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memorandum

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Leonard Bauer, City of Olympia

from Ilon Logan and Christina Hersum, ESA
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subject Critical Areas Ordinance Update - Gap Analysis and Best Available Science Consistency Review

The City of Olympia (City) is in the process of updating its Critical Areas Ordinance (CAO, Olympia Municipal Code [OMC] Chapter 18.32) in accordance with the requirements of the Growth Management Act (GMA) (RCW 36.70A). The GMA requires cities to consider best available science (BAS) in the development of critical areas policies and regulations. In 2004 and 2005, the City reviewed the best available science and conducted a major update of its CAO to comply with the GMA (Olympia, 2004; Olympia, 2005). More recently, the City completed a comprehensive update to its Shoreline Master Program (SMP), which was approved and became effective in October 2015. The City expects the current CAO update to be relatively limited in scope and focused primarily on clarifying definitions and terms, streamlining the code, and ensuring consistency with the City's recently adopted Comprehensive Plan.

ESA reviewed portions of the City's CAO for consistency with the current scientific literature and applicable regulatory agency guidance. Specifically, we reviewed the CAO sections for General Provisions (OMC 18.32.100 to 170), Important Habitats and Species (OMC 18.32.300 to 330), Streams and Important Riparian Areas (OMC 18.32.400 to 445), and Wetlands and Small Lakes (OMC 18.32.500 to 595). As a subconsultant to ESA, Robinson Noble reviewed the provisions for Drinking Water (Wellhead) Protection Areas (OMC 18.32.200 to 240) and Landslide Hazard Areas (OMC 18.32.600 to 645). Robinson Noble is a geotechnical firm specializing in hydrogeologic issues.

In general, the latest BAS documents pertaining to critical areas have been prepared by state agencies as guidance to local governments. The ESA team also reviewed recently updated critical area codes from other neighboring jurisdictions (e.g., Thurston County) and evaluated the code for areas where Olympia could achieve greater consistency with current standards and practices. Our recommendations also reflect our professional judgment and experience assisting numerous cities and counties with critical areas management, code interpretation and administration.

BAS Review and Gap Analysis Methods

ESA and Robinson Noble conducted a line-by-line review of the current CAO for the purposes of identifying areas of inconsistency with agency guidance and BAS. We also focused on specific areas of concern identified by City staff during an in-person meeting on January 27, 2016 and summarized in a list provided to us by you.

To organize our assessment of the City's CAO, we developed a gap analysis matrix (attached to this memo) to identify gaps and document consistency between CAO provisions and GMA regulations, relevant agency guidance, and BAS published since 2005. Since that time new scientific findings have been published describing methods for improving the success of compensatory wetland mitigation, buffer effectiveness, and ecological functions of floodplains, among other topics. The gap analysis matrix 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, our review identified several areas where the protection of critical areas could be improved by adding, removing, clarifying, and 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.** New code provision should be added to ensure compliance with GMA and BAS.
- **Consistency with BAS.** Code provision either does or does not, in our opinion, meet best available science or state guidance. Existing provision would result in detrimental impacts to critical areas and their functions and values.
- **Clarity/ User friendliness.** Code provision is difficult to administer due to clarity, readability, and understandability.
- **Internal consistency.** Code provision is redundant (included in multiple sections) or is located in an inappropriate section.
- **Update to reflect current City procedures.** Code provision may not accurately reflect the current administrative procedures used by City staff in implementing the CAO.

The basis for each item identified is explained in the matrix and a citation is provided where applicable. Recommendations for revising the actual code language to achieve compliance or improve consistency will be provided in a separate document, per Task 2 of our scope of work.

Overall Code Structure and Definitions

The organization and content of the City's CAO regulations in OMC 18.32 is unique compared to model codes (CTED, 2007; Bunten et al., 2012) and does not define and designate all five of the critical areas in a manner consistent with the GMA implementing rules. Per WAC 365-190-080, critical areas include the following areas and ecosystems:

(a) Wetlands;
(b) Critical aquifer recharge areas (CARAs);
(c) Fish and wildlife habitat conservation areas (FWHCAs);
(d) Frequently flooded areas; and
(e) Geologically hazardous areas.

Each critical area is defined in WAC 365-190 and some have multiple parts. For example, geologically hazardous areas are defined as "Areas that are susceptible to one or more of the following types of hazards shall be classified as a geologically hazardous area: (a) Erosion hazard; (b) Landslide hazard; (c) Seismic hazard; or (d) Areas subject to other geological events such as coal mine hazards and volcanic hazards including: mass wasting, debris flows, rock falls, and differential settlement" (WAC 365-190-120). WAC 365-190-080 also states that the definitions and guidelines in the chapter *must be considered* by the City when designating critical areas and when preparing development regulations that protect the function and values of critical areas.

