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Subject: City of Enumclaw Comprehensive Plan Update, Critical Areas Best Available Science

In 1995, an amendment to the Washington State Growth Management Act (GMA) (as detailed in Revised Code of Washington 30.70A.172) mandated that cities shall use "Best Available Science" (BAS) when developing policies and regulations to protect critical areas and give "special consideration" to "measures necessary to preserve or enhance anadromous fisheries." The GMA identifies the five following critical areas:

- Wetlands
- Critical Aquifer Recharge Areas
- Frequently Flooded Areas
- Geologically Hazardous Areas
- Fish and Wildlife Habitat Conservation Areas

This technical memorandum summarizes, and provides references to BAS, for each critical area identified by the GMA for use in the City of Enumclaw's (City's) Comprehensive Plan update.

1. Wetlands

a. Definition

Wetlands function at both a landscape and site scale to improve water quality and flood storage, and they serve as valuable habitat for plants and animals (Shelton et al. 2005). These functions are particularly valuable in urban settings; though urbanization has the potential to stress and degrade wetland systems. Per Enumclaw Municipal Code (EMC) 15.05, "regulated wetlands" are defined as the following:

Ponds 20 acres of less, including their submerged aquatic beds, and those lands defined as wetlands under the Federal Clean Water Act, 33 USC Section 1251 et seq., and rules promulgated pursuant thereto, and be those areas that are inundated or saturated by surface or ground water 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. Regulated wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands created as mitigation and wetlands modified for approved land use activities shall be considered as regulated wetlands. Regulated wetlands do not include those artificial wetlands intentionally

created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities. The applicant shall bear the burden of proving that the site was not previously a wetland. For identifying and delineating a regulated wetland, Enumclaw shall use the Federal Clean Water Act, 33 USC Section 1251 et seq., wetlands definition, and utilize identification and delineation criteria as currently used by the Department of Ecology.

b. Best Available Science

BAS for wetlands in Washington State is based on a two-volume document developed by Washington's Department of Ecology (Ecology) and Washington Department of Fish and Wildlife (WDFW) titled, *Wetlands in Washington State; Volume 1: A Synthesis of Science* and *Wetlands in Washington State* (Sheldon et al. 2005) and *Wetlands in Washington State; Volume 2: Guidance for Protecting and Managing Wetlands* (Granger et al. 2005).

Wetlands perform valuable functions that can be grouped into three categories: functions that improve water quality (for example, nutrient cycling, removing sediment, and sediment/toxicant retention), functions that alter flow patterns within a watershed (for example, flood control and groundwater recharge/discharge), and functions that provide habitat for plants and wildlife (including wetland-associated mammals, anadromous and resident fish, migratory and resident birds, amphibians, and invertebrates) (Sheldon et al. 2005).

Ecology has produced the *Washington State Wetland Rating System for Western Washington 2014 Update* using BAS to classify wetlands based on their functions, sensitivity to disturbance, importance, uniqueness, and capacity to be replaced (2014). The Washington State wetland rating system designates wetlands as Category I, Category II, Category III, and Category IV as follows:

- Category I—Category I wetlands are defined by several criteria. They are unique or rare, exhibit a higher level of sensitivity to disturbance compared to most wetlands, are relatively undisturbed, possess ecological characteristics that cannot be replicated within a human lifetime, or provide a high level of functions.
- Category II—Category II wetlands are challenging but not impossible to replace and provide elevated levels of some functions.
- Category III—Category III wetlands provide a moderate level of functions (scoring between 16 and 19 points using the Washington State wetland rating system), can usually be sufficiently replaced with a carefully considered mitigation plan, or are interdunal wetlands between 0.1 and 1-acre in size.
- Category IV—Category IV wetlands exhibit the lowest level of functions (scoring less than 16 points) and are generally severely disturbed. In most cases, these wetlands are replaceable and improvable.

Wetland buffers are vegetated areas directly adjacent to wetlands. These buffers can reduce the impacts to wetlands from adjacent land uses through physical, chemical, or biological processes (Hruby 2013). Buffers also offer terrestrial habitat for species that are primarily aquatic but require terrestrial environments for their survival, such as amphibians. Requiring specific buffer widths is one of the methods employed by local jurisdictions to preserve the functions and values of wetlands.

