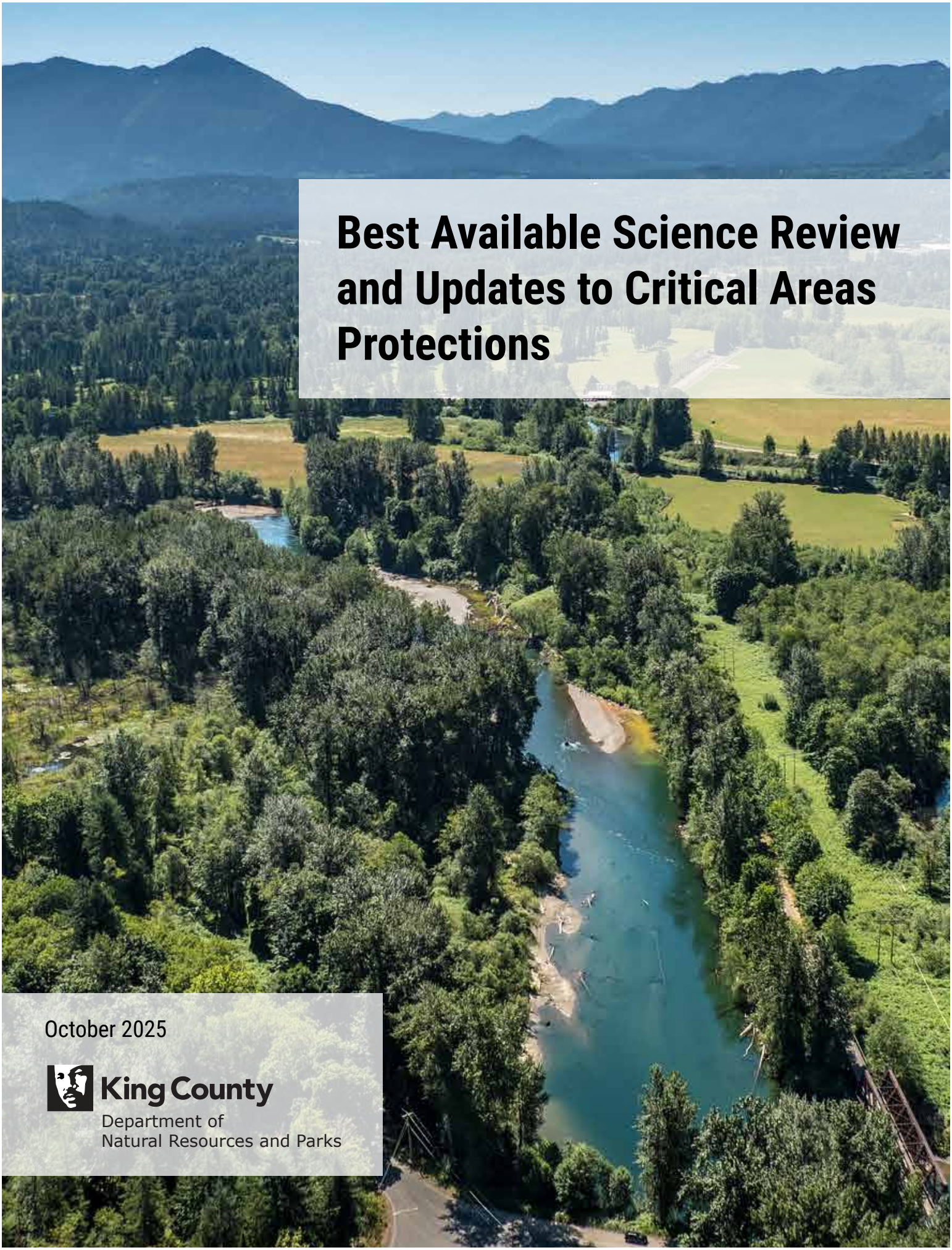

Best Available Science Review and Updates to Critical Areas Protections

October 2025

King County
Department of
Natural Resources and Parks

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Department of Natural Resources and Parks

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Table of Contents

Figures

Tables

Executive Summary

King County is currently updating its Comprehensive Plan to comply with the Washington State Growth Management Act (GMA). As part of this update, which is required by state law to be adopted by the end of 2025, King County must review and update Comprehensive Plan policies and associated development regulations that protect critical areas. Critical areas include wetlands, critical aquifer recharge areas (CARA), fish and wildlife habitat conservation areas (FWHCA), geologically hazardous areas (GHA), and frequently flooded areas. Each type of critical area provides unique ecological functions and values to communities across the local landscape. Some types of critical areas, such as GHAs, also pose risks to public health and safety.

The Comprehensive Plan and Critical Areas Ordinance (CAO) updates align with GMA goals within King County's unique context. Spanning 2,130 square miles, King County is the most populous county in Washington State, with 2,320,000 residents. As of 2023, unincorporated King County had approximately 249,100 residents. Over the next two decades, the County must plan for and accommodate 5,412 new housing units in urban unincorporated King County (urban UKC). The GMA directs that most population and employment growth be focused in urban areas to avoid sprawl, provide efficient and effective services and infrastructure, and protect environmentally critical areas.

King County's policies have long focused on limiting sprawl, focusing new development in the urban area and protecting agriculture and forestry. Through policy, land use designation, and nonregulatory tools like Transfer of Development Rights and the 4-to-1 program as well as long-standing land conservation programs, the County has been successful in focusing growth in the urban area and limiting growth in the rural area and Natural Resource Lands. King County continues to support a local food economy, with about 48,000 acres of farmland, including 41,000 acres in Agricultural Production Districts (APDs), where agriculture is the predominant land use.

The GMA establishes 15 goals to guide the development of comprehensive plans and development regulations. In addition, the GMA requires that King County include the best available science (BAS) as it updates critical areas policies and development regulations and gives special consideration to conserve or protect anadromous fish, such as salmon and steelhead trout. Where policies and development regulations depart from BAS, the County must provide the rationale for doing so, including legal, social, cultural, economic, and political information, and identify potential risks associated with the departure. When King County adopted critical areas policies and development regulations in 2004, it departed from BAS in some areas, such as adopting narrower riparian area widths (formerly aquatic area buffers) in unincorporated King County's (UKC) Urban Growth Area (UGA).

In 2010, Washington State updated the GMA, adding a requirement that jurisdictions ensure no net loss of existing critical areas functions and values. It also directed jurisdictions to protect critical areas through a combination of regulatory measures and

nonregulatory programs. The GMA also requires that jurisdictions plan for effects of a changing climate when updating protections for critical areas (see Section 1.1).

The County completed an initial BAS review in February 2024 to support the 2024 Comprehensive Plan update and initial CAO drafting, updated the BAS review in October 2024 to support the Executive-proposed CAO update, and is issuing this updated October 2025 BAS review to further inform Metropolitan King County Council (Council) review of the CAO update. To inform these BAS reviews, the County reviewed state law and guidance from the Washington State Department of Commerce and updated BAS from state agencies, including the Washington State Department of Ecology (Ecology) and the Washington Department of Fish and Wildlife (WDFW). King County's current BAS review was designed to expand on its 2004 BAS review. It aims to ensure compliance with current GMA requirements and administrative guidance with a heightened emphasis on incorporating significant state agency-issued BAS updates and achieving no net loss of critical areas functions and values. King County's current BAS review affirmed that many County policies and development regulations protecting critical areas in UKC are well aligned with GMA mandates and BAS. The current BAS review also identified regulatory updates necessary to improve alignment with BAS and satisfy GMA mandates and these changes were reflected in the Executive-proposed 2025 Comprehensive Plan and CAO updates transmitted to the Council in December 2024. This updated October 2025 BAS review reflects Council consideration of further amendments to the CAO. These regulatory updates are summarized below by critical area and are described in detail in the body of this report.

King County combines regulatory measures and nonregulatory programs to protect critical areas functions and values to ensure no net loss at the scale of watersheds and ecosystems. Regulatory protections for critical areas are primarily in King County Code (K.C.C.) Chapter 21A.24. However, stormwater management, clearing and grading, and shorelines regulations, as well as land use designation and zoning requirements, are also key parts of the County's regulatory approach. Additionally, the County implements nonregulatory plans, initiatives, programs, and projects to protect and restore critical areas functions and values. Key examples of programs and outcomes described in this report include the Land Conservation Initiative, watershed-based salmon recovery plans and habitat restoration projects, stormwater management programs and projects, the Clean Water Healthy Habitat Strategic Plan, the 2024 Flood Management Plan, and the fish-passage restoration program. Collectively, these efforts supplement development regulations, including critical areas regulations applied to sites undergoing new development.

Consistent with King County Comprehensive Plan policies and County commitments, the County invited consultation with federally recognized Indian Tribes. Additional information on consultation with federally recognized Indian Tribes can be found in Sections 1.4 and 1.5. Consistent with GMA, the County also provided opportunities for broad public participation and engaged with community groups with wide ranging interests. Information on public participation and community engagement related to review of key BAS findings and updates to regulations is summarized in Section 1.6.

The key findings, recommendations for regulatory updates, and companion nonregulatory actions for each critical area type are briefly summarized below. Additional detail can be found in the body of this report.

Wetlands

Commonly called marshes, swamps, or bogs, wetlands help protect communities from pollution and flooding. Wetlands attenuate floodwaters, trap sediment, and filter pollutants from stormwater runoff. Wetlands also provide critical habitat for animals, including migratory birds, amphibians, and commercially and culturally important salmon.

King County reviewed Washington State Department of Commerce (Commerce) guidance documents, recent Ecology BAS and regulatory guidance, King County's 2004 BAS, critical areas monitoring data, and supplemental literature to inform updates to policies and development regulations that protect wetlands. This review identified the need to increase protections for some wetlands (see Section 4.1.3) and to update requirements for select wetland mitigation activities (see Section 4.2.3).

Wetland development regulation updates improve environmental protections, with a focus on protecting rare wetlands that are difficult or impossible to recreate through restoration activities while also limiting impacts to the wildlife habitat functions of common wetlands. Additional updates are being made to prohibit clearing of established native vegetation in wetlands and wetland buffers for expanded or new agriculture, clarify standards for allowed alterations to wetlands and buffers, and increase wetland mitigation ratios in some cases. These updates are consistent with BAS review and help to ensure County compliance with GMA mandates, including requirements that counties plan for climate resilience and ensure no net loss of critical areas functions and values. Updates to these critical areas protections consider competing GMA goals and comprehensive planning priorities, including supporting housing development in the UGA, maintaining and enhancing the local agricultural industry, and administering a fair and timely permitting process.

In addition to updating wetland regulations, King County is investing in nonregulatory programs that will improve the management and protection of local wetlands. This includes updating its advisory wetland maps to better inform permitting staff and community members of the location and types of wetlands present in King County and seeking funding to update and focus its monitoring and adaptive management (M&AM) program to evaluate and improve the effectiveness of wetland regulations and nonregulatory programs.

Fish and Wildlife Habitat Conservation Areas

King County designates and regulates a variety of Fish and Wildlife Habitat Conservation Areas (FWHCAs) to sustain local populations of terrestrial animals and

fish species, including anadromous fish such as salmon and steelhead trout. King County reviewed Commerce guidance documents, recent WDFW BAS and regulatory guidance, King County's 2004 BAS, critical areas monitoring data, and supplemental literature to inform updates to policies and development regulations that protect FWHCAs.

The County's current BAS review identified the need to update protections for aquatic areas and for riparian areas, formerly characterized as aquatic area buffers. Riparian areas are the transitional areas between terrestrial and aquatic ecosystems. Riparian areas are diverse, dynamic, and complex ecosystems that support an abundance and variety of fish and wildlife. Updates to aquatic and riparian area protections include increasing the protected width of all types of riparian areas (see Section 5.1.3), clarifying how riparian areas are measured with respect to severe channel migration hazard areas (CMHAs) (see Section 5.2.3), and revising riparian area mitigation requirements (see Section 5.3.3).

Updates to riparian area development regulations improve environmental protections for aquatic and riparian areas with a focus on protecting riparian area functions and values such as bank stability, shade and temperature control, pollution removal and water purification, recruitment of habitat-forming large wood, natural erosion and sediment delivery, and habitat cover for aquatic and terrestrial animals. The current CAO updates also require the County to update its Public Rule that guides Farm Management Plan (FMP) review and approval in cases where development and implementation of an FMP is a condition for application of development regulations or qualification for tax incentive programs. Current CAO updates help ensure County compliance with GMA mandates, including requirements that counties plan for climate resilience, ensure no net loss of critical areas functions and values, and demonstrate special consideration for anadromous fisheries. Updates to these critical areas protections consider competing GMA goals and comprehensive planning priorities, including supporting housing development in the UGA, maintaining and enhancing the local agricultural industry, and administering a fair and timely permitting process.

To complement updates to riparian area regulations, King County is investing in nonregulatory programs that will improve the management and protection of riparian areas and aquatic areas. This includes updated advisory stream maps to better inform permitting staff and community members of the location and types of streams present in King County. The updated stream maps are publicly available online through King County's interactive mapping tool, King County iMap. King County has also adopted updates to its flood risk reduction strategic plan, called the 2024 Flood Management Plan. A primary focus of this plan is integrated floodplain management and the delivery of flood risk reduction projects that will also preserve, restore, and enhance the natural functions of flood-prone areas and contribute to habitat restoration. The County has accelerated investment in land conservation and floodplain reconnection projects, and these efforts are described in more detail in the body of this report.

In addition to updating riparian area regulations, the BAS review identified the need to update King County's Species of Local Importance (SOLI) and Habitats of Local Importance (HOLI) lists in the Comprehensive Plan (see Section 6.1.3).

The BAS review also identified the need to conduct a climate gradient analysis for wildlife habitat in the county. Once funding is secured from grant programs administered by the Department of Commerce, this mapping exercise will build upon state-led mapping and use climate-informed wildlife migration models and updated stream and wetland mapping resources to identify and map areas and corridors critical to the protection of local wildlife biodiversity as the climate changes over time. Together, updating SOLI and HOLI lists and wildlife mapping resources will inform the County's future conservation efforts, which are aimed at preserving the County's last, most important natural lands and urban green spaces.