Our review of OMC 18.32 finds there are gaps in regulations for certain critical areas and no explicit statement(s) noting that they are absent within the City limits (and therefore requiring no regulations in the City code). Using the geologically hazardous areas again as an example, the City's regulations address landslide hazard areas but do not address other geologically hazard areas defined in the WAC. It is possible that the coal mine hazards do not exist, but it is likely there are erosion hazard areas, seismic hazards, and volcanic hazards do exist within the City. Provisions and standards for these hazardous areas should be provided. The following table lists the GMA definitions for each type of critical area and provides a comparison with Olympia's critical areas code (OMC 18.32).

Table 1. GMA Defined Critical Areas and City Critical Areas Ordinance Categories

Critical Areas defined under GMA (WAC 365-190-080)	Olympia's Critical Areas (OMC 18.32.105)
Wetlands As defined in RCW 36.70A.030: Areas that are inundated or saturated by surface water or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from nonwetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from nonwetland areas created to mitigate conversion of wetlands.	Wetlands and Small Lakes (18.32.500-595) *Consistent with GMA definition; lakes are technically defined as FWHCAs (see section below)*
Critical Aquifer Recharge Areas (CARAs) Areas with a critical recharging effect on aquifers used for potable water are areas where an aquifer that is a source of drinking water is vulnerable to contamination that would affect the potability of the water.	Drinking Water (Wellhead) Protection Areas (18.32.200-240) *Consistent with GMA definition*
Fish and Wildlife Habitat Conservation Areas (FWHCAs) (a) Areas where endangered, threatened, and sensitive species have a primary association; (b) Habitats and species of local importance, as determined locally; (c) Commercial and recreational shellfish areas; (d) Kelp and eelgrass beds; herring, smelt, and other forage fish spawning areas; (e) Naturally occurring ponds under twenty acres and their submerged aquatic beds that provide fish or wildlife habitat;	Important Habitats and Species (18.32.300-330) Stream and Important Riparian Areas (18.32.400-445) *Consistent with GMA definition*

(f) Waters of the state; (g) Lakes, ponds, streams, and rivers planted with game fish by a governmental or tribal entity; and (h) State natural area preserves, natural resource conservation areas, and state wildlife areas.	
Frequently Flooded Areas Defined as floodplains and other areas subject to flooding perform important hydrologic functions and may present a risk to persons and property. (1) Classifications of frequently flooded areas should include, at a minimum, the 100-year flood plain designations of the Federal Emergency Management Agency and the National Flood Insurance Program. (2) Counties and cities should consider the following when designating and classifying frequently flooded areas: (a) Effects of flooding on human health and safety, and to public facilities and services; (b) Available documentation including federal, state, and local laws, regulations, and programs, local studies and maps, and federal flood insurance programs, including the provisions for urban growth areas in RCW 36.70A.110; (c) The future flow flood plain, defined as the channel of the stream and that portion of the adjoining flood plain that is necessary to contain and discharge the base flood flow at build out; (d) The potential effects of tsunami, high tides with strong winds, sea level rise, and extreme weather events, including those potentially resulting from global climate change; (e) Greater surface runoff caused by increasing impervious surfaces.	Flood Damage Prevention (16.70) *Addresses category "1" only; Frequently flooded areas are not included in Critical Areas Chapter 18.32*
Geologically Hazardous Areas Areas that are susceptible to one or more of the following types of hazards shall be classified as a geologically hazardous area: (a) Erosion hazard; (b) Landslide hazard; (c) Seismic hazard; or (d) Areas subject to other geological events such as coal mine hazards and volcanic hazards including: Mass wasting, debris flows, rock falls, and differential settlement.	Landslide Hazard Areas (OMC 18.32.600-645) *Addresses category "b" only; other geologically hazard areas are not addressed.*

The *Critical Areas Assistance Handbook: Protecting Critical Areas within the Framework of the Washington Growth Management Act* (CTED, 2007) provides a sample critical areas code that is well organized and addresses each critical area in a manner consistent with GMA. In addition, Thurston County recently updated their critical area regulations (TCC Chapter 24 Critical Areas) which addresses and defines each critical area. Both of these codes provide example language that could be used to address gaps in and add standards to Olympia's code.

Best Available Science and Code Consistency Review

The following sections highlight gaps in the current CAO and areas that are inconsistent with BAS. They also summarize key best available science documents for each critical area. A complete list of references consulted during our review is provided at the end of this memo.