Ecology's *Update on Wetland Buffers: The State of the Science, Final Report* (updated in 2014) and Appendix 8-C of *Wetlands in Washington State; Volume 2: Guidance for Protecting and Managing Wetlands* (hereafter referred to as Appendix 8-C) provides BAS related to wetland buffers and their regulation (Hruby 2013; Granger et al. 2005). Appendix 8-C proposes the following three alternatives, along with a second option for Alternative 3, to determine buffer widths:

- Alternative 1—This is the most conservative buffer approach with the widest buffer widths. It is based only on the wetland category as determined by the revised Wetland Rating System (Ecology 2014).
- Alternative 2—This approach bases wetland buffer widths on both the wetland category and intensity of adjacent land use (that is, low, medium, and high).
- Alternative 3—This alternative considers the wetland category, intensity of adjacent land, and the habitat function of the wetland (low, medium, or high). Alternative 3 also distinguishes Category I or II wetlands that are rare or unique (such as interdunal or estuarine wetlands).
- Alternative 3A—This approach determines buffer widths using a graduated scale, where buffer width increases for each one-point increment in the habitat score (rather than categorizing habitat scores as low, moderate, or high).

c. Recommendations

The City has adopted the most recent Washington Wetland Rating system; however, the method to determine buffer widths found in EMC 19.02.090.C has not been updated and is inconsistent with Appendix 8-C.

It is recommended that the City adopt the Alternative 3 methodology outlined by Ecology since it offers clear and adaptable buffer width standards based on the category and functions of the wetland and the proposed land use. This is the buffer width methodology used by other local jurisdictions, including (but not limited to) King County, Pierce County, Buckley, Black Diamond, and Tacoma.

2. Critical Aquifer Recharge Areas

a. Definition

Critical aquifer recharge areas are intended to protect groundwater that serves as a supply for drinking water and freshwater for streams, lakes, estuaries, wetlands, and springs and the ecosystems that these areas support (EPA 1995). Per EMC 15.05, critical aquifer recharge areas are defined as the following:

> *"…those areas that have been identified as having a critical recharging effect on aquifer use for potable water in community water systems."*

Critical aquifer recharge areas are categorized as the following by the City according to EMC 19.02.080:

- *Category I critical aquifer recharge areas include those mapped areas that Enumclaw has determined are highly susceptible to ground water contamination and that are located within a sole source aquifer or a wellhead protection area;*
- *Category II critical aquifer recharge areas include those mapped areas that Enumclaw has determined:*
    - *Have a medium susceptibility to ground water contamination and are located in a sole source aquifer or a wellhead protection area; or*
    - *Are highly susceptible to ground water contamination and are not located in a sole source aquifer or wellhead protection area*
- *Category III critical aquifer recharge areas include those mapped areas that Enumclaw has determined have low susceptibility to ground water*

b. Best Available Science

Aquifer recharge occurs when precipitation, infiltration from water bodies (such as lakes, wetlands, streams, and irrigation), or snowmelt seeps into the ground, contributing to the underground water supply available for wells (Ecology 2021). Contrastingly, discharge areas are locations where groundwater intersects the ground surface and flows out through sources such as wetlands, streams, lakes, estuaries, or ocean shores. Additionally, wells, particularly those employed by municipalities to extract larger volumes of water, can function as discharge areas.

Aquifers occur as either confined or unconfined sources of ground water. In an unconfined aquifer, the water table is the upper boundary, with no intervening aquitard (i.e., a geologic formation that does not readily transmit water) or aquiclude (i.e., a geologic formation allowing for the transmission of water) between the water and the ground surface. Conversely, a confined aquifer is located deeper underground and is separated from the surface by an aquitard or aquiclude. As water works its way down from the ground surface, it is unable to enter a confined aquifer because an impermeable material, such as clay or rock, blocks it. Much of the Enumclaw area has an unconfined aquifer over another confined aquifer because the Osceola mudflow is impervious. This creates a high water table (i.e., unconfined aquifer) near the surface.