These actions are in addition to the County's Land Conservation Initiative (LCI), which includes a focus on protection of riparian corridors, a long-standing Public Benefit Rating System tax incentive program that enhances protection of riparian areas and wildlife habitat, and large-scale floodplain reconnection projects.

Critical Aquifer Recharge Areas (CARA)

Critical aquifer recharge areas (CARA) are the geographic areas that have a critical recharging effect on aquifers used for potable water. Protecting groundwater is an important regional issue because groundwater provides approximately 30 percent of the water used in King County and is the primary source of water in UKC outside of the UGA. On Vashon-Maury Island and in other sole-source aquifer areas, it is the only source of drinking water.

King County reviewed Commerce guidance documents, King County's 2004 BAS, and supplemental literature to inform updates to policies and development regulations that protect CARA in UKC. This BAS review determined that King County's existing methodology of delineating CARA follows the state guidance from Ecology and Commerce and that minor updates to development regulations may be necessary to clarify how King County classifies CARA according to both aquifer vulnerability and susceptibility when the CARA map is updated (see Section 7.1.3).

King County will continue investing in programs to monitor groundwater resources and support engagement with communities about the importance of protecting groundwater supplies.

Geologically Hazardous Areas (GHAs)

Geologically Hazardous Areas (GHAs) are areas that are susceptible to erosion, sliding, earthquake, or other geological events that present risks to public health and safety. King County reviewed Commerce guidance and the scope of King County's 2004 BAS literature to inform the scope of the current BAS review for GHAs. This process

identified that BAS review was necessary for the management of alluvial fans, which are designated by the state as a type of GHA critical area.

Alluvial fans naturally occur along stream channels at the base of a slope. Hazardous geologic processes occur on alluvial fans, increasing risks to infrastructure and public health and safety. Debris flows and floods transport sediment and rocks at fast rates that can damage property or harm people. King County reviewed BAS and alluvial fan critical areas protections in other regional jurisdictions and determined that regulatory updates are necessary to establish development regulations for alluvial fans in UKC.

New alluvial fan development regulations in the K.C.C. define the County's role in alluvial fan and Alluvial Fan Hazard Areas (AFHA) management by implementing development standards that reduce public health and safety risks associated with this type of GHA (see Section 8.1.3). This includes limiting clearing and grading, establishing standards and conditions for expansion and replacement of existing structures, and prohibiting most new development in AFHAs while allowing select emergency actions to be permitted to reduce alluvial fan hazard risks to existing development and land uses. Updates satisfy the GMA requirement that the County designate and regulate GHAs while improving the County's ability to reduce GHA risks to public health and safety.

In addition to updating GHA regulations, King County will continue to coordinate with communities and other partners to guide investment in nonregulatory programs that support the management of critical areas, including GHAs, alluvial fans, and AFHAs. This includes operating nonregulatory open space acquisition programs, such as the LCI, which seeks to permanently protect lands across the county through voluntary acquisition of properties with high ecological value and those with critical areas that pose a significant risk to public health and safety.

Frequently Flooded Areas

The current CAO update includes very limited technical updates to code requirements related to development in frequently flooded areas. King County has scoped and secured grant funding to support a stand-alone update in 2026 and 2027 to the County's codes regulating development in frequently flooded areas.

Concurrent with the BAS review, the County drafted the 2024 King County Flood Management Plan, which contains policies affecting frequently flooded areas. To inform this update, King County reviewed state guidance published in 2021 for comprehensive flood hazard management planning, which promotes a focus on integrated floodplain management. King County also reviewed Water Resource Inventory Area (WRIA) salmon recovery plan goals for floodplain habitat and connectivity, climate change data for projected changes in river flows, and academic research on the functions and values of floodplains. The 2024 King County Flood Management Plan was adopted by the Metropolitan King County Council on September 17, 2024.

King County's review of BAS for frequently flooded areas focused on identifying K.C.C. revisions that could streamline regulatory review for habitat restoration and fish-passage projects. The identified revisions are intended to better support vital salmon recovery projects and to advance the County's goals related to reconnecting functioning floodplains and removing barriers to fish passage while maintaining compliance with the Biological Opinion (BiOp) provisions, Federal Emergency Management Agency (FEMA) National Flood Insurance Program (NFIP) standards, Ecology standards, and local regulatory standards. King County's current BAS review and regulatory updates for frequently flooded areas are addressed in Chapter 8 of this report.

1 Introduction

In 1990, Washington State passed the Growth Management Act (GMA), which required King County and other local jurisdictions to prepare comprehensive plans and implement development regulations. In 1994, King County adopted its first Comprehensive Plan under the GMA. Subsequently, the GMA was amended to require local jurisdictions to develop policies and regulations to protect critical areas. The GMA specifies that this process must include best available science (BAS). In 2004, King County enacted critical areas development regulations in the King County Code (K.C.C.). Critical areas include wetlands, areas with a critical recharging effect on aquifers used for potable water, fish and wildlife habitat conservation areas (FWHCA), geologically hazardous areas (GHA), and frequently flooded areas. In King County, areas with a critical recharging effect on aquifers used for potable water are referred to as critical aquifer recharge areas (CARA).

King County completed a state-mandated 10-year Comprehensive Plan update in 2024. As part of the Comprehensive Plan update, the County is required to review and update Comprehensive Plan policies and associated development regulations that protect critical areas by no later than the end of 2025. The GMA requires these updates to include BAS. The GMA also requires that jurisdictions give special consideration to the conservation or protection of anadromous fish such as salmon and steelhead trout.

The County completed an initial BAS review in February 2024 to support the 2024 Comprehensive Plan update and initial Critical Areas Ordinance (CAO) drafting, updated the BAS review in October 2024 to support the Executive-proposed CAO update, and is issuing this updated October 2025 BAS review to further inform Council review of the 2025 Comprehensive Plan and CAO update. This updated October 2025 BAS review reflects Council consideration of further amendments to the CAO. These regulatory updates are summarized below by critical area and are described in detail in the body of this report.

This report documents King County's BAS review process and introduces updates to Comprehensive Plan policies and associated development regulations. The remainder of Section 1 describes GMA goals and requirements. Section 2 describes the scope of King County's current BAS review. Section 3 describes King County's use of regulatory measures and nonregulatory programs to protect critical areas. Sections 4 through 8 are organized by critical area and introduce policies and development regulations that are being updated to include current BAS and meet GMA requirements. For clarity, two categories of FWHCA, riparian areas and wildlife habitat, are discussed in separate sections.

This report is primarily written in plain language to improve reader accessibility. Scientific concepts and regulatory requirements are generally discussed at a summary level, though some technical discussion is included to ensure BAS review findings and regulatory requirements are accurately represented. Technical experts reviewing this document can find greater detail in cited references. Readers can review updates to

critical areas policies and development regulations in the 2024 King County Comprehensive Plan and the K.C.C.

1.1 GMA Goals

The GMA is codified under Chapter 36.70A of the Revised Code of Washington (Chapter 36.70A RCW). The GMA establishes 15 goals to guide the development of comprehensive plans and development regulations (RCW 36.70A.020). This includes a newly adopted "climate change and resiliency" goal with which the County will be required to comply by 2029. The goals of the GMA are not listed in order of priority and are summarized below:

1. **Urban growth:** Encourage development in urban areas.
2. **Reduce sprawl:** Reduce the inappropriate conversion of undeveloped land into sprawling low-density development.
3. **Transportation:** Encourage efficient multimodal transportation systems.
4. **Housing:** Plan for and accommodate all economic segments.
5. **Economic development:** Encourage economic development throughout the state.
6. **Property rights:** Private property shall not be taken for public use without just compensation.
7. **Permits:** Applications should be processed in a fair and timely manner.
8. **Natural resource industries:** Maintain and enhance productive timber, agricultural, and fisheries industries.
9. **Open space and recreation:** Retain open space and enhance recreational opportunities.
10. **Environment:** Protect the environment, including air and water quality, and the availability of water.
11. **Citizen participation and coordination:** Encourage public involvement.
12. **Public facilities and services:** Ensure public facilities and services necessary to support development are adequate.
13. **Historic preservation:** Identify and encourage preservation.
14. **Climate change and resiliency:** Adapt to and mitigate the effects of a rapidly changing climate and rising sea levels.
15. **Shoreline management:** Goals and policies of the Shoreline Management Act (RCW 90.58.020).

1.2 King County Land Use, Landscape, and Policy Context

King County is updating its Comprehensive Plan and CAO regulations consistent with GMA goals and requirements and within the unique land use, development, and ecological context of King County.

King County's land area is 2,130 square miles and is characterized by cities large and small and by beautiful scenery and geographic variety stretching from the Puget Sound

in the west to the crest of the Cascade Mountains in the east. King County has a variety of working farms and forestlands as well as a significant open space network.

In 2023, King County had 2,320,000 residents, making it the 12th most populous county in the nation. King County's unincorporated area covers approximately 1,700 square miles and includes the urban area, rural area, and Natural Resource Lands (agriculture, forestry, mineral extraction). The 2023 population of unincorporated King County was approximately 249,100 (Washington State Office of Financial Management 2023).

Through the update of the Comprehensive Plan and CAO, the County seeks to simultaneously address GMA goals, some of which can be in conflict, while ensuring no net loss of ecosystem functions and values at an ecosystem scale. For example, focusing new growth in urban areas where it is more efficiently served by transportation infrastructure helps to meet environmental goals like reducing greenhouse gas emissions. However, this means additional clearing and impervious surface that impacts functions and values of riparian areas. It also can mean loss of green spaces that are increasingly important to communities and ecosystems affected by climate change.

The Washington State Department of Ecology's Wetland Guidance for Critical Areas Ordinance Updates notes that regulations may need to be tailored to fit individual circumstances. Factors to consider include the nature and extent of the wetland resources at risk, a city or county's rate of growth, the nature and level of impact from land uses in the jurisdiction, and the staffing resources available for a jurisdiction to implement and administer its CAO.

To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs, and that mix can vary by land use. For example, in the urban area, with a prevailing pattern of smaller, previously developed lots, the County uses a combination of critical areas protections, stormwater management investments, urban forestry programs, and open space conservation to protect critical areas functions and values while accommodating new housing and community priorities for green space. In the less developed rural area, characterized by denser forest cover and less impervious surface, the County is in some cases applying a higher critical areas regulatory standard coupled with open space conservation, tax incentives, transfer of development rights, farm management plans (FMPs), forest stewardship plans, and stormwater best management practices (BMPs) to protect critical areas functions and values.

1.2.1 Growth Targets for Unincorporated King County (UKC)

Based on the 2021 King County Countywide Planning Policies' King County Jurisdiction Growth Targets (King County 2021a, p. 23), the County must plan for and accommodate 5,412 net new housing units in urban unincorporated King County (urban UKC) through 2044. Of these units, 1,292 are in "unaffiliated" UKC outside the Potential Annexation Areas of the cities. The County does not have a growth target for the rural area or Natural Resource Lands.

Forty-two percent of UKC's development capacity is in areas with at least a moderate risk of displacement, indicating that a significant portion of future development could pose a displacement threat to existing communities without complementary anti-displacement actions. Displacement risk is higher in urban UKC than in rural UKC (King County 2023a).

GMA requires that the County designate an Urban Growth Area (UGA) where most growth and development forecasted for King County will be accommodated. The UGA must allow for a range of urban densities and areas sufficient to accommodate a broad range of needs and uses, and the area must be sufficient to meet 20-year growth projections. The GMA directs that most population and employment growth be focused in urban areas to avoid sprawl, provide efficient and effective services and infrastructure, and protect environmentally critical areas.

1.2.2 Focusing Growth in Urban Areas

King County, consistent with the GMA, has long-standing policies in its Comprehensive Plan intended to limit sprawl and focus new development in the urban area, including incorporated cities and their Potential Annexation Areas. The King County Comprehensive Plan supports planning for and accommodating housing that is affordable to all economic segments of the population, promoting a variety of residential densities and types, and encouraging preservation of existing housing stock and encouraging affordable, innovative, quality infill development and redevelopment in existing unincorporated urban areas. At the same time, the County has both policies and programs focused on protecting Natural Resource Lands and supporting agricultural and forestry uses.

Through policy, land use designation, and companion tools, such as Transfer of Development Rights, the 4-to-1 program, and long-standing land conservation programs, the County has been successful in focusing growth in the urban area and limiting growth in the rural area. Between 2006 and 2018, 54 percent of housing unit growth in King County occurred within the cities of Seattle and Bellevue, while 4 percent of housing unit growth occurred in urban unincorporated areas and 3 percent occurred in rural unincorporated areas (King County 2021b). The current growth rate in the County's rural area is approximately 1 percent of the County's overall growth.

1.2.3 Protection of Natural Resource Lands

Despite being the most populous county in the state and home to 39 cities and dense urban development throughout its western third, King County continues to have significant agricultural land supporting a local food economy. King County includes approximately 48,000 acres of farmland, including 41,000 acres in Agricultural Production Districts (APDs). Agriculture is the predominant land use in these districts, which also provide critically important salmon habitat and are subject to natural floodplain processes. King County has five APDs: Sammamish River, Snoqualmie River, Lower Green River, Upper Green River, and Enumclaw Plateau. More than

15,000 acres of farmland are permanently protected through the Farmland Preservation Program. There are approximately 1,800 farms in King County and total annual farm sales exceed $135 million. Additionally, nearly all fruits and vegetables grown in King County are sold to the fresh market locally (King County 2023b).

Longstanding and updated King County Comprehensive Plan policies support development of incentives to support agriculture, including property tax reductions and permit exemptions for activities complying with best management practices as well as the raising and management of livestock consistent with industry best management practices and county, state, and federal regulations related to the specific industry.

Approximately 60 percent of the county (811,000 acres) is covered by forests. Forest cover is most dense along the foothills of and within the Cascade Mountains and on Vashon-Maury Island. Tree cover in the urban areas of UKC varies depending on the intensity of development, from as high as 46 percent in the community of Maplewood to as low as 21 percent in the more intensely developed White Center neighborhood. Between 1992 and 2016, forest cover held steady in rural King County (from 70 percent to 71 percent total cover) but declined from 37 percent to 29 percent total cover in urban unincorporated areas.