Wetlands

Wetlands are specifically identified for protection as a critical area under the GMA (WAC 365-190-090). The City's current CAO provides standards for protection of wetlands in OMC 18.32.500-595. ESA's review finds that the wetlands section of the CAO needs to be updated in a few key areas to improve its consistency with BAS and current agency guidelines, as detailed in the attached matrix. A summary of key gaps are as follows (a complete list is in the attached matrix):

- Current regulations refer to outdated manuals for wetland delineation and wetland rating. These manuals have been replaced with revised and newer versions.

- Current provisions for buffer reductions with enhancement or for buffer averaging allow for more reduction and/or averaging than suggested by BAS (Bunten et al., 2012).

- Current wetland mitigation requirements do not reflect current BAS regarding wetland mitigation guidance (e.g., compensatory mitigation technical guidance, watershed-based documents, and the Credit-Debit Method) and the mitigation preference sequence.

<u>Wetland Model Code</u>

The wetland model code found in the *Critical Areas Assistance Handbook: Protecting Critical Areas Within the Framework of the Washington Growth Management Act* (CTED, 2007) was updated in 2012 to address small cities. The updated model code *Wetlands and CAO Updates: Guidance for Small Cities, Western Washington Version* (Bunten et al., 2012) and is considered Ecology's BAS for wetland regulations.

<u>Wetland Delineation and Rating</u>

In 2010, the US Army Corps of Engineers (Corps) released the *Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region* (Corps, 2010). The regional supplement updates portions of the *1987 Corps' Wetland Delineation Manual* and provides additional technical guidance and updated procedures for identifying and delineating wetlands. State law requiring the *Washington State Wetlands Identification and Delineation Manual* (Ecology, 1997) was repealed in 2011, and the state manual is no longer valid. State law now requires that wetland delineations follow the Regional Supplement (WAC 173-22-035).

Ecology released an update to the state wetland rating system, the *Washington State Wetland Rating System for Western Washington: 2014 Update* (Hruby, 2014), which went into effect January 2015. The rating system is still a four-tier system and most of the material in the 2014 updated manual remains the same as the 2004 manual. The updated wetland rating system includes a new scoring range (i.e., between 9 and 27 under the updated system versus 1 to 100 in the 2004 system) that is based on a qualitative scale of functions from high, medium, or low. The new approach to scoring wetland functions on a high, medium, or low scale is more scientifically supportable than Ecology's 2004 rating system (Hruby, 2014). The 2014 system also includes new sections for assessing a wetland's potential to provide functions and values on a landscape scale.

<u>Buffer Effectiveness</u>

The guidance document, *Wetlands in Washington State – Vol. 1 A Synthesis of the Science* (Sheldon et al., 2005), synthesizes literature related to wetland buffers and buffer effectiveness among other wetland-related topics. In 2013, Ecology published *Update on Wetland Buffers: The State of the Science, Final Report* which updated the 2005 synthesis with a literature review of scientific documents published between 2003 and 2012 (Hruby, 2013). The 2013 update reviewed each of the conclusions in the Sheldon et al. (2005) report and referenced 144 scientific articles.

The updated buffer synthesis confirmed that buffers perform an important water quality functions by trapping pollutants before they reach a wetland. Generally, the wider the buffer, the more effective it is at protecting water quality; however, recent research reveals that several other factors contribute to the effectiveness of buffers in protecting water quality functions. These factors include slope, type of vegetation, surface roughness, soil properties, and type and concentration of pollutants. Specifying only the width of a buffer as a means for protecting water quality functions can be complicated and may not address these other factors (Hruby, 2013). With respect to protecting habitat quality, research in the past decade reveals that wider buffers are needed to protect wetland-dependent species, many of which require larger areas of relatively undisturbed uplands for survival (Hruby, 2013). Previously, Sheldon et al. (2005) recommended buffer widths between 50 and 300 feet for the protection of wildlife habitat, depending on site specific factors. The more recent recommendations specify buffer widths that go beyond 300 feet for many wildlife species. The *Planner's Guide to Wetland Buffers for Local Governments* prepared by the Environmental Law Institute (42) recommends a range of 100–1000ft for wildlife, 30–100ft for sediment removal, 100-180ft for nitrogen removal, and 30-100ft for phosphorus removal.