The vulnerability of an aquifer is based on its susceptibility to contamination and the quantity of contaminants present. An aquifer's susceptibility relates to the ease through which water can infiltrate from the surface into the aquifer (Cleary and Cleary 1991). In practice, this means a highly susceptible aquifer (that is, one that readily receives water) is prone to contamination, dependent on the contaminants present. Contaminant loading measures the amount of contaminants in an aquifer's recharge areas. Contaminants can include chemicals used in industrial or household applications (if improperly used) and some naturally occurring sources like saltwater.

c. Recommendations

The City has categorized critical aquifer recharge areas (CARAs) in relation to their susceptibility to contamination and contaminant loading and CARAs have been mapped per these definitions. These CARAs areas are identified via publicly available maps and by the City's Water System Comprehensive Plan. The City should evaluate Activities that pose contamination risks or withdrawals that threaten future supply (for drinking water, streams, and wetlands) and they should be called out within EMC Article IV. *Development for Critical Areas*.

3. Frequently Flooded Areas

a. City of Enumclaw Definition

Frequently flooded are floodplains and flood prone areas that represent a benefit to Enumclaw residents and fish and wildlife in terms of habitat; however, they can also pose a potential risk to public safety. According to WAC 365-190-030(8), frequently flooded areas include, but are not limited to, streams, rivers, lakes, coastal areas, wetlands, and areas where high groundwater forms ponds on the ground surface. Frequently flooded areas are regulated to manage potential risk to public safety and, per EMC 15.04, are defined as the following:

> *"Floodplains and other areas subject to a one percent or greater chance of flooding in any given year."*

b. Best Available Science

Flooding is a naturally occurring process that leads to the formation of floodplains. When flood waters overtop streambanks, the velocity of the water outside of the channel slows compared to the velocity of the stream. This results in the deposition of sediment carried by the overflow, which contributes to the creation of a floodplain (Dunne and Leopold 1978; Knighton 1998). Floodplains provide numerous valuable functions, including flood storage; flood conveyance; reduction of excessive erosion; reduction of sediment deposition into waterbodies; groundwater recharge and discharge; interception and treatment pollutants; fish, wildlife, and plant habitat; carbon sequestration; micro-climate modification; and recreational and educational opportunities (Kusler 2011).

Floodplain management typically focuses on a no adverse impact strategy. In practice, this means a floodplain property owner is responsible for ensuring their land use activities do not

negatively impact onsite flood storage or increase flood risk to neighboring areas (ASFPM 2003). This strategy is often implemented by requiring no net increase in flood elevations, which helps protect floodplain functions and promotes floodplain restoration (like reconnecting side channels and reducing armoring).

c. Recommendations

- Risk and hazards associated with frequently flooded areas can be reduced by adopting land use policies that encourage development outside of mapped floodplains.

4. Geologically Hazardous Areas

a. Definition

Geologically hazardous areas are areas where the potential for erosion, landslides, earthquakes, or other geological events make them unsuitable for locating development in alignment with public health and safety considerations. Per EMC 19.02.070, the City has determined that three of the geologically hazardous areas listed in WAC 365-190-120 are "relevant to the city." These are erosion hazard areas, landslide hazard areas, and seismic hazard areas. The other geologic hazard areas described in WAC 365-190-120 are volcanic hazard areas and mine hazard areas. Per EMC 19.02.070, the City erosion hazard areas and landslide hazard areas are defined as the following:

- Erosion hazard area—*Areas identified as having high or very high water erosion hazard by the U.S. Department of Agricultural Soil Conservation Service as supplied by the SCS office*
- Landslide hazard area—*Areas potentially subject to landslides based upon the following combination of geologic, topographic and hydrologic factors:*
    - *Areas of historic failing including:*
        - *Those areas delineated by the U.S. Department of Agriculture Soil Conservation Service as having "severe" limitations for building site development;*
        - *Those areas mapped as quaternary slumps, earthflows, mudflows, lahars, or landslides on maps published by the U.S. Geological Survey or Department of Natural Resources Division of Geology and Earth Resources;*
        - *Areas with all three of the following characteristics:*
            - *Slopes of 15 percent gradient or greater; and*
            - *Hillsides intersecting geologic contacts with a relatively permeable sediment overlaying a relatively impermeable sediment or bedrock; and*

- *Springs or ground water seepage;*

- *Areas that have shown movement during the Holocene Epoch or which are underlain or covered by mass wastage debris of the epoch;*
- *Slopes that are parallel or subparallel to planes or weakness in subsurface materials;*
- *Privately owned areas with slopes that have gradients greater than 80 percent subject to rock fall during seismic shaking*

EMC 19.02.070 does not define or outline how to identify seismic hazard areas.

b. Best Available Science

- Erosion hazard area—Within the City, erosion hazard areas are most likely to occur within riverine environments, where erosion is usually related to the channel migration zone (Newman 2018). Channel migration zones are where a stream or river is expected to move naturally over time, within the floodplain.