1.2.4 Application of Standards to Different Land Uses and Development Patterns

The County's existing CAO, adopted in 2004, includes different standards for wetlands and riparian areas based on land use designation to reflect GMA goals that focus growth in urban areas, support agriculture, and limit sprawl outside the UGA, where wetlands and riparian areas are generally in better condition. For example, the riparian area widths applied to Type S and Type F waters in the current CAO are 115 feet in the urban unincorporated area and 165 feet outside of urban areas. Livestock provisions also provide for reductions in buffer widths with development of an FMP and application of BMPs.

The 2024 CAO update strengthens protection for riparian areas and wetlands while continuing to tailor the application of some standards in a manner that advances GMA goals for focusing growth in urban areas and supporting agriculture. Under the proposed CAO update, riparian area widths for Type S and Type F waters that are applied to new development would increase to 180 feet within urban unincorporated areas and to 200 feet outside of the UGA. Provisions recognizing and supporting existing agricultural operations are retained while raising the minimum level of protection for riparian areas and wetlands under the Livestock Management Ordinance first adopted in 1993 (K.C.C. 21A.30.030 through 21A.30.075). Where 2024 CAO updates depart from BAS recommendations for standards to protect critical areas functions and values, this report provides additional supporting information and rationale for each critical area, including policy drivers for the departure, risk assessment, and identification on nonregulatory actions that help to mitigate risks.

1.2.5 Nonregulatory Programs

Land conservation efforts since the 1970s have protected more than 190,000 acres. The County's conservation efforts remain a key nonregulatory program to protect habitat and critical areas functions and values at a watershed and ecosystem scale. Starting in 2016, the County developed the Land Conservation Initiative (LCI) to identify and conserve up to 65,000 acres of high-conservation-value lands, including urban green space, regional trails, natural lands, rivers, farmlands, and forests over a 30-year period. King County proposed and the voters approved a "lid lift" for the Conservation Futures Tax in 2022 to increase funding, and the County has made policy changes to enable more aggressive pursuit of landscape-scale conservation to accelerate investment on open space in the near term.

Since the 1999 federal Endangered Species Act listings of Chinook salmon and bull trout, King County has supported the development and implementation of federally approved, watershed-based salmon conservation plans. Over the last 25 years, King County and salmon recovery partners have implemented a significant number of salmon habitat restoration projects called for in these plans. These plans recommend long-term salmon habitat restoration efforts, such as floodplain restoration, riparian restoration, fish-passage barrier removals, and wetland restoration along salmon-bearing streams and rivers. King County also conducts habitat project effectiveness monitoring to ensure salmon benefit from these projects and to improve future project implementation efforts. For example, peer-reviewed research published by King County in 2024 indicated that projects should remove armor from riverbanks, restore natural channel margins, add large wood and riparian vegetation, and increase complexity in river channels by reconnecting or restoring side channels, thus restoring a mosaic of habitats (David et al. 2024). By doing so, King County projects increase habitat diversity, supporting multiple juvenile salmonid species and life history stages across a range of conditions. By implementing salmon habitat restoration projects, King County has improved riparian, floodplain, and wetland habitat conditions and critical areas along salmon-bearing streams and rivers. In the next 5 years, King County has several floodplain and nearshore restoration projects planned, and will restore an estimated 100 acres of floodplain and approximately 400 feet of marine shoreline on Vashon-Maury Island. These efforts reflect coordinated investments in salmon recovery, flood risk reduction, and climate resilience across WRIA priority areas.

1.3 GMA Requirements for BAS Review and Updates to Critical Areas Protections

In addition to the goals described in Section 1.1, the GMA requires that King County protect critical areas. The GMA states that:

> "In designating and protecting critical areas under this chapter, counties and cities shall include the best available science in developing policies and development regulations to protect the functions and values of critical areas. In addition, counties and cities shall give special consideration to conservation or

protection measures necessary to preserve or enhance anadromous fisheries" (RCW 36.70A.172).

Additional GMA regulations and planning guidance are offered to jurisdictions in the Washington Administrative Code (WAC). WAC 365-196-830 details requirements for protection of critical areas. Chapter 365-195 WAC describes requirements for including BAS in County decision-making processes. These elements of the WAC are further described below.

1.3.1 WAC 365-196-830 Protection of Critical Areas

Adopted in 2010, WAC 365-196-830 details requirements and guidance for the protection of critical areas under the GMA. Protection in this context means preservation of the functions and values of the natural environment or safeguarding the public from hazards to health and safety. It requires that jurisdictions ensure no net loss of existing critical areas functions and values and directs jurisdictions to protect critical areas through a combination of regulatory measures, nonregulatory programs and BMPs. The WAC highlights the importance of using a regional approach when giving special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries. Conservation and protection measures may address land uses on any lands within a jurisdiction and not only lands with designated critical areas. Further, local governments may develop and implement alternative means of protecting critical areas from some activities using BMPs or a combination of regulatory measures and nonregulatory programs. The County's approach to using both regulatory and nonregulatory approaches, at the parcel and ecosystem scale, are provided in this report.

The WAC underscores that, while avoidance of impacts is the most effective way to protect critical areas, development regulations may impact critical areas if compensatory mitigation is required or other corresponding mitigation efforts occur.

1.3.2 Chapter 365-195 WAC Best Available Science

Chapter 365-195 WAC provides guidance to jurisdictions as they locate and include scientific information in their planning processes. The six sections within this chapter of the WAC are summarized below.

WAC 365-195-900 Background and Purpose

Describes BAS requirements of the GMA and references relevant sections of the RCW. This section states that the inclusion of BAS is especially important to salmon recovery efforts and to other decision-making affecting threatened or endangered species.

WAC 365-195-905 Criteria for Determining Which Information is the "Best Available Science"

Provides guidance on what information obtained during development of critical areas policies and regulations qualifies as BAS. Directs jurisdictions to conduct a BAS review when updating critical areas regulations, stating that the complexity of BAS review should reflect the scope of amendments to critical areas policies and development regulations. Jurisdictions are directed to use information that local, state, or federal natural resource agencies have identified as BAS. This section identifies common sources of scientific and nonscientific information.

WAC 365-195-910 Criteria for Obtaining the Best Available Science

Directs jurisdictions to obtain scientific information through consultation with state natural resource agencies and tribes or through a jurisdiction's own efforts.

WAC 365-195-915 Criteria for Including the Best Available Science in Developing Policies and Development Regulations

Identifies what counties and cities should include in the record to demonstrate that BAS has been included in the development of critical areas policies and regulations. This includes identifying:

- polices and development regulations adopted to protect the functions and values of the critical areas at issue
- the relevant sources of best available scientific information included in the decision-making
- any nonscientific information—including legal, social, cultural, economic, and political information—used as a basis for critical areas policies and regulations that depart from recommendations derived from the BAS
- rationale for departing from science-based recommendations
- potential risks to the functions and values of the critical area or areas and any additional measures chosen to limit such risks

This section also underscores the requirement to include BAS in decisions to grant applications for administrative variance or exemption.

WAC 365-195-920 Criteria for Addressing Inadequate Scientific Information

Offers decision-making guidance to jurisdictions when there is an absence of valid scientific information or incomplete scientific information relating to a critical area. Jurisdictions are instructed to use a "precautionary or a no-risk approach" until uncertainty is sufficiently resolved. Adaptive management is offered as an interim approach.

WAC 365-195-925 Criteria for Demonstrating "Special Consideration" Has Been Given to Conservation or Protection Measures Necessary to Preserve or Enhance Anadromous Fisheries

Offers additional guidance related to the GMA requirement that jurisdictions conserve, protect, and enhance anadromous fisheries, such as salmon and steelhead trout. This section references relevant sections of the RCW and states that special consideration should be given to habitat protection measures relevant to stream flows, water quality and temperature, and other environmental factors important to all life stages of anadromous fish. Such special consideration should be evidenced in the record (see Section 3.4).

1.4 Tribal Consultation

The County is committed to developing and sustaining a robust government-to-government relationship with sovereign Tribal Nations and promoting self-governance by their membership. Additionally, the County and Indian Tribes frequently partner on habitat restoration projects and scientists from King County and Indian Tribes have served together on research and planning teams.

The County began the review of BAS and critical areas regulations in 2022. King County invited federally recognized Indian Tribes to participate in government-to-government consultation during the BAS review process, including the Suquamish Tribe, Muckleshoot Indian Tribe, Tulalip Tribes, Snoqualmie Tribe, and Puyallup Tribe. At the time this report was initially drafted in February 2024, King County had met with representatives from the Suquamish Tribe, Tulalip Tribes, and Snoqualmie Tribe to review and discuss BAS findings and regulatory updates and has responded to follow-up questions. These meetings provided King County valuable input and feedback to inform updates to both regulatory updates and companion nonregulatory actions. For example, during the consultation process, the County heard request for greater clarity about the review process for FMPs that support regulatory flexibility for agriculture. The BAS report has been updated with additional information and recommendations.

King County's Comprehensive Plan includes policies to guide consultation with tribal governments. Chapter 1 of the Comprehensive Plan, Regional Growth Management Planning, describes King County's commitment to supporting broad participation in local planning processes. Policy RP-104 in the 2024 Comprehensive Plan update states,

> King County shall coordinate with Indian tribes during its planning processes in a manner that respects their sovereign status, promotes tribal self-determination and self-governance, and honors past and present agreements.

Chapter 5 of the Comprehensive Plan, Environment, describes how development of environmental regulations, projects, and programs to conserve and restore the natural environment should be coordinated. Policy E-107 in the 2024 Comprehensive Plan

update recommended by the King County Council Local Services and Land Use Committee states,

> Development of environmental regulations, restoration and mitigation projects, and incentive and stewardship programs should be coordinated with Indian tribes, local jurisdictions, federal and state agencies, special interest groups, and residents when conserving and restoring the natural environment consistent with Urban Growth Area, Rural Area, and Natural Resource Lands goals.

1.5 Indigenous Knowledge or Traditional Ecological Knowledge

The County recognizes the valuable contributions of Indigenous Knowledge (IK) that Tribal Nations and Indigenous Peoples have gained and passed down from generation to generation and views traditional ecological knowledge (TEK) as essential, complementary, and bringing a deeper understanding of the value and stewardship needs for critical areas, cultural resources protection, and restoration than Western science alone.

King County conducted this BAS review in accordance with state law establishing the definition and requirements for BAS (see Section 1.3). During Tribal consultation on the BAS review, a request was made for written recognition of TEK, also referred to as IK, and commitments for its use be included as part of this BAS report where possible as well as to be recognized as on the same plane as Western science in formally adopted policies of the Comprehensive Plan.

In scoping this BAS review, the County reviewed state law and guidance related to BAS. State law definitions and descriptions of BAS do not include TEK or otherwise define or require TEK in the context of local governments conducting BAS reviews. The County has requested, as part of comments on rulemaking to implement 2023 House Bill 1181, that the State provide guidance for local governments regarding review and application of IK in the context of reviewing and including BAS as required by the Growth Management Act.

On October 22, 2025, Governor Bob Ferguson issued an Executive Order calling for drafting new state policies for Tribal consultation and requiring expanded training for state workers on sovereignty and other issues related to understanding the unique nature of the ties between the State and Tribal governments. The order references the importance of IK and directs that, by October 1, 2026, the Governor's Office of Indian Affairs shall provide a report to the Governor's Office with recommendations for improvements to existing policies or practices for protecting IK and other sensitive Tribal Nation information. King County will review this report and guidance for application to County efforts to seek and safeguard IK.

The federal government previously issued guidance to federal agencies recognizing IK or TEK:

> "Traditional Ecological Knowledge, also called by other names including Indigenous Knowledge or Native Science, (hereafter, TEK) refers to the evolving knowledge acquired by indigenous and local peoples over hundreds or thousands of years through direct contact with the environment. This knowledge is specific to a location and includes the relationships between plants, animals, natural phenomena, landscapes, and timing of events that are used for lifeways, including but not limited to hunting, fishing, trapping, agriculture, and forestry. TEK is an accumulating body of knowledge, practice, and belief, evolving by adaptive processes and handed down through generations by cultural transmission, about the relationship of living beings (human and non-human) with one another and with the environment. It encompasses the world view of indigenous people which includes ecology, spirituality, human and animal relationships, and more" (U.S. Fish and Wildlife Service 2011).

The Biden-Harris Administration formally recognized IK, also referred to as TEK, as one of many important bodies of knowledge that contributes to the scientific, social, and economic advancement of communities in the United States. The County reviewed federal guidance, including definitions and principles, as presented by the Council on Environmental Quality (CEQ) in its November 30, 2022, Guidance Memorandum (Council on Environmental Quality 2022).

The County has sought and applied IK to inform design and implementation of capital projects. Recent examples include:

- Harbor Island Dock Demolition Project in the Duwamish Estuary
- The Čakwab Levee Setback Project on the Middle Green River
- Lower Russell Road Levee Setback Project on the Lower Green River
- Kokanee salmon recovery efforts on Lake Sammamish and tributary streams

Two examples of upcoming opportunities to seek and incorporate IK include updates to the County's native plant guide that is provided as a resource to County residents, development of a climate-adaptive plant list called for in the current update of the CAO, and development of old-growth corridor strategy described in the 2024 Comprehensive Plan update policies and work plan.

The County would like to engage in dialogue with Tribes in and near King County consistent with the framework for government-to-government consultation in the Washington State Centennial Accord and informed by the report ordered by the Governor's recent order on Tribal relations. This dialogue would enable the County to understand each federally recognized Tribe's definition and treatment of IK and their recommendations for how IK should inform County decision-making.

1.6 Community Engagement and Public Participation

Consulting with Tribes and engaging with the community during the comprehensive planning process aligns with GMA goals (see Section 1.1) and strengthens King County

efforts to protect the environment and comply with GMA mandates, including the requirements that development regulations be informed by BAS and that counties ensure no net loss of critical areas functions and values (see Section 1.3).

Chapter 1 of the 2024 Comprehensive Plan, Regional Growth Management Planning, describes King County's commitment to supporting broad participation in local planning processes. For example, Policies RP-102 and RP-103 describe how King County engages communities to inform comprehensive planning and provide a high quality of life to King County community members.