Ecology's model code outlines a combined fixed-width and variable-width approach to wetland buffers, with a minimum buffer prescribed based on a wetland's category and an additional buffer based on increasing habitat points (Bunten et al., 2012; "Table XX.1" revised December 2014). Ecology (Bunten et al., 2013) acknowledges that in highly developed communities, such as Olympia, standard buffer widths may be difficult to achieve. When a development project requests a reduction to a standard buffer width, Ecology suggests that the local jurisdiction require documentation to demonstrate that a smaller buffer will protect wetland functions and values. Ecology also suggests that, additional mitigation measures may be necessary to ensure "no net loss" of wetland functions and values (Granger et al., 2005). Mitigation measures that can be used to protect wetlands in these instances include requiring noise-generating activities be located away from wetland, routing toxic runoff away from wetland, and planting dense native vegetation to discourage disturbance (Bunten et al., 2012; "Table XX.2"). The model code recommends that standard buffers should not be reduced below 25 percent of the standard buffer with (Bunten et al., 2012). Granger et al. (2005) notes that for some situations where the buffer is composed of non-native vegetation, and therefore providing limited functions and values, simply applying a fixed width buffer may fail to provide the necessary characteristics to protect a wetland's functions. In these cases, it can be better to restore the buffer through enhancement activities.

Mitigation for Wetland Impacts

One of the topics that has evolved the most since Olympia's last code update is wetland mitigation. Mitigation includes avoiding, minimizing, rectifying, reducing, and compensating for impacts. According to data analyzed by the National Research Council (NRC), compensatory mitigation efforts, particularly on-site mitigation installed by the permittee, have poor success rates and have not achieved the national policy of "no net loss" of wetland area and functions (NRC, 2001).

To address these mitigation deficiencies, in early 2008 the Corps and Environmental Protection Agency (EPA) released revised regulations governing compensatory mitigation for authorized impacts to waters of the US, including wetlands. The Federal Rule, formally known as the *Compensatory Mitigation for losses of Aquatic Resources; Final Rule*, lays out criteria and performance standards designed to improve the success and quality of mitigation activities (Corps, 2008).

The 2008 Rule outlines a mitigation hierarchy, with preference for formally-approved mitigation banks over ILF programs and ILF programs over permittee-responsible mitigation (mitigation performed by a private party, usually the permit applicant). These different forms of mitigation are defined as follows:

- *Mitigation Banks*— restoring, establishing, enhancing, and/or preserving aquatic resources through funds paid to a public or private Sponsor to satisfy compensatory mitigation requirements for Corps permits. At banks, the Sponsor has already secured a mitigation site and initiated mitigation activities before fees are accepted. Typically, mitigation banks exist at one location and the Corps does not have authority over bank expenditures.
- *In-Lieu Fee (ILF) Programs*—restoring, establishing, enhancing, and/or preserving aquatic resources through funds paid to a governmental or non-profit natural resources management entity to satisfy compensatory mitigation requirements for Corps permits. In-lieu fee programs accept mitigation fees before securing and implementing projects. These programs implement mitigation at multiple sites as funds become available and after the Corps approves project funding.
- *Permittee-responsible Mitigation using a Watershed Approach* – when a mitigation bank or ILF program is not available, then a permittee-responsible mitigation may be considered using a watershed approach. The goal is to maintain and improve the quality and quantity of aquatic resources within the watershed where the impact occurs through meaningful mitigation constructed by the project applicant.

Alternative forms of mitigation do not change the requirements for permit applicants to follow the prescribed "mitigation sequence" of avoid, minimize, rectify, reduce, and compensate for impacts. Each of these steps still is required, but the above types of compensatory mitigation must be used, if available, instead of traditional on-site mitigation projects. In 2015, the Corps permit system was analyzed to determine how the 2008 Rule has affected the number or type of compensatory mitigation projects (IWR 2015). The report states that over the past 5 years, the Corps issued 56,400 permits or authorizations each year nationally, with only 10% of these authorizations actually requiring compensatory mitigation. As a result of the 2008 rule, project impacts are being avoided and minimized with fewer projects requiring compensatory mitigation at banks.

Currently in Olympia, there are no formally-approved mitigation banks or ILF programs. Thurston County is in the process of developing an ILF program, but it will not likely be approved and functioning for some time. Therefore, permittee-responsible mitigation is likely to be the most common approach to compensating for unavoidable impacts to wetlands associated with development in Olympia. To meet the requirements of the 2008 Mitigation Rule, the applicant must demonstrate that the mitigation project uses a watershed approach.

Other BAS for compensatory mitigation is provided in a two-part guidance document published by Ecology, in coordination with the Corps and EPA. The document was intended to improve the quality, consistency, and effectiveness of compensatory mitigation in Washington State. Part 1 of the document, *Wetland Mitigation in Washington State—Part 1: Agency Policies and Guidance* (Ecology Publication #06-06-011a, March 2006a), provides regulatory background and outlines information that regulatory agencies use. Some of this information has been superseded by the 2008 Federal Rule; however, the wetland mitigation ratio recommendations are still pertinent. Part 2 of the document, *Wetland Mitigation in Washington State—Part 2: Developing Mitigation Plans* (Ecology Publication #06-06-011b, March 2006b) provides specific technical guidance on developing a compensatory wetland mitigation plan.