  While erosion is a natural process, excessive erosion (which can be caused by anthropogenic effects such as vegetation clearing, redirection of drainage, and new impervious surface resulting in increased surface water runoff) and associated sediment deposition can detrimentally impact stream channels, shorelines, and the flora and fauna that use these systems (Booth 1990; Booth 1991; Nelson and Booth 2002). The magnitude of erosion hazard can be impacted by soil type, topography, vegetation, rainfall, and surrounding land use and development activity.

- Landslide hazard areas—Landslides encompass a variety of processes that involve the downward and outward movement (such as, sliding, toppling, falling, or spreading) of materials that compose slopes (USGS 2004). While landslides are a natural process that help deliver woody material and gravel to streams, they pose a significant threat to human safety and development.

  Three landslide types are common within the Puget Sound region and include rapid-shallow landslides, block fall landslides, and deep-seated landslides (King County 2004). The most commonly observed type of landslide is the rapid-shallow landslide that usually occur in response to heavy rainfall (Tubbs 1974; Thorsen 1987). This is because past glacial deposits in the region have often resulted in surface layers that are more permeable than the underlaying material (often bedrock), leading to water perching between the two layers. When heavy precipitation events occur, the permeable upper layer is rapidly infiltrated, while the lower layer remains stable, causing the upper layer to slide over it (USGS 2004; Varnes 1978). Block fall landslides are more common where the base of a slope has eroded due to streamflow or wave energy, while deep-seated landslides involve the movement of substantial blocks of soil and underlying substrate.

Vegetation can help to protect slope stability by reducing erosion, strengthening the soils through their root systems, and intercepting rainfall—all of which inhibit landslides. (Schmidt et al. 2001; Myers 1993).

- Seismic hazard areas—WAC 365-190-030(18) and 190-120(7) describe seismic hazard areas as those "*subject to severe risk of damage as a result of earthquake induced ground shaking, slope failure, settlement or subsidence, soil liquefaction, surface faulting, debris flows, lahars, or tsunamis*." Areas with the greatest risks associated with seismic activity (including settlement and soil liquefaction) are underlain by low density, cohesionless soils, and usually associated with a shallow groundwater table (Newman 2018). Seismic activity can cause direct and indirect damage through ground shaking, surface faulting, subsidence and uplift, ground failure, landslides, liquefaction, differential compaction, and water waves (Newman 2018; King County 2004).

  The City is within the Puget Sound Lowlands, which lies within the Cascadia Subduction Zone (CSZ). The CSZ is made up of a series of tectonic plates that cause daily seismic activity (mostly undetectable) and has the potential to cause a large thrust earthquake in the future (possibly as large as Magnitude 9.0 [King County 2004; Stanley et al. 1999]). Additionally, the Tacoma Fault, Seattle Fault, and Western Rainier Seismic Zone are in proximity to the City (WDNR 2023).

  The Washington Geological Survey (a branch of WDNR) maintains the Washington Geologic Information Portal, which provides mapping of active faults, liquefaction susceptibility, seismic site class (which denotes how the ground will respond to seismic shaking, used to determine required levels of construction), and locations/records of historical earthquake damage (WDNR 2023). This resource shows that most of the City lies within predicted 7.0 shaking intensity (also known as Modified Mercalli Intensity) areas associated with the CSZ, Tacoma Fault, and Seattle Fault.

c. Recommendations

- Unlike erosion hazard areas and landslide hazard areas, there is not a clear definition within EMC 19.02.070 for seismic hazard areas. Consider elaborating on how to identify a seismic hazard area, such as the definition presented in King County Code 21A.06.1045: "*Seismic hazard area: an area subject to severe risk of earthquake damage from seismically induced settlement or lateral spreading as a result of soil liquefaction in an area underlain by cohesionless soils of low density and usually in association with a shallow groundwater table.*"

- Additionally, it is recommended that the City identify seismic hazard areas and provide this information to the public via mapping (similar to how King County has identified seismic hazard areas within their King County iMap application) (King County n.d.). This effort can be informed using WDNR's Geologic Information Portal.

