff and budget, necessary to review the proposal, or resources can be provided by an applicant for an amendment;*
  - *iii. The proposal does not raise policy or land use issues that are more appropriately addressed by an ongoing work program item approved by the city council;*
  - *iv. The proposal will serve the public interest by implementing specifically identified goals of the comprehensive plan or a new approach supporting the city's vision; and*
  - *v. The essential elements of the proposal and proposed outcome have not been considered by the city council in the last three years. This time limit may be waived by the city council if the proponent establishes that there exists a change in circumstances that justifies the need for the amendment.*

Next Steps

At the October 17th meeting, staff will provide a brief overview of the proposed 2019 Comprehensive Plan Amendment docket, answer questions the Planning Commission may have, and seek a recommendation from the Planning Commission.

Attachments:

A. Draft Resolution 15XX

CITY OF MERCER ISLAND
RESOLUTION NO. 15__

A RESOLUTION OF THE CITY OF MERCER ISLAND, WASHINGTON, ESTABLISHING THE CITY'S 2019 COMPREHENSIVE PLAN AMENDMENT DOCKET

WHEREAS, the City of Mercer Island is required to plan under the Growth Management Act of 1990, as amended, including adopting and regularly updating and amending its Comprehensive Plan; and

WHEREAS, the Growth Management Act allows the City to amend the Comprehensive Plan on an annual basis; and

WHEREAS, public notice of the opportunity to apply for Comprehensive Plan amendments for 2018 was provided on August 29, 2018; and

WHEREAS, on October 3, 2018, the City of Mercer Island Planning Commission held a public meeting to consider possible items for a preliminary docket of amendments; and

WHEREAS, on October 17, 2018, the City of Mercer Island Planning Commission held a public meeting and made a recommendation to the Mercer Island City Council on a docket of Comprehensive Plan amendments to be considered in 2019; and

WHEREAS, on December XX, 2018, the Mercer Island City Council held a public meeting to consider the Planning Commission's recommended final docket of amendments to be considered in 2019;

NOW THEREFORE, BE IT RESOLVED BY THE MAYOR AND THE CITY COUNCIL OF THE CITY OF MERCER ISLAND, WASHINGTON AS FOLLOWS:

1. The City Council directs City staff and the Planning Commission to analyze, study, and make recommendations to the City Council on the proposed Comprehensive Plan amendments listed on the final docket attached hereto as Exhibit A.

PASSED BY THE CITY COUNCIL OF THE CITY OF MERCER ISLAND, WASHINGTON, AT ITS REGULAR MEETING ON THE Xth DAY OF DECEMBER 2018.

CITY OF MERCER ISLAND

_____
Debbie Bertlin, Mayor

ATTEST:

_____
Deborah Estrada, City Clerk

RESOLUTION NO. 15__—EXHIBIT A

2019 Preliminary Comprehensive Plan Docket

Item No.	Proposed By	Potentially Affected Section, Goal or Policy	Summary of proposal
1	Planning Commission	Land Use Element / Land Use Figures	Remove specific Town Center subarea designations from the Land Use Element.
2	Planning Commission	Land Use Element	Establish goals and policies to prevent and / or mitigate the impacts of climate change.
3	City	Land Use Element / Economic Development	Placeholder for the development of goals and policies supporting economic development on Mercer Island.