<u>Mitigation Ratios</u>

Ecology's *Guidance for Protecting and Managing Wetlands* (Granger et al. 2005) provides current BAS guidance on ratios for compensatory mitigation which are used by most local jurisdictions including the City of Olympia (Appendix 8-C). As an alternative to using mitigation ratios, Ecology developed *Calculating Credits and Debits for Compensatory Mitigation in Wetlands of Western Washington* (Hruby, 2012) as a tool for determining how much compensatory mitigation is needed to replace lost wetland functions and values. Termed the "Credit-Debit Method," this manual uses a functions- and values-based approached to score functions lost at the project site (i.e., "Debits") compared to functions gained at a mitigation site (i.e., "Credits"). A mitigation project is considered successful when the "credit" score for a compensatory mitigation project is higher than the "debit" score. Based on our local experience, the Corps and Ecology are increasingly relying on the Credit-Debit Method instead of mitigation ratios alone.

Fish and Wildlife Habitat Conservation Areas

Fish and wildlife habitat conservation areas (FWHCAs) are specifically identified for protection as a critical area under the GMA (WAC 365-190-130). The current CAO provides standards for protection of fish and wildlife habitat conservation areas in two sections of OMC 18.32: Important Habitats and Species (18.32.300-330) and Streams and Important Riparian Areas (18.32.400-445). Our review of these sections identified the following key gaps or inconsistencies (a complete list is in the attached matrix):

- Stream typing system and definitions adopted in the CAO refer to an outdated state stream typing system and are not fully consistent with current City procedures as directed in City memo (Stahley, 2010).
- Current buffer widths specific to streams that occur within deep ravines (>10 feet depth) may be below BAS-recommended buffers if salmonids are present.
- Current buffer reduction allowances on streams using enhancement or buffer averaging provide a greater degree of buffer width reduction (or averaging) than recommended by BAS (Bunten et al., 2012).

Stream Typing

Under state law (RCW 90.48.020), waters of the state include lakes, rivers, ponds, streams, inland waters, underground waters, salt waters and all other surface waters and watercourses. Streams also fall under the GMA definition of "fish and wildlife habitat conservation areas" and state law refers to the use of the Washington Department of Natural Resources (DNR) stream typing system in Title 222 WAC, the forest practices regulations.

The stream typing system codified in OMC 18.32.410 refers to the outdated numeric DNR Stream Typing System. However, in 2010 the City produced a memo regarding the interpretation of OMC 18.32.410, which directed code administrators to follow the WAC definitions and the current DNR classification system (Stahley, 2010). The interpretation was needed to resolve ambiguity and make it clear that the City has adopted and intends to use the State's current definitions and typing system.

Buffer Widths

The recent WDFW publications mentioned above (Knight, 2009 and WDFW, 2009) do not provide any new or updated science on stream buffers and recommended widths. In general, the most recent recommendations for stream buffer widths vary from 75 feet to well over 300 feet to protect a suite of riparian ecological functions (Brennan et al., 2009; May, 2003; Knutson and Naef, 1997). Some of these riparian ecological functions (e.g., elk habitat, migratory corridors, and protections for specific priority species) may not be applicable to the urban or suburban land use setting. Specific to salmonids, Ecology has published guidance on minimum riparian buffer widths for implementing riparian restoration or planting projects that use water quality-related state and federal pass-through grants or loans (Appendix L in Ecology, 2013). The buffer widths are recommended by the National Marine Fisheries Service (NMFS) to help protect and recover Washington's salmon populations. NMFS recommends a 100-foot minimum buffer for surface waters that are currently or historically accessed by anadromous or listed fish species and a 50-foot buffer for surfaces that do not have current or historical access.

Salmon and Fish Habitat and Biodiversity

State, federal, and tribal agencies have prepared many of the latest documents pertaining to fish and wildlife habitat conservation areas. Much of this science is related to protecting salmon and fish habitat. In 2009, the Washington Department of Fish and Wildlife (WDFW) published *Land Use Planning for Salmon, Steelhead and Trout: A Land Use Planner's Guide to Salmonid Habitat Protection and Recovery* as part of an initiative to integrate local planning programs with salmon recovery efforts (Knight, 2009). The guidance provides science-based management recommendations in the form of model policies and regulations to be used by local jurisdictions during GMA and SMA planning and periodic updates. Recommendations are organized by topic areas that include specialized management programs (e.g., stormwater) or habitat elements (e.g., nearshore areas) to protect salmonid habitat function from development impacts.