The County began the BAS and CAO review in 2022 and developed draft updates in consultation with federally recognized Indian Tribes and in coordination with state and federal agencies and community partners. The County provided public notice of the potential areas of change to critical areas regulations in May 2022, June 2022, January 2023, and June 2023. Additionally, the County published a progress report summarizing BAS review approach and key findings and identifying critical areas code changes under consideration in December 2023. The draft environmental impact statement for the 2024 update, which included evaluation of potential changes to critical areas regulations, was published in December 2023. The County published an initial BAS report and proposed policy and code updates in March 2024. The final environmental impact statement for the 2024 update, which included evaluation of potential changes to critical areas regulations, was published in November 2024. The County provided public comment opportunities throughout the 2024 Comprehensive Plan update process.

While developing the BAS Report and recommended updates to the CAO, King County also engaged a diverse group of community organizations with varied interests in agriculture, housing development, environmental stewardship, and growth management as it reviewed and drafted BAS and updated Comprehensive Plan policies and associated development regulations related to the management of critical areas. These organizations included:

- Community Alliance to Reach Out and Engage (CARE) / Stewardship of Wetland Areas by Neighbors (SWAN)
- Fish, Farm, Flood Implementation Oversight Committee
- Futurewise
- Joint Rural Area Team
- King Conservation District
- King County Agricultural Commission
- Master Builders Association of King and Snohomish Counties
- Puget Soundkeeper
- Seattle King County Realtors Association
- Skyway Coalition
- Watershed Resource Inventory Areas and Salmon Recovery Forums
- White Center Community Development Association

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2 King County's Best Available Science Review

King County completed an extensive best available science (BAS) review when updating its Comprehensive Plan and establishing critical areas development regulations in 2004. The 2004 BAS report, *Volume I: A Review of Scientific Literature*, documented King County's review of BAS applicable to protection of critical areas. A companion report, *Volume II: Assessment of Proposed Ordinances*, documented King County's inclusion of BAS in the development of its Comprehensive Plan and development regulations.

King County reviewed BAS to inform the 2024 updates to its Comprehensive Plan and development regulations. The County's current BAS review builds on the County's 2004 BAS review and was informed by state guidance documents and technical assistance tools. The current BAS review process included review of King County's 2004 BAS report, BAS documents provided by state natural resource agencies, and supplemental scientific literature. This section introduces state guidance documents and BAS resources, and documents King County's approach to the BAS review.

2.1 Washington State Resources for Critical Areas Protection Updates

The Washington State Department of Commerce (Commerce) has produced two key resources that guided King County's BAS review:

- Commerce's 2023 Critical Areas Handbook: an in-depth guidance document designed to help communities review and revise locally adopted programs for designating and protecting critical areas under the Growth Management Act (GMA). The handbook also provides recommendations for monitoring the implementation and effectiveness of critical areas regulations in support of adaptive management.
- Commerce's 2024 Critical Areas Checklist: a concise technical assistance tool designed to help communities review local policies and critical areas regulations for GMA compliance.

2.2 Washington State BAS Resources

After King County prepared its 2004 BAS report, the State of Washington produced BAS documents for some critical areas. These BAS documents are briefly introduced here and are discussed in detail in later sections of this report.

2.2.1 Washington State BAS Documents for Wetlands

The Washington State Department of Ecology (Ecology) has worked in partnership with the Washington Department of Fish and Wildlife (WDFW) to produce BAS documents for the management of wetlands:

- Volume 1: A Synthesis of the Science (Sheldon 2005): summarizes literature relevant to the science and management of freshwater wetlands.
- Volume 2: Guidance for Protecting and Managing Wetlands (Granger 2005): provides guidance for the protection and management of wetlands in Washington State. Based on the science provided in the 2005 Volume 1 companion document.
- Update on Wetland Buffers: The State of the Science (Hruby 2013): revisits key points of the 2005 Volume 1 science report and reviews previous conclusions against new scientific literature published between 2003 and 2012.
- Wetland Guidance for CAO Updates: Western Washington Version (Bunten 2016): provides updated guidance in the protection and management of wetlands in western Washington State.
- Wetland Mitigation in Washington State Part 1: Agency Policies and Guidance, Version 2 (Ecology 2021): provides updated guidance for improving wetland protections and quality and effectiveness of compensatory wetland mitigation in Washington State.
- Wetland Guidance for Critical Areas Ordinance (CAO) Updates: Western and Eastern Washington (Ecology 2022): provides wetland guidance and tools for jurisdictions working on implementing the requirements of Washington State's Growth Management Act (GMA), specifically, designating and protecting wetland critical areas.

2.2.2 Washington State BAS Documents for Riparian Areas

WDFW has produced BAS documents for riparian areas, a type of Fish and Wildlife Habitat Conservation Area (FWHCA). These resources, available online, are:

- Riparian Ecosystems, Volume 1: Science Synthesis and Management Implications (Quinn et al. 2020): summarizes literature relevant to the science and management of riparian areas.
- Riparian Ecosystems, Volume 2: Management Recommendations (Rentz et al. 2020): offers guidance for the protection and management of riparian areas.

The WDFW BAS documents primarily address the needs of aquatic species and include only limited consideration for terrestrial species. WDFW committed to review BAS for the needs of terrestrial species in the future (Quinn et al. 2020).

2.3 King County's BAS Review Scope

Consistent with WAC 365-195-905, the depth and complexity of the current BAS review reflect the scope of amendments to existing Comprehensive Plan policies and critical areas regulations. King County's current BAS review was designed to expand on King County's 2004 BAS review. It aims to ensure compliance with current GMA requirements and administrative guidance with a heightened emphasis on achieving no

net loss of critical areas functions and values. Additionally, it focuses on incorporating significant state agency updates to BAS for riparian areas and wetlands while bolstering local management and protection of critical areas.

King County relied on the Commerce Critical Areas Handbook and Checklist (Commerce 2023 and Commerce 2024) as the primary guidance to scope the current BAS review for each critical area. The review also included comprehensive planning considerations, including nonscientific information, for each critical area and recognized the importance of both regulatory measures and nonregulatory programs in effectively managing and preserving critical areas functions and values at the ecosystem scale. The scope of King County's BAS review is summarized below for each critical area.

King County shared drafts of updates to the critical areas code with Ecology staff, WDFW staff, and Commerce staff. Community engagement and tribal consultations to review BAS findings and Critical Areas Ordinance (CAO) changes under consideration are summarized in Section 1.4. Additionally, the publication of the draft critical areas code in March 2024 provided the public with the opportunity to review and provide comment.

2.3.1 Wetlands

King County reviewed Commerce guidance documents, Ecology BAS updates, King County's 2004 BAS, supplemental literature, and County critical areas monitoring data. This review found that regulatory updates are necessary to improve environmental protections and comply with GMA mandates, including requirements that cities and counties plan for climate resilience and ensure no net loss of critical areas functions and values. Ecology guidance recognizes the potential need to tailor regulations to the circumstances of the jurisdiction, noting that "the recommendations in this document are intended to provide guidance for all local governments, but they may need to be tailored to fit individual circumstances. Factors to consider include the nature and extent of the wetland resources at risk, a city or county's rate of growth, the nature and level of impact from land uses in the jurisdiction, and the staffing resources available for a jurisdiction to implement and administer its CAO" (Ecology 2022).

2.3.2 Riparian Areas

King County reviewed Commerce guidance documents, WDFW BAS, King County's 2004 BAS, supplemental literature, and County critical areas monitoring data. This review found that regulatory updates are necessary to improve environmental protections and comply with GMA mandates, including the requirements that cities and counties plan for climate resilience, ensure no net loss of critical areas functions and values, and demonstrate special consideration for the protection of anadromous fisheries.

2.3.3 Wildlife Habitat

King County reviewed Commerce guidance documents, King County's 2004 BAS, and supplemental literature. This review found regulatory and nonregulatory updates are necessary to improve protections for wildlife and wildlife habitat and to comply with state requirements that cities and counties plan for climate resilience.

2.3.4 Critical Aquifer Recharge Areas (CARA)

King County reviewed Commerce guidance documents, King County's 2004 BAS, and supplemental literature. This review found minor regulatory updates may be necessary to clarify County CARA protections when the CARA map is updated.

2.3.5 Geologically Hazardous Areas (GHA)

King County reviewed Commerce guidance documents and the scope of King County's 2004 BAS literature. This process identified that BAS review was necessary for the management of alluvial fans, a type of GHA. King County reviewed relevant BAS and found that regulatory updates are necessary to establish development standards for alluvial fans. These regulatory updates reduce risks to public health and safety and improve environmental protections while complying with state requirements that cities and counties manage critical areas to protect public health and safety and plan for climate resilience.

2.3.6 Frequently Flooded Areas

King County updated the King County Code (K.C.C.) in 2020 to comply with regulatory guidance and standards from the Federal Emergency Management Agency (FEMA) and Ecology. King County participates in the FEMA National Flood Insurance Program (NFIP) and is subject to compliance with the FEMA Biological Opinion (BiOp) for the Puget Sound region.

The current BAS review for frequently flooded areas is focused on revisions to the CAO provisions for frequently flooded areas to streamline regulatory review for habitat restoration and fish-passage projects. The identified revisions are intended to better support vital salmon recovery projects and to advance the County's goals related to reconnecting functioning floodplain and removing barriers to fish passage while maintaining compliance with the BiOp provisions, FEMA NFIP standards, Ecology standards, and local regulatory standards.

Concurrent with BAS review and development of this report, King County updated its Flood Management Plan. The adopted 2024 King County Flood Management Plan describes in detail County policies affecting frequently flooded areas. As part of developing this update, King County reviewed 2021 state guidance for comprehensive flood hazard management planning, which promotes integrated floodplain management, nonstructural alternatives, and ecological restoration. King County also reviewed WRIA

salmon recovery plan floodplain habitat and connectivity findings and goals, climate change data for projected changes in river flows, and academic research on the functions and values of floodplains.

By modifying King County floodplain standards for salmon recovery projects to streamline regulatory review—while adhering to FEMA minimum standards—King County strives to better protect salmon and orca populations and critical habitats consistent with the BiOp. Current floodplain development standards would still be applied to non-restoration projects such as buildings and new impervious surfaces.

2.3.7 Critical Areas Summary Graphic

King County's BAS review evaluated BAS and local protection of critical areas, including wetlands, riparian areas, wildlife habitat, CARAs, GHAs, and frequently flooded areas. This document discusses these critical areas in separate sections, but BAS review considered that these areas are ecologically integrated elements of the local landscape. Figure 2.1 displays and introduces the essential functions and values of each critical area discussed in this report.

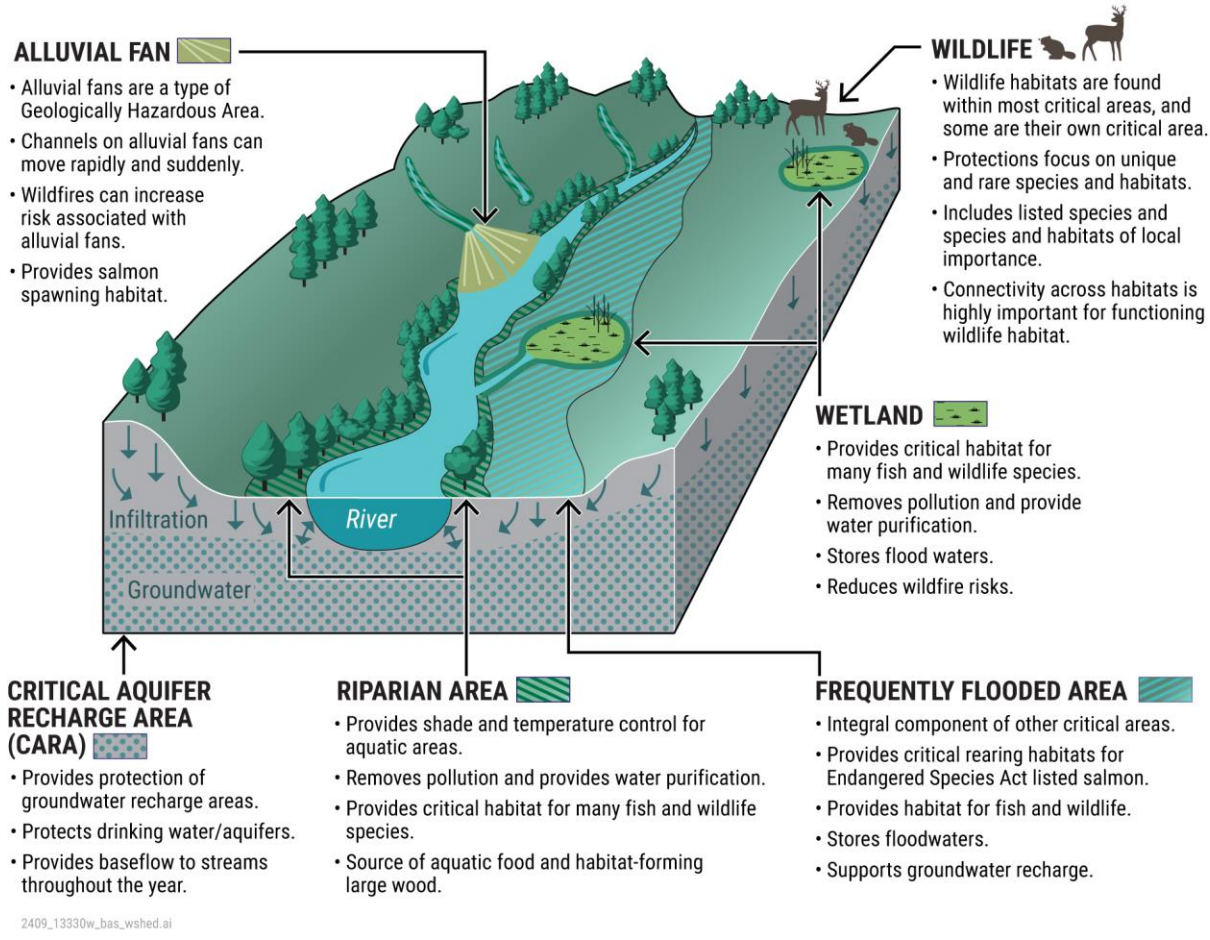

Figure 2.1 Critical areas and essential ecological functions and values.

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3 King County's Approach to Protecting Critical Areas

Growth Management Act (GMA) requirements for review of Best Available Science (BAS) and protection of critical areas are summarized in Section 1.3.