- There are currently no development standards within EMC Article IV. *Development for Critical Areas* for geologically hazardous areas. Consider adding development standards for such areas as to mitigate the risks associated with developing in these geologically hazardous areas (which might include language that specifies that mitigation shall meet the City's desired level of hazard, risk level, or performance).
- Consider that the effects of climate change are likely to impact geological processes in the Puget Sound region, including higher frequency of landslides and erosion because of declines in snowpack and increased frequency and intensity of heavy rain events (Mauger et al. 2020).
- Consider how erosion hazard policy is related to tree retention policy and landscaping codes. Vegetation retention and planting is essential to stabilizing soils, thereby reducing erosion risks.

5. Fish and Wildlife Habitat Conservation Areas

a. Definition

Fish and Wildlife Habitat Conservation Areas (FWHCAs) include terrestrial and aquatic habitats that support the survival of fish and wildlife. It is critical to safeguard these ecosystems because habitat loss poses the greatest threat to many species. Per EMC 15.04, FWHCAs are defined as the following:

1. *Areas with which endangered, threatened and sensitive species have a primary association.*
2. *Habitats and species of local importance which include a seasonal range or habitat element with which a given species has a primary association and which, if altered, may reduce the likelihood that the species will maintain and reproduce over the long term. These might include areas of high relative density or species richness, breeding habitat, winter range and movement corridors. These might also include habitats that are of limited availability or high vulnerability to alteration such as cliffs, talus and wetlands. Species of local importance are those species that are of local concern due to their population status or their sensitivity to habitat manipulation or that are game species.*
3. *Naturally occurring ponds under 20 acres and their submerged aquatic beds that provide fish or wildlife habitat. These do not include ponds deliberately designed and created from dry sites such as canals, detention facilities, wastewater treatment facilities, farm ponds, temporary construction ponds (of less than three years' duration) and landscape amenities. However, naturally occurring ponds may include those artificial ponds intentionally created from dry areas in order to mitigate conversion of ponds, if permitted by a regulatory authority.*

4. *Lakes, ponds, streams and rivers planted with game fish, including fish planted under the auspices of a federal, state, local or tribal program or which supports priority fish species as identified by the Department of Fish and Wildlife.*

EMC 19.02.100 states that the City only supports two types of habitat designated as FHWCAs, stating, "*The two types are stream habitat and buffers (riparian areas) adjacent to regulated streams or waterbodies."* The definition of FHWCAs per EMC is consistent with the information presented in WAC 365-190-130 (excluding commercial and recreational shellfish areas, kelp and eelgrass beds, and herring, smelt and other forage fish spawning areas) as the City does not support saltwater habitat.

b. Best Available Science

Per WAC 365-190-130, FWHCAs are lands designated and managed to ensure the preservation of viable populations of specific species within their natural geographic ranges over the long term and to prevent the formation of isolated subpopulations. Protecting FWHCAs, creating new FWHCAs, and reducing fragmentation of existing habitat corridors is essential for the sustained survival and growth of specific fish and wildlife species.

The City contains both aquatic and terrestrial FHWCAs that support fish, bird, and mammal species based upon the following BAS:

i. Endangered, Threatened, and Sensitive Species Primary Association Areas

Table 1 shows species known or suspected to occur within the City that are listed as threatened, endangered, or are candidates for listing under the federal or state Endangered Species Act (ESA) and bird species that are protected under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (as defined in WAC 232-12-297 and 16 U.S.C. § 1532). This information was gathered using the United States Fish and Wildlife Service (USFWS) Information for Planning and Consultation tool and the National Marine Fisheries Service Protected Resources Application (USFWS n.d.; NMFS n.d.).