Another WDFW document relates to managing biodiversity and habitat quality in developing areas and is called *Landscape Planning for Washington's Wildlife: Managing for Biodiversity in Developing Areas* (WDFW, 2009). The document provides information to planners and others that can be used to minimize the impacts of development to wildlife and to conserve biodiversity. It includes science-based recommendations regarding planning for biodiversity at the watershed scale and at the site and sub-division scale including habitat management plans (HMP) and vegetation plans.

Wildlife Habitat Connectivity

Research related to general wildlife habitat connectivity indicates that connectivity is important for species to travel and carry out life processes. Research concludes that stream/riparian buffers alone will not be enough to protect certain species and that a broader approach to protecting wildlife is needed, especially in areas that are intensely developed (Hruby, 2013; Semlitsch and Jensen, 2001). Small mammals, amphibians, and reptiles are generally more sensitive to changes and gaps in connectivity compared to larger mammals and birds (WDFW, 2009). Areas with less than 50 percent undisturbed land cover (i.e., developed urban environments) need assistance to ensure that habitat connectivity is maintained (WDFW, 2009). In addition to using local critical areas inventory information and Priority Habitats and Species (PHS) data, WDFW recommends protecting large undeveloped habitat patches and open space areas as part of planning and building habitat corridors (WDFW, 2009). Habitat corridor widths greater than 1,000 feet generally provide the most benefit for the most species (WDFW, 2009).

Frequently Flooded Areas

Frequently flooded areas are specifically identified for protection as a critical area under the GMA (WAC 365-190-110). The current CAO regulations do not identify or address frequently flooded areas as critical areas. However, the City does have flood damage prevention regulations that meet minimum NFIP and Washington State criteria, adopted as OMC 16.70. Our review of this chapter identified the following key gaps (a complete list is in the attached matrix):

- Current flood hazard regulations do not go beyond the FEMA minimum requirements for floodplain management as recommended by Ecology and BAS.

- Current flood hazard regulations focus chiefly from the perspective of flood effects on human health, safety, and property, and the effects of human activities on flooding. As discussed below, floodplains perform a variety of beneficial functions and recent BAS and guidance from state and federal agencies emphasize ecological functions.
- The City's updated SMP proposes increased restrictions on development and redevelopment that apply to floodplains and frequently flooded areas within in the shoreline jurisdiction only and not to other floodplains in the City.

Ecology and FEMA Guidance

In 2015, Ecology released *Guidance to Local Governments on Frequently Flooded Areas Updates in CAOs* that contains a useful summary of BAS sources for updating the designation and mapping of frequently flooded areas and new information that focuses on improving habitat in floodplains (Ecology, 2015). As noted in Ecology (2015), Ecology and FEMA encourage local governments to go beyond the FEMA minimum requirements for floodplain management, whenever possible. Greater protection from floods may be a policy objective that should be incorporated into a local jurisdiction's critical areas regulations. For example, some jurisdictions use the "flood of record" elevations to regulate the minimum elevation of structures, where the record flood is higher than the 100-year flood elevation used by FEMA (called the Base Flood Elevation [BFE]). Additionally, some jurisdictions require that structures be built two (or three) feet above the BFE or flood of record, rather than the minimum FEMA standards.

Ecological Functions of Floodplains

Due to the 2009 Biological Opinion (BiOp) by the National Marine Fisheries Service (NMFS) regarding protection of some federally listed species under the Endangered Species Act, there is a requirement by FEMA to assess the effects of floodplain development on habitat used by listed species. This new standard for protection is now required for National Flood Insurance Program (NFIP) participating communities (NMFS 2009; FEMA 2013). Although limited in Olympia, floodplains perform a variety of beneficial functions including providing for natural flood and erosion control, water quality maintenance, groundwater recharge, biological productivity, fish and wildlife habitat (Steiger et al., 2005), production of wild and cultivated products, recreational opportunities, and areas for scientific study and outdoor recreation (Kusler, 2011). Floodplains typically contain several major types of habitats including aquatic, riparian, wetland, and upland habitat. Thus, recent BAS and regional guidance for protection of ecological functions within a floodplain emphasize the importance of other critical areas (including wetlands, streams, riparian areas, and FWHCAs) within floodplains, and emphasizes the need to protect these areas from development (PSP, 2010; NMFS, 2009).

Relationship to SMP

The majority of the City's marine shorelines are within the 100-year floodplain designated by FEMA and activities occurring in this zone are regulated under the City's SMP (OMC 14.08). The City's updated SMP includes proposed standards that restrict development and redevelopment from occurring where it would require structural flood hazard reduction measures. Further, the updated SMP only permits structural flood control works when necessary to protect health/safety or existing development, and only when documented that permitted facilities would not result in a net loss of ecological functions.