King County has successfully implemented requirements of the GMA since 1994. After King County enacted development regulations to protect critical areas in 2004, the State of Washington introduced a heightened regulatory requirement in 2010 requiring jurisdictions to ensure no net loss of critical areas functions and values (see Section 1.3). In addition, state agencies have issued updated guidance and BAS for some critical areas.

King County is strengthening critical areas protections through the Comprehensive Plan policy updates, regulatory updates, land use designation and zoning requirements, and continued implementation of stormwater management and clearing and grading requirements, and a broad array of nonregulatory programs. Many of these nonregulatory programs have been active for decades and have protected the functions and values of critical areas and the broader King County landscape. Updates to critical areas protections are also informed by the GMA requirement that jurisdictions plan for effects of a changing climate as well as demonstrate special consideration of habitat protection measures relevant to stream flows, water quality and temperature, and other environmental factors important to all life stages of anadromous fish (see Section 1.3.2).

As noted in Section 1.2, King County is updating its Comprehensive Plan and Critical Areas Ordinance (CAO) consistent with GMA goals and requirements and within the unique land use, development, and ecological context of King County. Through the update of the Comprehensive Plan and CAO, as well as commitments to companion nonregulatory actions, the County seeks to simultaneously address GMA goals, some of which can be in conflict, while ensuring no net loss of ecosystem functions and values at an ecosystem scale. To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs, and the mix that is most effective can vary by land use and development patterns.

CAO guidance from Ecology for counties and cities notes that the application of guidance "may need to be tailored to fit individual circumstances. Factors to consider include the nature and extent of the wetland resources at risk, a city's or county's rate of growth, the nature and level of impact from land uses in the jurisdiction, and the staffing resources available for a jurisdiction to implement and administer its CAO" (Ecology 2022). CAO Guidance from the Washington State Department of Commerce (Commerce) echoes this point (Commerce 2023).

The following subsections introduce King County's regulatory and nonregulatory approaches to protecting critical areas functions and values at an ecosystem scale and provides additional information on the legal, social, cultural, economic, and political basis and rationale for departures from BAS. King County's nonregulatory programs that protect critical areas functions and values and frame a coordinated approach to

protection of ecosystems are discussed as well, including examples of the County's history of success in achieving landscape-scale environmental protection.

3.1 Regulatory Measures

King County protects critical areas functions and values in unincorporated King County (UKC) through regulatory measures, including Comprehensive Plan policies, land use designations, and development regulations. Development and land use activities taking place in UKC are also subject to applicable state and federal laws, such as the State Environmental Policy Act (SEPA), State Forest Practices Act, State Hydraulic Project Approval, federal Clean Water Act, and federal Endangered Species Act (ESA).

As noted in Section 1.3, King County, consistent with GMA, has long-standing policies in its Comprehensive Plan intended to limit sprawl and focus new development in the urban area, including incorporated cities and their Potential Annexation Areas. Through policy, land use designation, and companion tools, such as Transfer of Development Rights, the 4-to-1 program, and long-standing land conservation programs, the County has been successful in focusing growth in the urban area and limiting growth in the rural area. The current growth rate in the County's rural area is approximately 1 percent of the County's overall growth.

While the King County Comprehensive Plan and development regulations provide significant protections to critical areas at both the ecosystem and parcel scales, the BAS review indicated the need to update some policies and development regulations to strengthen protection of critical areas functions and values. King County's ability to protect the functions and values of critical areas through regulatory measures at the individual parcel scale is limited in some circumstances where governments are required to allow reasonable use of private property.

3.1.1 King County Comprehensive Plan Policies

Comprehensive Plan policies outline King County's approach to achieving GMA goals. Policies related to critical areas management and protection are primarily found in Chapter 3 (Rural and Natural Resource Lands), Chapter 5 (Environment), and Chapter 6 (Shorelines) of the 2024 Comprehensive Plan.

Updates to King County's 2024 Comprehensive Plan policies include BAS and are informed by GMA goals. In some cases, policy updates depart from BAS to accommodate GMA goals that intersect with the protection and management of critical areas. Relevant GMA goals and King County comprehensive planning considerations that inform departures from BAS are described in the individual sections for each critical area.

Updates to critical areas policies are summarized where applicable in Sections 4 through 8 of this report. To review detailed 2024 changes to policy language, please see the 2024 Comprehensive Plan legislation.

3.1.2 King County Code

King County's Department of Local Services uses the King County Code (K.C.C.) to regulate development and land use activities in UKC. Development regulations that offer protections to critical areas are primarily found in K.C.C. Chapter 21A.24. Standards in portions of the K.C.C., such as Title 9 (Surface Water Management), Chapter 16.82 (Clearing and Grading), and Title 19A (Land Segregation), also provide land use controls and development standards that protect critical areas. For example, surface water management, also known as stormwater management, includes requirements for controlling the volume and rate of stormwater runoff as well as treating pollution that is carried in runoff from impervious surfaces like rooftops and paved areas. Stormwater management requirements for new development play an important role at the watershed and site-specific scales in protecting the functions and values of critical areas like wetlands and riparian areas as well as protecting public health and safety by preventing flooding, erosion, sedimentation, landslides, and exposure of salmon and other wildlife to pollutants.

Updates to development regulations in the K.C.C. include BAS and are informed by GMA and Comprehensive Plan goals. In some cases, updates to development regulations include BAS departures to accommodate GMA and Comprehensive Plan goals that intersect with the protection and management of critical areas. Relevant GMA goals and King County comprehensive planning considerations are discussed where updates depart from BAS.

BAS-informed updates to development regulations are described in Sections 4 through 8 of this report. To review the most current adopted County codes, please see K.C.C. Title 21A. For the 2024 code updates, please see the 2024 Comprehensive Plan legislation.

3.1.3 Reasonable Use and Critical Areas Alteration Exceptions

In order to avoid unconstitutional takings and fulfill the GMA goal to protect property rights and allow for reasonable use of private property, the K.C.C. allows permit applicants to request Reasonable Use Exceptions (RUE) when all reasonable uses of a site, as allowed by adopted zoning, are denied as a result of a critical area. King County's legal authority and the definition of reasonable use are included in K.C.C. Title 21A.

In addition to the RUE process, the K.C.C. Title 21A allows permit applicants to request Critical Areas Alteration Exceptions (CAAE). A CAAE allows adjustments to the application of zoning code standards to critical areas buffers on a particular property. County CAAE decisions are subject to appeal.

3.2 Risk Management and Critical Areas Protections

There is no approach to regulating critical areas that completely eliminates risk of harm to critical areas, as any change in land use or development at the parcel scale inherently has some level of impact on complex natural ecological processes that occur at both a site and landscape scale. King County generally aims to take low- and moderate-risk approaches to regulate and protect critical areas. In limited circumstances, King County may take a higher-risk approach to regulating critical areas functions to account for comprehensive planning considerations and meet competing GMA goals. King County seeks to limit the use of higher-risk regulatory approaches. Where higher-risk regulatory approaches are used, King County employs a broad array of nonregulatory programs to protect critical areas and reduce risk to critical areas functions and values. King County documents the rationale for regulatory updates in detail in later sections of this report.

3.2.1 Risk Assessment of Regulatory Updates

The GMA directs King County to assess development regulations and identify potential risks to the functions and values of critical areas (see Section 1.3). King County's 2004 BAS review included a qualitative assessment of potential risks to critical areas functions and values by comparing proposed development regulations with BAS. Regulations departing or nearly departing from BAS were identified according to best professional judgement. Regulatory approaches to critical areas management were then classified as having a low, moderate, or high risk of degrading critical areas, not taking into account companion nonregulatory programs and regulations beyond the CAO that mitigate risk.

King County's current BAS review follows a similar approach to the 2004 risk assessment. Regulatory updates discussed in this report are qualitatively classified as being low, moderate, or high risk when compared with BAS review findings. In this document, low- and moderate-risk approaches are those that generally align with regulatory strategies and values (e.g., the width of a given wetland buffer) discussed in BAS and, as applicable, in state agency guidance documents. Low-risk approaches are more precautionary relative to moderate-risk approaches. This means that activities regulated by low- and moderate-risk approaches are expected to have low or moderate risk of impacting critical areas functions and values, respectively. Regulatory measures that depart from BAS recommendations are considered to have higher risks of negative impacts to critical areas. Activities regulated using high-risk approaches are expected to have a high-risk of impacting critical areas functions and values. The complexity of risk assessment included in each critical area section is informed by the scale of change to regulatory standards.

3.3 Nonregulatory Programs

King County recognizes the importance of protecting critical areas functions and values through both regulatory measures and nonregulatory programs. WAC 365-196-830

details requirements and guidance for the protection of critical areas under the GMA. Protection in this context means preservation of the functions and values of the natural environment or safeguarding the public from hazards to health and safety. Although jurisdictions may protect critical areas in different ways or may allow some localized impacts to critical areas, or even the potential loss of some critical areas, the GMA requires that jurisdictions ensure no net loss of existing critical areas functions and values and directs jurisdictions to protect critical areas through a combination of regulatory measures, nonregulatory programs, and BMPs. Conservation and protection measures may address land uses on any lands within a jurisdiction and not only lands with designated critical areas. Further, local governments may develop and implement alternative means of protecting critical areas from some activities using BMPs or a combination of regulatory measures and nonregulatory programs. The WAC highlights the importance of using a regional approach when giving special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries.

An evaluation of no net loss for critical areas is not defined or described in the WAC, but Ecology provides useful guidance on how to evaluate no net loss for shoreline master programs, which may inform the evaluation of no net loss for critical areas. Nonregulatory programs, such as voluntary riparian restoration, stream enhancement projects, and multi-benefit floodplain reconnection projects that protect and restore critical areas functions and values beyond what is required by regulations, are an essential part of King County's approach to achieving no net loss. Paired with King County's Comprehensive Plan policies and development regulations, these nonregulatory programs help King County satisfy the GMA's requirement that cities and counties ensure no net loss of critical areas functions and values. The County's approach to using both regulatory measures and nonregulatory programs, at the parcel and ecosystem scale, is described in this report.

3.3.1 Natural Resource Management Initiatives

King County develops and implements plans and initiatives to ensure effective and equitable management of natural resources, including critical areas. Key plans include the Clean Water Healthy Habitat (CWHH) Strategic Plan, the Land Conservation Initiative (LCI), the 30-Year Forest Plan, the Strategic Climate Action Plan (SCAP), and the 2024 Flood Management Plan. Each plan assesses equity impacts, as outlined in the County's Equity and Social Justice (ESJ) Strategic Plan, addressing historical inequities in exposure to environmental risk and pollution and access to a healthy environment.

These plans and initiatives are briefly summarized here, and additional information about these plans and the management of specific critical areas is discussed where applicable in later sections of this report. Readers can learn more about these plans and initiatives by visiting linked webpages and reviewing relevant reports and strategic plans.

These plans complement development regulations and bolster ongoing ecosystem protection, restoration, and resilience at landscape and watershed scales. These plans supplement development regulations, including critical areas regulations, that are applied to new development at the site-development scale. They are supported by policies in the adopted 2016 Comprehensive Plan. Additionally, the 2024 Comprehensive Plan included policy updates that reinforce the foundation for ongoing protection and restoration of critical areas functions and values as well as ecosystem-scale protection and restoration.

While not an exhaustive review of the plans and initiatives listed above, the following key examples illustrate how these efforts enhance protection, restoration, and resiliency of critical areas.

The CWHH Strategic Plan aims to align the County's work around 6 enterprise-wide goals and 13 strategies to deliver faster, better results for people and the environment. The six goals include:

1. Healthy Forests and More Green Space
2. Cleaner, Controlled Stormwater Runoff
3. Reduced Toxics and Fecal Pathogens
4. Functional River Floodplains
5. Better Fish Habitat
6. Resilient Marine Shorelines

The CWHH Strategic Plan articulates outcomes for both people and the environment, and two measures for each goal, along with strategies to improve environmental and community outcomes at an ecosystem scale. For example, the Better Fish Habitat goal includes measures for restoration of fish passage, while the Functional River Floodplains goal focuses on reconnecting floodplains. The plan identifies specific strategies and guides investments in protection and restoration to meet these goals, addressing emerging threats, such as climate change, population growth, and chemicals of emerging concern.

In 2016, the King County LCI established strategies for conserving 65,000 acres of high conservation value land over 30 years in six categories: urban green space, trails, natural lands, rivers, farmlands, and forests. This effort builds on previous protections of more than 190,000 acres since 1970. This initiative guides landscape-scale conservation strategies, including:

- "Fee title" acquisitions through which King County acquires all property rights and owns and manages the land.
- Conservation easement acquisitions through which the County acquires select property rights to protect conservation values in perpetuity.
- Working with landowners to enroll in voluntary incentive programs that result in conservation.

Land conservation, with priorities set at an ecosystem and watershed scale, strengthens protection of critical areas functions and values and works in tandem with development regulations that are focused on addressing impacts of new development and redevelopment at a parcel scale. For example, wetland and riparian area functions and values for wildlife exist at scales that may vastly exceed the size of an individual parcel. Conservation of forested headwaters and river corridors helps to create protected corridors for wildlife to reach vital habitats, which may vary among seasons or over a species life cycle. The overarching goal is to create a resilient, connected, and dynamic mosaic of protected habitats benefiting the environment, wildlife, and people of the region.

In terms of the impact of King County's land conservation efforts, since January 2005, King County DNRP has acquired fee title to more than 9,000 acres of conservation land and conservation easements covering more than 50,000 acres. Voter-approved increases in the Conservation Futures Tax levy rate in 2022, as well as recent policy and code changes to reduce or waive match requirements, are enabling an acceleration in parcel-specific and landscape-scale conservation acquisitions. The 59,000+ acres of conservation acquisitions since 2005 were predominantly in rural and resource zones, but in recent years the County has been increasing the rate of acquiring open space in urban areas as well. While not every parcel of protected land has critical areas, permanent protection of ecological functions and values is often a key reason for seeking permanent protection. For example, of the more than 850 parcels protected under LCI since 2016, more than 65 percent have some portion of the parcel within 200 feet of a river or stream, and more than 85 percent of the parcels intersect at least one type of regulated critical area. While not every fee or easement acquisition under the LCI is focused on ecological conservation (e.g., trail corridor protection)—in many cases where ecological protection isn't the primary reason for conservation—the County's ownership interest helps to ensure regulatory compliance (e.g., through fee ownership by a public agency or through regular easement compliance monitoring).