Table 1. ESA State and Federal Listed, Sensitive, and Candidate Species Known or Suspected to Occur in the City of Enumclaw

Species	Listing Status (Federal/State)	Regulatory Agency	Regulation	Designated Critical Habitat in City of Enumclaw?
Mammals				
Gray Wolf (*Canis lupus*)	Endangered (Federal)	USFWS	ESA Section 7	None
Birds				

Marbled Murrelet (*Brachyramphus marmoratus*)	Threatened (Federal)	USFWS	ESA Section 7	None
Streaked Horned Lark (*Eremophila alpestris strigata*)	Threatened (Federal)	USFWS	ESA Section 7	None
Yellow-billed Cuckoo (*Coccyzus americanus*)	Threatened (Federal)	USFWS	ESA Section 7	None
Bald Eagle (*Haliaeetus leucocephalus*)	None	USFWS	Golden Eagle Protection Act & MBTA	None
Golden Eagle (*Aquila chrysaetos*)	Non-BCC, vulnerable	USFWS	Golden Eagle Protection Act & MBTA	None
Black Swift (*Cypseloides niger*)	None	USFWS	MBTA	None
California gull (*Larus californicus*)	None	USFWS	MBTA	None
Evening Grosbeak (*Coccothraustes vespertinus*)	None	USFWS	MBTA	None
Lesser Yellowlegs (*Tringa flavipes*)	None	USFWS	MBTA	None
Olive-sided Flycatcher (*Contopus cooperi*)	None	USFWS	MBTA	None
Rufous Hummingbird (*Selasphorus rufus*)	None	USFWS	MBTA	None
Western Grebe (*Aechmophorous occidentalis*)	None	USFWS	MBTA	None

Species	Listing Status (Federal/State)	Regulatory Agency	Regulation	Designated Critical Habitat in City of Enumclaw?
Fish				
Bull Trout (*Salvelinus confluentus*)	Threatened (Federal)	USFWS	ESA Section 7	None
Steelhead [Puget Sound DPS] (*Oncorhynchus mykiss*)	Threatened (Federal)	NOAA	ESA Section 7	Boise Creek and Newaukum Creek
Chinook [Puget Sound ESU] (*Oncorhynchus mykiss*)	Threatened (Federal)	NOAA	ESA Section 7	Boise Creek and Newaukum Creek
Coho (*Oncorhynchus kisutch*)	Candidate (Federal)	NOAA	ESA Section 7	None
Invertebrates				
Monarch Butterfly (*Danaus plexippus*)	Candidate (Federal)	USFWS	ESA Section 7	None

BCC = Bird of Conservation Concern

Non-BCC = Non-Bird of Conservation Concern

DPS = distinct population segment

ii. Priority Habitats and Species Association Areas

The Priority Habitats and Species (PHS) database undergoes regular updates, incorporating input from WDFW field biologists and other scientists. It serves as a repository of the best available science on the geographic distribution of wildlife species and habitats with special status in Washington. WDFW identifies PHS habitats as conservation and management priorities due to high density and diversity of fish and wildlife species, vital habitat functions, significance to priority species, restricted distribution or scarcity, susceptibility, or cultural significance (that is, commercial or recreational value) (Newman et al. 2018; WDFW 2008).

PHS maps areas in northeast and south Enumclaw as habitat for priority species Rocky Mountain elk (*Cervus elaphus nelson*) and elk (*Cervus elaphus*) (identified as Green/Cedar river winter elk range and White River elk range, respectively) (WDFW n.d.). Additionally, agricultural fields that flood in the winter north and south of SE 448th St. in the City are shown as habitat for waterfowl (including dabbling ducks, geese, and swans).

Naturally Occurring Ponds Under 20 Acres with Submerged Aquatic Beds that Provide Fish or Wildlife Habitat

Naturally occurring ponds less than 20 acres provide critical breeding habitat for a number of native amphibians that breed in still water (Leonard et al. 1993). These native

amphibians include Northwestern Salamander (*Ambystoma gracile*), Long Toed Salamander (*Ambystoma macrodactylum*), Western Toad (*Anaxyrus boreas*), Pacific Treefrog (*Pseudacris regilla*), Northern Red-Legged Frog (*Rana aurora*), Cascade Frog (*Rana cascadae*), Oregon Spotted Frog (*Rana pretiosa*), and Roughskin Newt (*Taricha granulosa*) (Hayes et al. 2008). Aside from Oregon Spotted and Cascade Frogs, these amphibians follow a seasonal cycle where they reproduce in lentic habitats (that is, still, non-flowing waterbodies) and then transition into terrestrial habitats for a large part of their nonbreeding season. Disturbed connectivity between smaller ponds used to breed and larger summer, fall, and overwintering waterbodies can result in significant amphibian mortality (McAllister et al. 1999).