Critical Aquifer Recharge Areas

Critical aquifer recharge areas (CARAs) are specifically identified as a critical area under the GMA (WAC 365-190-100). Currently, the City does not identify or designate CARAs as critical areas, but the City does map and regulate uses within "wellhead" protection areas per state drinking water regulations (OMC 18.32.200-240). The regulations for drinking water protection areas appear to be in compliance with state law and consistent with BAS. The following paragraphs describe the City's approach to CARAs and summarize important BAS sources for CARA protection.

Wellhead Protection Areas as CARAs

The City has noted that it has not defined CARAs thus far, relying on the identified wellhead protection areas to serve the same purpose (Buxton, pers. comm. 2016). This approach is only adequate if the City has conducted reviews of the surface geology and soil conditions within its UGA and determined that aquifer susceptibility to surface contamination is low. This type of evaluation can identify areas where underlying soils and geologic conditions allow for groundwater recharge (and correspondingly have a higher chance for contamination). CARA mapping has been completed for Thurston County, including the City's urban growth area. Areas of "extreme" aquifer susceptibility are mapped by the County as occurring near the City limits indicating similar unmapped areas of aquifer susceptibility may be present in the City.

Preventing Contamination of Drinking Water

In 2015, City of Olympia drinking water was supplied by the new McAllister Wellfield (78% of total supply) and three additional groundwater sources. Three other wells are on standby as additional water sources. The Washington State Department of Health (DOH) assessed the susceptibility of Olympia's water sources to risk of contamination and determined that the McAllister Wellfield, Hoffman, and Indian Summer wells as having low risk; the Allison Springs wells as having moderate risk; and the Shana Park well as being at high risk of potential contamination (Olympia, 2016).

Drinking water wells are at risk of contamination from road spills, storm water, septic systems and hazardous materials, including pesticides and fertilizers (Olympia, 2016). Preventing contamination is necessary to maintain groundwater drinking supplies and to avoid extreme costs (or the loss of resource) necessary if contamination were to occur (CTED, 2007). Depending upon which wellhead protection zone the proposed development resides, varying levels of protection and limitations of use are prescribed by the state DOH and incorporated into the City's regulations.

BAS recommendations specific to minimizing the potential for aquifer contamination have not changed significantly in the last ten years, and remain focused on ensuring that uses and activities with higher potential for contamination are appropriately evaluated (or prohibited) when occurring in areas with high vulnerability. In 2005, Ecology published guidance to assist local jurisdictions with developing protection measures in their CAO. The publication *Critical Aquifer Recharge Areas – Guidance Document* includes an 8-step process for identifying, characterizing, and managing groundwater withdrawals and recharge impacts (Ecology, 2005). The guidance also includes BAS sources for protecting CARAs.

Geologically Hazardous Areas

Geologically hazardous areas are specifically identified as a critical area under the GMA (WAC 365-190-120) and notes four categories; erosion hazards, landslide hazards, seismic hazards, and areas subject to other geological events such as coal mine hazards and volcanic hazards. Olympia's critical areas code identifies regulations for only two of the four these categories of geologic hazards: erosion and landslide hazards. However, for erosion hazards, OMC13.16 Erosion Hazard Areas is referenced, which does not provide any specific provisions for erosion hazard areas and only references the Drainage Design and Erosion Control Manual for Olympia, 2009 for guidance. Our review found that the code needs to be updated in a few key areas to improve its consistency with the GMA, BAS literature, and current agency guidelines, as detailed in the attached matrix. A summary of key gaps follows:

- Current regulations address some but not all of the geologically hazardous area categories designated by the GMA and its implementing regulations as "critical areas."
- Current regulations do not prescribe a minimum factor of safety for development on or near steep slopes.
- Current buffers for landslide hazard area are below minimum standards recommended by BAS.

Classifying Slope Stability

The main updates to science regarding geologic hazards involve standards of regional (Puget Sound area) practice. Although not required by state law, the current practice for the region is to classify steep slope stability by setting minimum factors of safety for development. The WSDOT Geotechnical Design Manual (2015) requires a factor of safety of 1.5 for slopes with existing structures on or near the top of the slope or structures that could be impacted downslope. For non-critical hazards, the factors of safety are 1.25. As a reference, the Pierce County Code (Chapter 18E.80.020C2c) has minimum factors of safety of 1.5 static and 1.1 seismic. City codes such as City of Bellevue require factors of safety of 1.5 for static and 1.15 for seismic (1.4 and 1.1 for non-critical slopes) and Bothell is 1.5 static and 1.2 seismic.