Further, land conservation via fee-simple acquisition and conservation easements can support strategic protection of riparian corridors and habitat connectivity in a way that the application of development regulations to parcel-specific development proposals cannot. For example, more than 75 percent of the parcels sought for future protection under the LCI have some portion of the parcel within a riparian corridor measured 200 feet on each side of the mapped centerline of a river or stream.

Looking forward, the vast majority of areas the LCI seeks to protect for conservation reasons have one or more critical areas present on some portion of the parcels sought for conservation. Conservation under LCI—both what has been protected so far and what will be protected in years to come—is a concrete and measurable way King County is protecting critical areas functions and values through nonregulatory programmatic actions.

Other planning efforts, such as SCAP, the 2024 Flood Management Plan, and the 30-Year Forest Plan, provide frameworks for achieving various environmental outcomes

and building resilience in the face of climate change. These efforts aim to mitigate ongoing impacts from climate change and to adapt to changing conditions.

In summary, King County's suite of nonregulatory plans and initiatives complement regulatory measures to create a livable region for people while retaining, restoring, and enhancing functions and values derived from healthy, intact ecosystems.

3.3.2 Natural Resource Management Programs and Projects

In addition to plans and initiatives, King County invests in innovative and effective programs and implements specific projects to protect, enhance, and restore the natural environment. These programs and projects implement actions recommended by the overarching plans and initiatives mentioned above to safeguard and restore critical areas as well as to protect, restore, and enhance natural systems at a watershed scale. These ongoing programs and specific projects constitute a proactive approach to improving the functions and values of healthy ecosystems, complementing development requirements that address the impacts of new development and redevelopment at the site or parcel scale.

The following are examples of King County's programs and projects that protect, restore, and enhance critical areas and broader ecosystem functions and values:

- The Transfer of Development Rights (TDR) program permanently conserves land and allows the transfer of development potential from protected rural areas to urban areas where infrastructure can better support new development.
    - Outcome: More than 146,000 acres have been conserved through TDR since 1999.

- The Basin Steward Program strategically plans acquisition and restoration projects in ecologically important areas of the county. Working closely with partners in the Watershed Resource Inventory Area (WRIA) Forums, and informed by WRIA Salmon Recovery Plans, the program identifies, funds, and implements Habitat Restoration Projects for each major watershed.
    - Outcome: Over the past 20 years, King County and WRIA partners have constructed hundreds of habitat projects in strategic locations spanning all of King County's watersheds, as well as Vashon-Maury Island, ranging from small planting projects to major floodplain restoration projects. Increasingly, a focus for habitat restoration and multi-benefit flood risk reduction projects is reconnection of historical floodplains. Since 2020, the County has completed four major multi-benefit flood risk reduction projects that reconnect more than 250 acres of floodplain. The 2024 Flood Management Plan emphasizes these types of actions as important to build climate resilience and restore ecosystem function alongside reducing flood risk.

- King County's 3 Million Trees project is part of King County's Strategic Climate Action Plan and intended to sequester carbon, strengthen climate resilience of

forests in King County, establish tree canopy in urban areas where loss of forest cover and urban heat islands are occurring with development, and support watershed health, including augmenting regulator protection for riparian area functions and values. The 3 Million Trees project has three parts:

1. **Protect:** Accelerating protection of forest land, conserving 6,500 acres that support approximately 2 million trees.
2. **Plant:** Planting 500,000 more trees countywide, mostly in communities that have few trees and where trees can improve salmon habitat.
3. **Prepare:** Preparing 1,000 acres of forest (about 500,000 trees) to be more resilient under a changing climate with warmer, drier summers. These actions include removing noxious weeds and thinning forests in some areas to create more room for healthier trees to thrive.
    - Outcome: Since 2021, the project has protected 1.5 million trees, planted nearly 460,000 trees, and prepared approximately 450,000 trees, contributing more than 2.4 million trees toward the 3 million tree goal.

- The Small Habitat Restoration Program (SHRP) enhances streams and wetlands through voluntary implementation of small projects.
    - Outcome: Since 1995, SHRP has implemented more than 675 projects, planted more than 265,000 trees, and restored more than 15 miles of riparian habitat on public and private land.

- The Fish Passage Restoration Program (FPRP) has completed a comprehensive inventory of more than 3,000 sites along County-owned roads and trails and on County property that are potential barriers to upstream habitat. Prioritization analysis determined that completing 50 restoration projects would restore access to at least half of the habitat that is currently blocked by County structures, impeding salmon from swimming upstream.
    - Outcome: Since 2019, County fish-passage restoration projects have reopened access to 40 miles of stream habitat. FPRP is using information from the inventory to inform prioritization of County fish-passage project investments and grant applications with the goal of restoring access to half of the habitat by 2039.

- Since the 1999 federal Endangered Species Act listings of Chinook salmon and bull trout, King County has supported the development and implementation of federally approved watershed-based salmon conservation plans in each of its major watersheds. Over the last 25 years, King County and salmon recovery partners—such as cities, Tribes, and nongovernmental organizations—have implemented a significant number of salmon habitat restoration projects called for in these plans. These plans recommend long-term salmon habitat restoration efforts such as floodplain restoration, riparian restoration, fish-passage barrier removals, and wetland restoration along salmon-bearing streams and rivers. To date, hundreds of acres of river floodplains have been reconnected through the removal of levees and revetments, more than 1,000 acres of riparian restoration have taken place through the collective actions of many partners, marine

shorelines of King County on Vashon and Maury islands are being restored through the removal of bulkheads to enhance habitat for forage fish that salmon feed on as they migrate, and the County has undertaken a strategic approach to prioritizing and implementing fish passage barrier removals associated with County properties and facilities. The plans also call for investments in public education and outreach to engage the broader community in this vital effort. King County also conducts scientific investigations to better understand how salmon are using our rivers and streams as well as habitat project effectiveness monitoring to ensure salmon benefit from the projects that we construct and to improve future project implementation efforts. By implementing salmon habitat restoration projects, King County has improved riparian, floodplain, and wetland habitat conditions and critical areas along salmon-bearing streams and rivers. At the same time, these projects support human needs and human health by reducing flood risk to communities, reducing the effects of climate change through reforestation, and making our waters clean and swimmable.

Two recent examples of projects that stemmed from WRIA planning efforts are the Riverbend Floodplain Restoration Project on the Cedar River and the Fall City Floodplain Restoration Project on the Snoqualmie River. Collectively, these projects created or enhanced over 200 acres of floodplain habitat in important reaches for salmon, including instream rearing and refuge, spawning, and off-channel habitat for Chinook, coho, and sockeye salmon; steelhead; and cutthroat trout.
In addition to benefits to salmon, these projects also:

- Reduced flood risk by restoring natural floodplain storage and reconnecting river channels.
- Improved wetland and riparian habitat for amphibians, birds, and other wildlife.
- Enhanced water quality and sediment transport, supporting broader ecosystem functions and resilience.

In the next 5 years, King County has several floodplain and nearshore restoration projects planned and will restore an estimated 100 acres of floodplain and approximately 400 feet of marine shoreline on Vashon-Maury Island. These efforts reflect coordinated investments in salmon recovery, flood risk reduction, and climate resilience across WRIA priority areas.

- The Public Benefit Rating System (PBRS) offers an incentive to conserve certain types of open space on private property in King County by providing a property tax reduction. PBRS categories that directly relate to protection of critical areas include aquifer protection areas, significant wildlife or salmonid habitat, and surface water quality buffer areas. Under this program, the appraised land value of participating property is assessed at a “current use” value, which is lower than the “highest and best use” assessment value that would otherwise apply to the property (see King County Code, Chapter 20.36). A point system determines a property’s PBRS enrollment level with points assigned to various open space

resources, including protecting buffers to streams and wetlands, groundwater recharge areas, significant wildlife habitat, significant plant or ecological sites, and conserving farm and forestlands among others (a full list of categories and possible points is on the program website). If the enrolled portion of a property meets or exceeds the threshold number of points to be eligible, the resulting tax reduction could be 50 percent to 90 percent of the appraised land value for the portion of the property participating.

The program regularly monitors enrolled properties to ensure landowners maintain the open space resources in the same or better condition as when approved for enrollment.

In most circumstances, areas that are already required to be protected due to pre-existing regulations or land use actions are ineligible for enrollment in PBRS. For example, open space areas protected by a native growth protection easement, forest retention covenant or other covenants required as part of a development process or subdivision, or zoning regulations do not qualify. However, the program often protects areas adjacent to regulated critical areas and buffers, providing additional protection for critical areas functions and values through voluntary but binding nonregulatory means.

- Outcome: Currently, more than 1,450 landowners and 14,900 acres participate in this program.

- Urban Forestry Program. Following through on recommendations in the King County 30-Year Forest Plan, the County established the Urban Forestry Program in late 2023. The newly established program aims to increase urban tree canopy, especially in low-cover areas, and maintain the health of existing urban forests to enhance urban tree canopy in unincorporated areas and meet County goals and community needs. Healthier and more abundant urban forests will help protect and enhance forest ecosystems in urban areas, with associated benefits to functions and values of critical areas within and near urban forests.

Readers can learn more about nonregulatory programs by visiting linked webpages and reviewing relevant reports. Additional information about nonregulatory programs related to the management of each critical area is discussed in later sections of this report.

3.3.3 Implementation of Development Regulations

Regulations can only be effective when they are used consistently and correctly. Thus, in addition to plans, initiatives, and programs, King County is also updating maps and improving communications materials to ensure development regulations in the K.C.C. are implemented correctly and consistently.

Updated Stream and Wetland Mapping

King County is updating its stream and wetland maps to better inform residents, landowners, permit applicants, and permitting staff of the location and types of streams and wetlands present in King County. King County permitting staff currently use stream and wetland mapping resources first produced in the 1980s and 1990s to inform critical areas permitting processes. To improve implementation of policy and the K.C.C., King County updated its stream and wetland maps in 2024. These resources were updated using the latest data, technologies, and methods to produce vastly more accurate maps. The updated stream maps are publicly available online through King County's interactive mapping tool, King County iMap. More accurate maps benefit community members by instilling greater confidence about the type(s) of critical areas that occur on a given parcel, leading to fewer surprises when people seek to develop or alter land use. Better maps should also help King County efficiently process permit applications, which could benefit both applicants and permitting staff. These maps are advisory, meaning the extent of critical areas and their buffers are subject to field verification during the permitting process.

Permitting Bulletins

King County produces customer bulletins and guidance documents to summarize and answer common questions about code changes. These documents offer plain language summary guidance to applicants as they navigate new permitting requirements. King County will update these documents for wetlands, riparian areas, wildlife habitat, alluvial fans, and frequently flooded areas following adoption of the final CAO update. The County will offer training to Permitting staff to support consistent application and communication of Critical Areas code updates. At the request of the Agriculture Commission and the King Conservation District, the County will also develop a frequently asked questions document with a focus on the impact of regulatory changes on agriculture.

Code Enforcement Updates

King County is responsible for enforcing codes. The King County Auditor's Office completed an audit of the code enforcement process in November 2023. The audit report makes recommendations focused on prioritization, streamlining enforcement processes, data and management, communication with property owners, and collaboration across agencies to improve efficiency and effectiveness of King County's code enforcement. The King County Permitting Division has developed proposed code updates and a report to implement recommendations from the audit. Proposed code updates include those to distinguish between residential and nonresidential violators, increase penalties for violations, create procedural efficiencies, and prioritize violations based on risk and potential for environmental harm. Taken together, these updates intend to make more effective use of limited resources to obtain code compliance for violations that have a higher risk of harm to critical areas functions and values.

Farm Management Plans

Farm Management Plans (FMPs) are property-specific plans composed of BMPs that can help protect critical areas while supporting continued agriculture operations. FMPs are generally voluntary but are a requirement for some County cost-share assistance, tax incentives, and pathways for regulatory flexibility for agricultural development and livestock.

The King Conservation District (KCD), which works with farm owners and operators to develop FMPs, takes into consideration the size of the farm, type of soils, slope of the land, proximity to streams or water bodies, type of livestock or crops, and resources, such as machinery, buildings, and available finances. Specific technical assistance and projects are based on the Natural Resource Conservation Service's (NRCS) list of approved BMPs. Examples of actions and BMPs for farms include: stream-side fencing, gutters and downspouts, composting manure, pasture management and renovation, weed management techniques, creating sacrifice areas, cross fencing, and pasture rotation of livestock.

As reported by KCD, from 2015 to 2022 the Farm Team created 458 total FMPs. Data extracted from the KCD Landowner Incentive Program identifies 73 approved riparian buffer projects from 2015 to 2020 and the installation of 62 projects. This includes 23 buffer fences constructed during this time to exclude livestock from wetlands.

King County has an existing Public Rule (PUT 8-21) that establishes procedures for development, review, and approval of FMPs that are used as the basis for modifications to standards in K.C.C. Chapters 21A.24 (Critical Areas), 16.82 (Clearing and Grading), and 9.04 (Stormwater Management) in application to agricultural development activities. The intent is to protect critical areas by allowing landowners who are engaged in agriculture to undertake a specified set of activities using the proven standards, BMPs, and planning systems developed by NRCS, applied by KCD through the FMP development process, and reviewed and approved by King County Department of Natural Resources and Parks (DNRP). The Farm Management Plan Public Rule was adopted in 2005. Planned updates to this rule should further clarify the review, approval, and registration process for FMPs used as the basis for application of critical areas protections and will improve transparency, ensure application of the most current NRCS BMPs for protection of critical areas functions and values, and support application of a monitoring and adaptive management framework for critical areas. The current CAO updates would require DNRP to update the Farm Management Plan Public Rule in 2026 to establish an inventory of FMPs reviewed as a condition for application of CAO and Livestock Ordinance provisions or qualification for PBRS tax incentives and to publish summary information. The County will invite Tribal consultation and community engagement on the Public Rule update. The County will coordinate the Public Rule update with the KCD, King County Agriculture Commission, Salmon Recovery Forums, Ecology, and WDFW.