It is difficult to ascertain the number of naturally occurring ponds less than 20 acres with submerged aquatic beds serving as wildlife habitat in the City. However, these areas are currently protected as waters or wetlands and are not specifically called out for protection as a FWHCA.

Waters Planted with Game Fish

Within the City, there are no waters planted with game fish by WDFW.

Riparian areas and buffers

Riparian areas include lakes, streams, and rivers and their associated active flood plains, channel migration zones, wetlands, and adjacent contributing management areas. These features are typically designated by local critical area ordinances and protected by a buffer to protect ecosystem functions. Riparian areas provide ecosystem functions that affect aquatic habitats, including stream bank stability, stream shading, litter fall, and coarse wood debris (WDFW 2009). **Riparian areas are critical to the survival of fish and salmonid species**, which require healthy waters to survive throughout their various life stages. This means streams and rivers have clean and cool, with a variety of habitats providing fish species with opportunities to rest, hide from predators, and reproduce (that is, spawn) (WSRCO 2020). In addition to habitat benefits, riparian areas also provide benefits to the community, including moderating flood flows and temperatures and removing pollutants.

WDFW publications ***Riparian Ecosystems, Volume 1: Science Synthesis and Management Implications*** and ***Riparian Ecosystems*** and ***Riparian Ecosystems, Volume 2: Management recommendations*** provide BAS related to riparian areas and associated buffers (which WDFW refers to as riparian management zones) and their regulation (Quinn et al. 2020, Rentz et al. 2020).

WDFW recommends the following to approach for managing riparian systems and their buffers (Rentz et al. 2020):

- Shift terminology from the concept of "stream buffers" to riparian management zones (RMZs). An RMZ is defined as "a scientifically based description of the area adjacent to rivers and streams that has the potential to provide full function based on the site potential tree height (SPTH) conceptual framework" (Quin et al. 2020). The objective of an RMZ is to provide a wide enough space to potentially provide full riparian function. While stream buffers are regulated to protect streams, they may not provide full riparian function. WDFW recommends that a RMZ be delineated on a site-specific basis, measured from the outer edge of the channel migration zone (where present) or from the ordinary high water mark, when a channel migration zone is not present. The SPTH of an area is "…the average maximum height of the tallest dominant trees (200 years or older) for a given site class." When the SPTH of an area is less than 100 feet, WDFW recommends a 100 foot minimum RMZ width based on the minimum area necessary to provide biofiltration and infiltration of runoff, shade, and wood recruitment.
- Delineate regulatory riparian buffers that remain and identify degraded areas for restoration. WDFW recommends the use of 200-year Site Potential Tree Height ($SPTH_{200}$) to determine the width of the riparian management zone or buffer for all stream types. WDFW provides an Online Site Potential Tree Height Map Tool which shows that the $SPTH_{200}$ in and around the City of Enumclaw is 100 to 105 feet for Red Alder (primarily within the City and associated with riparian areas) and 196 feet for Douglas Fir (primarily in upland areas).
- Create a minimum buffer width of 100 feet to remove 95% or more removal of pollutants. The amount of pollutant removal desired is a community choice. Buffer widths for pollutant removal are as follows (Quinn et al. 2020):

Pollutant	Buffer width for 80% Removal (ft)	Buffer width for 99% Removal (ft)
Sediment	25	153
Nitrogen, surface	90	200
Nitrogen, subsurface	30	322
Phosphorus	52	101
Pesticides	49	68

- Evaluate baseline current conditions to support goals to maintain and improve ecosystem functions.
- Identify and prioritize the protection of remaining riparian functions, enhancement of areas with degraded functions, and opportunities to maintain and restore in-stream and riparian connectivity.
- Require habitat management plan or critical area report whenever an activity is proposed in a buffer.
- Adopt best management practices and regulate land use activities likely to impact riparian ecosystems found within buffers, including onsite sewage disposal; bank hardening; clearing, grading, and filling; invasive or noxious plant removal; forest practices and conversions, wildfire hazard reduction; hazard tree removal; restoration and enhancement; emergency activities; and educational or recreational areas.