Landslide Hazard Area Buffers

Current best practice for the region is to require a minimum 50-foot buffer around landslide hazard areas. This buffer can be reduced when supported by the judgement of a geotechnical professional. Neighboring jurisdictions Thurston County, Pierce County, and King County recommend a 50-foot landslide hazard area of buffer.

Mapping

The United States Geological Society (USGS) updated seismic hazard mapping for Olympia in 2014 and they show similar peak ground acceleration risk as previous mappings in 2008 (http://earthquake.usgs.gov/hazards/products/conterminous/). The updated maps represent an assessment of the best available science in earthquake hazards and incorporate new findings on earthquake ground shaking, faults, and seismicity. The USGS website has tools to customize the Peak Ground Acceleration maps for various return periods and create a seismic hazard map for a specific site (http://earthquake.usgs.gov/hazards/apps/). The 2012 International Building Code utilizes this USGS hazard data in its seismic code.

The availability of LiDAR (light detection and ranging) imagery is considered a recent source of best available science for geologic hazards. The LiDAR data should provide a clearer means of identifying potential landslide hazard areas as steep slopes potentially subject to landslides can be readily identified.

Reporting

In 2006, the Washington State Geologist Licensing Board prepared *Guidelines for Preparing Engineering Geology Reports in Washington* (DOL, 2006). The guidelines were intended to improve the quality and consistency of engineering geology reports in Washington. It includes reference guidance for preparation and also review of geologic reports and can be utilized for simplifying code language regarding geology hazard reports.

Assessment of Critical Area Inventory Maps

The City provided ESA with the most up-to-date GIS data for critical areas mapping. ESA reviewed each data source as indicated in the table below. Upon initial review, the City has complete and reliable data for some critical areas including fish and wildlife habitat conservation areas (streams) and wetlands. However, mapping for other critical areas is missing or incomplete. For example, the City uses soils data to map steep slopes, but has not mapped any seismic hazards, severe erosion hazard areas, landslide hazards, or subsidence hazards (if present). In addition, the City relies on the National Wetland Inventory (NWI) and does not maintain any local mapping of delineated or potential wetlands.

Table 1. Summary of GIS Data Layers Related to Critical Areas

Critical Area	Data Data Layer Name	Source	Notes
Wetlands	National Wetland Inventory (clip) Layer: Wetlands_NWI_nwipoly_sv	USFWS	National Wetland Inventory (NWI) data is out-dated and incomplete compared to a locally-derived wetland inventory or data source if available.
Fish and Wildlife Habitats	City created layer of streams Layer: City_Streams	City	City maintains stream data layer that appears complete and is reliable. City has multiple data layers for fish presence that appear complete. No data layer exists that maps "important riparian areas" No data layer exists that maps "lakes" Many of the data layers provided are relevant to FWHCAs that occur in shoreline jurisdiction (e.g., PHS smelt, rocksole presence).
	Bald eagle territory Layer: DFW_baldeagle_bf	WDFW	
	Fish bearing streams by water type Layer: Wildfish_Fish_Bearing_tc_watertyping	Wildfish Conservancy	
	Fish distribution Layer: DFW_fishdist_sv	WDFW	
	Fish distribution (SASI database) Layer: DFW_sasi	WDFW	
	Fish bearing streams (DNR) Layer: DNR_Fish_Bearing_Streams	WDNR	
	WDFW PHS observation points Layer: HabitatDFWObservationAreas	WDFW	
	WDFW PHS habitat polygons Layer: HabitatDFWPrioritySpecies	WDFW	
	Forage fish survey locations Layer: DFW_forage_fish_survey_pts	WDFW	
	WDFW PHS smelt spawning areas Layer: DFW_doc_smelt_spawning	WDFW	
	Rocksole presence Layer: DFW_rocksole	WDFW	
Frequently Flooded Areas	Flood hazards Layer: FloodHazardsWSDOT1997	WSDOT	Flood zones appears to be FEMA 2012 DFIRM data and therefore sufficient. WSDOT layer is a buffered data set with polygons and 300-foot buffer. Unknown use.
	Flood zones Layer: FloodZones2012	FEMA	
Critical Aquifer Recharge Areas	None provided. Map viewed on City website		City maintains a data layer showing wellhead protection areas that appears complete.
Geologically Hazardous Areas	Soil survey data (SSURGO) Layer: Steep_Slopes_USGS_soils	USDA	City uses USDA soils data to map steep slopes in the City.

Next Steps

The attached matrix contains a variety of gaps or missing provisions in the City's code. Once the City has reviewed the list and determined how best to address the identified gaps, ESA will provide recommendations for revising the code. Our recommendations will include specific code language where applicable. We anticipate the City will want to discuss some of the gaps prior to the recommendation work and this step will allow time for communication.

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