Additionally, the Metropolitan King County Council approved a 5-year work plan (2025 through 2029), KCD annual rates and charges, and authorization for King County to enter into an interlocal agreement (ILA) with the KCD on October 15, 2024. The ILA provides the framework for the County and KCD to continue to cooperatively undertake and fund natural resource conservation programs, projects, and activities through December 31, 2029. The categories of service in the work plan are:

- Farm Assistance and Working Lands Sustainability
- Riparian Improvement
- Forest Health
- Member Jurisdiction Grants
- Administration
- Communication, Outreach, Resources, and Education

The ILA requires annual reporting by KCD that describes progress achieved toward the current year's Program of Work and associated natural resource benefits and outcomes, and reports any barriers toward implementing the program of work. During the BAS review and CAO update process, King County staff met with the KCD Board and Planners to review current BAS, regulatory changes under consideration, and interest in strengthening monitoring and reporting on FMP development and implementation. During development of the recently approved 5-year KCD Program of Work, KCD indicated that it will increase monitoring of FMPs and improve data sharing. KCD will provide greater program transparency, which will include details about the types and implementation rate of BMPs included in FMPs, actions taken to encourage BMP implementation, and the number of plans developed and approved to provide regulatory flexibility for farmland owners.

Forest Stewardship Plans

Forest Stewardship Plans are developed in partnership between landowners and resource management agencies to guide forest management. Management actions guided by plans often include timber harvest in compliance with applicable rules, but plans also typically include information and management guidelines to increase forest health (e.g., invasive species management, disease control), reduce wildfire risk, increase forest carbon potential, improve wildlife habitat, and other stewardship and management actions that are beneficial to overall ecosystem health but are not specifically required under CAO or the Washington State Forest Practices Act. Forest Stewardship Plans are voluntary but are required prior to enrollment in certain tax reduction and incentive programs and can also provide landowners some flexibility in application of some CAO standards. Importantly, Forest Stewardship Plans increase landowner awareness of property conditions—including locations of critical areas and buffers—and provide strategies for site management that support critical areas functions and values beyond regulations that focus solely on the space within the critical area and its buffer.

3.4 Special Consideration of Anadromous Salmonids

WAC 365-195-925 states that special consideration should be given to habitat protection measures relevant to stream flows, water quality, temperature, and other environmental factors important to all life stages of anadromous fish. Examples of proposed regulatory changes and nonregulatory actions that demonstrate Special Consideration has been given to conserving and protecting anadromous fisheries include:

- Updates to CAO to:
  - increase riparian widths in all areas of UKC to better protect water quality, provide shade to address rising water temperatures, and allow trees to grow and fall, forming new habitat (see Section 5.1.4).
  - strengthen riparian area protection by increasing the width of riparian areas for streams and rivers with mapped severe channel migration hazard areas where rivers are actively moving across the floodplain (see Section 5.2.3).
  - increase protections for estuarine wetlands and coastal lagoons, which are important habitats for salmon and other fish (see Section 4.1.3).
  - better support floodplain reconnection projects that support rearing and other life stages for salmonids (see Section 8.1.3).
  - update definition of fish and fish habitats to protect critical areas functions and values for all fish, which expands protections outside of anadromous salmonid-bearing aquatic areas (see Section 5.1.4).
- Updates to the County's stream type map layer to:
  - accurately indicate where stream channels are located, enabling riparian buffers to be defined.
  - classify stream segments according to King County's 2005 regulatory stream typing framework (S, F, N, O, unclassified) (see Section 5.1.6).
- Establishment of the Fish Passage Restoration Program, which has completed inventory and prioritization of all suspected barriers and is supporting increased investment in barrier removal (see Section 5.1.6).
- Continued support, partnership, and investment in watershed-based salmon recovery forums that identify, prioritize, and seek grant funding for research and salmon habitat restoration projects (see Section 3.3.2).
- Floodplain reconnection projects that have opened access to habitat critical to all stages of anadromous fish. Since 2020, the County has completed four major multi-benefit flood risk reduction projects that reconnect more than 250 acres of floodplain (see Section 8.1.5).

Additional information on regulatory measures and nonregulatory programs that demonstrate special consideration for protection measures for anadromous fisheries are noted, as appropriate, in subsequent sections of this report.

3.5 Critical Areas Monitoring and Adaptive Management

King County is currently protecting critical areas, including wetlands, through a variety of regulatory measures and nonregulatory programs. Commerce recommends but does not usually require local governments to develop a monitoring and adaptive management (M&AM) program for critical areas. An effective M&AM program can help identify needed improvements in permitting practices and enforcement. It also detects ecological changes in critical areas and points to needed improvements in polices, regulations, and possibly companion nonregulatory actions. The hallmarks of an effective program are relevant questions, defensible data and results to answer them, a process to compare results to thresholds that, when crossed, trigger changes in processes, programs, regulations, and policies that protect critical areas.

According to Commerce's CAO Handbook, an M&AM program is required only when risks to critical areas are largely unknown or when regulations deviate from BAS. Where required, Commerce notes the need for a permit monitoring system to ensure permits were issued and implemented correctly and consistently and to determine whether ecological losses are due to problems with local regulations. Commerce notes that a comprehensive M&AM program consists of three parts: permit implementation monitoring, permit effectiveness monitoring, and ecological validation monitoring. Respectively, these parts determine whether code was implemented correctly and consistently, identify issues with projects and permits that emerge over time, and point to deficiencies in code or situations resulting in harm to critical areas. King County conducts all three of these elements in some form and, compared to other local governments, is particularly strong in the area of ecological validation monitoring (i.e., status and trends). However, all elements and their application can be strengthened to achieve a more robust M&AM framework.

3.5.1 Permit Implementation Monitoring

Permit implementation monitoring determines whether code is being implemented correctly and consistently. This requires a permit tracking system, reviewing permits to ensure they are complete and compliant, conducting inspections to verify projects as built comply with all conditions, regular reporting on findings and recommendations, and enacting processes to improve the permitting system.

King County Permitting Division has an online permit tracking system that supports online applications, e-payments, and digital plan reviews. Permitting staff review permits for completeness and compliance and perform inspections to confirm that mitigation is installed correctly. K.C.C. 21A.24.130 requires financial guarantees and 3 to 5 years of monitoring and reporting for permits with critical areas impacts. The permit tracking system is 13 years old and has limited functionality to easily query issued permits that impact critical areas functions and values. King County permit implementation monitoring would be strengthened with replacement of the online permitting system with an integrated system that better supports queries about specific permit conditions,

implementation from permit application through inspection and enforcement (if applicable), and establishment of a regular cycle for data review and reporting.

3.5.2 Permit Effectiveness Monitoring

Permit effectiveness monitoring is similar to implementation monitoring but focuses on the period of time after a project is completed. Permit effectiveness monitoring determines whether issues with projects and permits arise in the months or years after the project is completed. This requires post-project investigations to verify permits being issued are consistent with all regulatory requirements, that projects meet permit requirements over a longer period, and that issues with compliance and permit procedures are known and addressed.

Permitting Division staff drive continuous improvements in processes. Inspectors train to work with applicants so the mitigation is correctly installed. Permit effectiveness monitoring would be strengthened with more capacity for ongoing inspection, analysis, and reporting relative to benchmarks and triggers for corrective actions when benchmarks are not met.

3.5.3 Ecological Validation Monitoring

Ecological validation monitoring detects harm or loss of critical areas functions and values related to regulatory standards rather than their implementation. Because this monitoring exceeds the capacity of most local governments, Commerce suggests using ecological data from state agencies, at minimum. Where jurisdictions have monitoring capacity, Commerce recommends they perform status and trend monitoring and use findings to inform programmatic action to correct unforeseen losses, revise code, update BAS and BMPs, and perform voluntary restoration. Washington Department of Fish and Wildlife (WDFW) recommends tracking four indicators: a) the portion of critical areas with tree canopy cover; b) the portion of tree canopy cover within critical areas that will be lost within a decade, assuming trends from the previous decade continue; c) the amount of change within critical areas over time in terms of lost canopy cover and new impervious and semi-impervious surfaces; and d) comparison between areas within and outside of critical areas boundaries of the rate of tree loss and conversion to impervious and semi-impervious surfaces. For decades, King County has carried out status and trend monitoring that includes stream health (bugs); water quality in streams, lakes, and Puget Sound; sediment quality; streamflow and temperature; aquatic food webs; and groundwater quality (more limited). The County also completed two time-series studies of land cover change and environmental responses in nine lowland streams in rural, developing UKC. Findings from trend monitoring and these studies are highlighted later in this report. In addition to programs, the County undertakes targeted studies focused on the causes of change in environmental conditions, particularly in streams and lakes. The County conducts flood hazard mapping (both riverine and coastal), assesses and develops strategies to address flood risk in repetitive loss areas, and maps channel migration and landslide hazards.

4 Wetlands

Commonly called marshes, swamps, or bogs, wetlands are those areas that are saturated or inundated by surface or ground water with a frequency sufficient to support plants that depend on saturated or seasonally saturated soil conditions for growth and reproduction. Healthy wetlands help protect communities, infrastructure, and ecosystems from storms and flooding by attenuating stormwater and trapping sediment (Rasmussen et al. 2018). Population growth has led to increased application of fertilizer (Cheng et al. 2020) and other chemicals (Zhu et al. 2022), resulting in more nutrients and pollutants that can run off into the watershed. Wetlands can help filter out those contaminants (Hruby 2013) and thereby reduce their impacts on human and environmental health. Wetlands and the forested buffers surrounding them also provide critical habitat for animals, including migratory birds, amphibians, and commercially and culturally important salmon (Graff and Middleton 2001), and provide opportunities for recreation like hiking and bird watching. The benefits of these wetland ecosystem functions and values generally increase as total wetland cover increases in a watershed.

The Growth Management Act (GMA) requires counties to designate and protect the functions and values of critical areas, including wetlands, using best available science (BAS) (see Sections 1.3.1 and 1.3.2). The GMA defines wetlands in RCW 36.70A.030. Washington's wetlands vary widely in their functions and values. Some types of wetlands are common while others are rare. The Washington State Department of Ecology (Ecology) produces resources and tools for jurisdictions to develop their own land use codes and regulations to protect and restore wetland functions and values while managing community growth and development. These resources include BAS reports and guidance documents (see Section 2.2.1) as well as the Washington State Wetland Rating System for Western Washington (Hruby 2014).

Development can negatively affect wetlands through both direct and indirect impacts (Ecology et al. 2021). Direct impacts, such as wetland loss or degradation, result from activities that occur within wetlands, such as dredging, filling, and draining. Indirect impacts to wetlands and wetland buffers include inputs of stormwater and pollutants generated by land development, degradation or loss of wetland buffers to clearing and development, drainage diversions, or other activities within the contributing drainage area to the wetland. Agricultural activities can also harm wetlands by draining or filling wetlands and converting them to tree or row crops or pasture, leading to the elimination of wetlands themselves. Conversion to land development and agriculture (Chappell 2001) is the primary cause of wetland loss in western Washington.

Wetland functions are also sensitive to the hydrological changes that will occur as a result of climate change (Glick 2011). Potential climate change impacts to wetlands include changes to the timing, volumes, and frequency of flooding and inundation (hydroperiod). These hydroperiod changes are expected to lead to changes and losses to wetlands and the functions and values they provide (Fay 2016)—particularly the types of habitats they provide and their ability to manage water quality and flooding

(Ecology 2023). Climate changes will also make wetlands more sensitive to both direct and indirect impacts from human land use activities (Salimi et al. 2021). The combination of wetland disturbance from human activities and changes in climate will have greater impacts on wetland functions than either stressor would alone.

Climate projections indicate flooding will increase in many Pacific Northwest watersheds over the course of the 21st century, a result of both decreasing snowpack and more intense heavy rain events (Salathé Jr. et al. 2014). For example, by the 2080s, the amount of flow associated with a 10-year peak flow is projected to increase by 72 percent for the Snoqualmie River near Snoqualmie, by 72 percent for the South Fork Skykomish River near Index, and by 58 percent for the Green River near Auburn (Lee 2018). Flows associated with the 100-year flood event are projected to increase by 18 to 55 percent for large rivers. Stream temperatures in the Puget Sound region are projected to increase by 4.0°F to 4.5°F by the 2080s in response to increasing air temperature and declining summer streamflow (Morgan 2016). Heavy rainfall events, typically caused by "atmospheric rivers," are expected to become more intense, with 24-hour rain events intensifying by an average of 22 percent (Morgan 2016).

The predicted increases in precipitation and elevated summer temperatures will create a cascade of ecosystem impacts that will directly affect wetlands by modifying their hydroperiods and biological communities. Upland plant communities that buffer wetlands will also be affected. Ecology (Ecology 2023) identified potential impacts of climate change to wetlands, including:

- Loss of carbon stores in the soil
- Changes in soil structure
- More frequent drying or flooding
- Changes in plant or animal communities
- Saltwater intrusion into freshwater coastal wetlands
- Changes in the timing and amount of water available to wetlands fed by snowmelt

This section discusses BAS, comprehensive planning considerations, development regulations, and King County programs related to the protection of wetlands and wetland functions and values. King County's current BAS review for wetlands was informed by Washington State guidance (see Section 2.1) and included a review of King County's 2004 BAS report, BAS documents produced by Ecology (see Section 2.2.1 and 2.2.2), and other published resources and peer-reviewed literature.

4.1 Wetland Buffers

Buffers are defined in King County Code (K.C.C.) 21A.06.122 as a designated area contiguous to a critical area that is intended to protect and be an integral part of the functions and values of the critical area and reduce impacts from adjacent land uses. Wetland buffers protect functions and values from both direct and indirect impacts. Functions provided by wetland buffers include reducing sedimentation, pollutant and

nutrient input, direct human and animal disturbance, and noise and glare while also providing visual separation. In addition to protecting wetland functions and values, buffers provide wetland-associated species with essential habitat needed for feeding, roosting, breeding, and rearing of young as well as cover for safety, mobility, and thermal protection.

Ecology's 2022 guidance document offers multiple examples of how local jurisdictions may apply wetland buffer widths. These options are presented in Appendix C of Wetland Guidance for Critical Areas Ordinance (CAO) Updates: Western and Eastern Washington (Ecology 2022). Consistent with Ecology guidance for buffer Option 1, King County buffer widths are based on three factors: the wetland category, the level of impacts from adjacent land uses, and the functions or special characteristics of the wetland that need to be protected.