c. Recommendations

- EMC 15.04 (*Definitions*) describes FWHCAs more broadly than EMC 19.02.100 (which says that the City has only designated streams and associated buffers as FHWCA, excluding terrestrial habitat). It is advised that EMC 19.02.100 is updated to include missing language described in EMC 15.04 and consider protection of important terrestrial habitat.
- While certain habitats of local importance are described in EMC (including cliffs, talus, and wetlands), no species of local importance are designated. Therefore, consider designating species of local importance. Designation could be based on species that are federally listed (as threatened, endangered, or candidate) and have designated critical habitat within the City (such as Steelhead [Puget Sound DPS] and Chinook [Puget Sound ESU]) and WDFW priority species with habitat within the City, including Rocky Mountain elk and elk. Consider consulting the Department of Natural Resources Natural Heritage Program to provide a list of high quality ecological communities, systems, and rare plants. This information can be used to designate habitats and species of local importance.
- Revise 19.02.100(C), which outlines stream typing according to WAC 22-16-030, to more clearly identify what nomenclature is being used. It is recommended that the current nomenclature (that is, Type S, Type F, Type Np, Type Ns, and Type O) be revised as follows: “Type S, formerly Type 1, for streams and watercourses of statewide significance.” Remove the reference for Type O since it is no longer present in WAC 22-16-030.

- Include the update to WAC 365-190-030, which states that FWHCAs do "*not include such artificial or constructs as irrigation delivery systems, irrigation infrastructure, irrigation canals, or drainage ditches that lie within the boundaries of, and are maintained by, a port district or an irrigation district or company.*"
- Consider WDFW's recommendation that the RMZ delineation steps be applied to all stream types (whether or not they are fish-bearing).
    - Type S Waters: The City's buffer width of 100 feet for Type S waters is consistent with WDFW's RMZ delineation process based on the SPTH200 for red alder (100 to 105 feet), which is the predominant tree species vegetating riparian buffers in the City.
    - Type F Waters: The City should consider increasing the buffer width for fish bearing streams (Type F) from 75 feet up to 100 to 105 feet consistent with the SPTH200 for red alder.
    - Type Np and Ns Waters: The City could consider revising the buffer width of Type Np and Type Ns waters to better align with BAS provided by WDFW. The City currently has a 50 foot buffer for Type Np waters and a 25 foot buffer for Type Ns waters, which is below WDFW's RMZ delineation method which essentially results in a 100-foot minimum buffer recommendation for all streams. While the buffer for Type Np waters is similar to what many jurisdictions maintain (see Table 2), the City could consider increasing the buffer width for type Ns streams to reduce pollutants by at least 80%, depending on the type of adjacent land uses and quality of the buffer.

Table 2. WDFW Riparian Management Zone Guidance and Local Stream Buffers

Water Type	WDFW Guidance	Enumclaw	King County	Covington	Black Diamond[A]	Pierce County
S	100 - 196	100	115	115	75	100
F	100 - 196	75	115	115	50-75	150
Np	100 - 196	50	65	60	25	115/65
Ns	100 - 196	25	65	30	25	115/65
O	100 - 196	0[B]	25	N/A	25	35

Notes:

[A]: The City of Black Diamond's stream buffers do not translate to current nomenclature. Given this, within the City of Black Diamond, Type S correlates to Type 1, Type F correlates to Type 2 or 3, Type Np correlates to Type 4, Type Ns correlates to Type 5.

[B]: Per Enumclaw Municipal Code 19.2.100(C), The City will not impose a buffer requirement on Water Type O unless the Administrator is convinced, on the basis of available field data and personal knowledge, that

a buffer is needed to protect downstream critical areas from a risk of significant adverse impact due to onsite water quality degradation.

Qualifications:

Erika Shook, AICP. B.A. Planning Studies, MURP, Master of Urban and Regional Planning.

Tess Amen. B.S. Biology. Certificate of Wetland Science and Management.

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