The width of a buffer is based on the minimum distance necessary to protect the most sensitive functions provided by the wetland. Development regulations in the K.C.C. designate wetland buffer widths, or levels of protection for wetland functions, based on wetland category and the intensity of the impact of adjacent land use, designated as high, moderate, or low impact. Wetland buffer widths and the categories of high-, moderate-, and low-impact land uses are defined in K.C.C. 21A.24.325. Previous wetland buffer widths are also shown in Table 4.1.

Table 4.1 Previous wetland buffer widths.

Wetland Category and Characteristics	Intensity of Adjacent Land Use		
	High Impact	**Moderate Impact**	**Low Impact**
Category I			
Wetlands of High Conservation Value	250 feet	190 feet	125 feet
Bog	250 feet	190 feet	125 feet
Estuarine	200 feet	150 feet	100 feet
Coastal Lagoon	200 feet	150 feet	100 feet
Forested	Buffer width to be based on score for habitat functions or water quality functions		
Habitat score 8 to 9 points (high level of function)	300 feet	225 feet	150 feet
Habitat score 6 to 7 (moderate level of function)	150 feet	110 feet	75 feet
Category I wetlands not meeting any of the criteria above	100 feet	75 feet	50 feet

Wetland Category and Characteristics	Intensity of Adjacent Land Use		
	High Impact	Moderate Impact	Low Impact
Category II			
Estuarine	150 feet	110 feet	75 feet
Habitat score 8 to 9 points (high level of function)	300 feet	225 feet	150 feet
Habitat score 6 to 7 (moderate level of function)	150 feet	110 feet	75 feet
Category II wetlands not meeting any of the criteria above	100 feet	75 feet	50 feet
Category III			
Habitat score 8 to 9 points (high level of function)	300 feet	225 feet	150 feet
Habitat score 6 to 7 (moderate level of function)	150 feet	110 feet	75 feet
Category III wetlands not meeting any of the criteria above	80 feet	60 feet	40 feet
Category IV	50 feet	40 feet	25 feet

The K.C.C. provides regulatory allowances to accommodate new development, including allowed alterations (K.C.C. 21A.24.045), buffer averaging (K.C.C. 21A.24.325.B.), and buffer reduction (K.C.C. 21A.24.325.C.6.). Allowed alterations and buffer averaging require that avoidance criteria (K.C.C. 21A.24.125), mitigation requirements (K.C.C. 21A.24.130), and other applicable requirements in the K.C.C. are met. Buffer reductions alter the required buffer width from high-impact to moderate-impact land use intensity (a 25 percent reduction) for development within the Urban Growth Area (UGA), provided all impact minimization measures in K.C.C. 21A.24.325.C.6 are implemented. Current code also classifies agricultural uses as a moderate-intensity land use (and agricultural uses with a Farm Management Plan (FMP) as low-intensity land use) for the purposes of determining wetland buffer widths.

In addition to the regulatory allowances discussed above, King County offers regulatory allowances to applicants seeking permits for select commercial agricultural activities. This includes regulatory allowances for livestock activities detailed in the Livestock Management Ordinance (LMO) (K.C.C. Chapter 21A.30). The regulatory allowances offered by the LMO are dependent on whether the applicant obtains an FMP) (Table 4.2).

Table 4.2 Previous Livestock Management Ordinance grazing area buffer widths.

Wetland Category	Grazing area buffer width with a Farm Management Plan (K.C.C. 21A.30.045)	Grazing area buffer width without a Farm Management Plan (K.C.C. 21A.30.060)
Category I, II, or III (excluding grazed wet meadows)	0 – 25 feet	50 feet
Category IV (excluding grazed wet meadows)	0 feet	0 feet

4.1.1 BAS Review

King County's current BAS review for wetland buffer widths was informed by Washington State guidance (see Section 2.1) and included review of King County's 2004 BAS report (see Section 2.0), BAS documents produced by Ecology (see Section 2.2.2), and other published resources and peer-reviewed literature. Ecology states that, "the scientific literature is clear that buffers are necessary to protect wetland functions and values" and identifies buffers as one of the most important tools available to protect wetlands at the site level in Washington (Ecology 2022).

The following sections discuss wetland functions and values, which are grouped into three main categories—habitat, improving water quality, and hydrologic functions—and also discuss state guidance for protection of wetland buffers.

Habitat Functions

Wetlands are well-recognized as biodiversity hotspots with up to 40 percent of the world's species living in or breeding in wetlands (Convention on Wetlands 2021). Their role as transitional areas between aquatic and terrestrial ecosystems, together with the structural habitat diversity they provide and their high nutrient inputs and primary productivity, contribute to supporting biodiversity (Convention on Wetlands 2021; Barbier et al. 2011). Wetlands attributes are significantly correlated with species richness within taxonomic groups, including amphibians, birds, mammals, reptiles, and endemic terrestrial species (Dertien et al. 2020). Estuarine wetlands and tidal marshes are important nurseries for a wide range of species (Barbier et al. 2011), including fish and birds.

Conserving wetland habitats, habitat patches, and vegetated corridor networks in urban areas and throughout the watershed is critical for certain species and provides migration and refuge from drought and increasing temperatures due to climate change (Hruby 2013). BAS recommends buffer widths ranging from 100 feet to 1,000 feet to protect habitat function for wildlife and for protecting existing vegetated corridors (Environmental Law Institute 2008). A broader approach to protecting wildlife such as mammals, birds, and amphibians is needed, as larger buffers alone may not prevent the populations of these animals from declining.

Wetlands located in urban areas are generally less common and are more impacted by adjacent light and noise pollution, often contain non-native and invasive plant species, and lack intact vegetated corridors or habitat patches connecting adjacent habitat. Urban wetlands can help decrease the “heat island” effect, in which urbanized areas experience higher relative temperatures than surrounding rural areas. Wetlands are more effective at decreasing the heat island effect when they are larger and more aggregated (Ecology et al. 2021). In addition, BAS indicated that degraded emergent wetlands should not be ignored because they can support amphibians that may use lower-quality wetland habitats, including Category IV wetlands that are often dominated by reed canary grass (Ecology et al. 2021).

Water Quality Functions

BAS documents addressed wetland water quality functions, including removal of sediment, nutrients like phosphorus and nitrogen, metals, toxic compounds, and pathogens (Verhoeven et al. 2006; Duffy 2011; Hruby 2013; Ecology et al. 2021). Ecology’s BAS notes that assuming the width, slope, and vegetation of a buffer are sufficient to protect water quality in a wetland may not be a fully effective approach. Soil infiltration, surface roughness (partially caused by vegetation), slope length, and adjacent land use practices are also important environmental factors that play a role in buffer effectiveness (Hruby 2013).

In some cases, if the soils in a buffer are saturated with phosphorus, changes in temperature, pH, and volume of the flows coming through the buffer can lead to the release of the stored phosphorus, resulting in pulses of much-higher-than-typical phosphorus concentrations to the wetland (Hruby 2013). Other studies found that buffers may become saturated with sediment over time and become less effective at removing pollutants. A review of the literature on vegetated buffers in agricultural areas concluded that the efficacy of trapping sediments depended on vegetation type, the density and spacing of plants, the size of sediment particles, the slope gradient and length, and flow convergence, as well as the buffer width (Hruby 2013).

BAS review found that the following buffer widths are generally effective at pollutant removal (Environmental Law Institute 2008):

- 30 to 100 feet for sediment removal
- 100 to 180 feet for nitrogen removal
- 30 to 100 feet for phosphorus removal

Hydrologic Functions

During floods, buffers and wetlands can slow runoff and absorb excess water. This reduces peak flows and can lessen downstream flooding. Coastal wetlands have the capacity to attenuate wave energy and dissipate the impacts of flood waters associated with rising seas and storm surges, especially during flood events (Van Coppenolle and Temmerman 2019), preserving human infrastructure (Salgado 2017). Freshwater and

riverine wetlands can decrease the frequency and magnitude of floods by storing water and slowing peak flow events (Kadykalo and Findlay 2016); even isolated wetlands within leveed systems still have flood protection value (Theiling 2013). Montane wet meadows provide a wide range of water-supply regulation benefits, including flood attenuation, groundwater storage, and extended dry season base flows (Ramstead et al. 2012; Hunt et al. 2018).

King County's review of Ecology BAS indicates that buffers around depressional wetlands can protect wetland hydrologic functions by storing water and releasing it more slowly than the surrounding uplands (Hruby 2013). However, the amount of stormwater a wetland can store will be reduced if surface flows coming into the wetland contain sediment and fill the depression. Buffers may also lose their effectiveness to disperse surface flows over time as flows create rills and channels, causing erosion within a wetland buffer.

Wetland Buffer Widths

King County reviewed Ecology BAS and guidance documents that include recommendations for wetland buffer widths based on a moderate-risk approach (Ecology 2022). Ecology states:

> "Adopting narrower buffers represents a higher-risk approach, and [jurisdictions] need to be prepared to justify, using BAS, why such an approach is necessary and to offer alternative means of protecting wetland functions that help reduce the risk. Jurisdictions may choose to adopt a lower-risk approach. Implementation of such an approach should be based on BAS and may necessitate such things as wider buffers with limited exemptions, exceptions, and averaging; and no administrative buffer reductions" (Ecology 2022).

Ecology's 2022 guidance document offers multiple examples of how local jurisdictions may apply wetland buffer widths. These options are presented in Appendix C of Wetland Guidance for Critical Areas Ordinance (CAO) Updates: Western and Eastern Washington (Ecology 2022). Options presented by Ecology offer varying levels of complexity and flexibility and are based on the following assumptions:

- Wetlands are categorized using the Washington State Wetland Rating System (Hruby 2014).
- Buffer widths are measured along the horizontal plane.
- Specified buffers remain relatively undisturbed over time.
- Wetland buffers are densely vegetated with native plant species appropriate for the ecoregion or that perform similar functions.
- Unvegetated or sparsely vegetated buffers, or those vegetated with invasive species that do not perform needed functions, are planted with appropriate plant species. If buffers are not planted, they are widened to ensure adequate buffer functions are provided.

Consistent with Ecology guidance for Buffer Option 1, King County buffer widths are based on three factors: the wetland category, the level of impacts from adjacent land uses, and the functions or special characteristics of the wetland that need to be protected. Wetland category, functions, and special characteristics are determined by the Washington State Wetland Rating System. Ecology's wetland guidance references dairies, nurseries, greenhouses, growing and harvesting crops requiring annual tilling, raising and maintaining animals, etc. as high-intensity agricultural activity, and orchards, hay fields, light or rotational grazing, etc., as moderate-intensity agricultural activity (Ecology 2022). Current code classifies agricultural development as moderate intensity and agricultural development with an FMP as low-intensity land use for the purposes of determining wetland buffer widths. The County's treatment of some agricultural activities (e.g., raising and maintaining of animals) as moderate or low intensity with an FMP represents a departure from Ecology guidance. However, many of the high-intensity agricultural activities identified in Ecology guidance are already limited in King County by zoning, development codes, and Farmland Preservation Program easement restrictions. Additionally, because most farms in King County are small (average size about 30 acres), family-owned businesses that focus on specialty crops with reduced inputs and tillage, such as perennial crops and most hay fields, King County's agricultural activity falls mainly into the moderate category described by Ecology guidance. Additional information on King County agriculture and land use intensity can be found in Section 4.1.2, Comprehensive Planning considerations.

Ecology indicates that, generally, the effectiveness of a buffer is largely dependent on it being well vegetated with native species, and that buffers with sparse or non-native vegetation should either be planted or widened to achieve adequate function (Ecology 2022). However, Ecology does not provide a specific definition or criteria for "well vegetated." King County's existing and proposed critical areas standards for wetland buffer widths take into account habitat quality as determined by the Washington State Wetland Rating System. This scoring system considers buffer vegetation characteristics, including surrounding habitat connectivity and nearby priority habitats and features. King County reviewed wetland rating data from City of Tukwila that was readily available and confirmed that a wetland's habitat score is a relatively strong proxy for its buffer quality, given that buffer characteristics account for two thirds of that score. This means that the proposed buffers for wetlands with moderate to high habitat scores are expected to be well vegetated in the majority of cases. Wetlands with low habitat scores, however, are more likely to have degraded buffers. Although Ecology states that buffer widths should not be reduced in exchange for planting, it does not provide specific guidelines for wetland buffer vegetation. To increase certainty that wetland buffer standards account for being "well vegetated," King County, in consultation with Ecology and the Washington Department of Fish and Wildlife (WDFW), proposes to develop technical guidelines for assessing the ecological integrity of wetland buffers to provide design criteria for establishing functional wetland buffers. Additionally, K.C.C. already identifies circumstances that would support increasing buffers applied to a particular site and the current update would add a provision specifically addressing poorly vegetated buffers.

4.1.2 Comprehensive Planning Considerations

In addition to BAS review, King County considered nonscientific information when updating wetland buffer widths. As King County updates its Comprehensive Plan policies and associated development regulations found in the K.C.C., it seeks to simultaneously address GMA goals (see Section 1.1), King County Comprehensive Plan Priorities (see Section 3.1.1.), and new state requirements to plan for and accommodate a range of housing types and affordability levels within the urban area while ensuring no net loss of ecosystem functions and values at an ecosystem scale (see Section 1.2). To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs to reduce the risk of impacts to critical areas functions and values.

Ecology guidance recognizes the potential need to tailor regulations to the circumstances of the jurisdiction, noting that "the recommendations in this document are intended to provide guidance for all local governments, but they may need to be tailored to fit individual circumstances. Factors to consider include the nature and extent of the wetland resources at risk, a city or county's rate of growth, the nature and level of impact from land uses in the jurisdiction, and the staffing resources available for a jurisdiction to implement and administer its CAO" (Ecology 2022).

Widening wetland buffers heightens environmental protections by increasing the distance maintained between permitted land use activities and wetlands. By increasing this distance, the amount of land available for activities such as housing development is decreased. King County's existing wetland buffer requirements include provisions for buffer reductions for high-intensity land uses, such as residential development in the urban area, to support the GMA goal of focusing growth in urban areas, provided all impact minimization measures in K.C.C. 21A.24.325.C.6 are implemented. Proposed updates would clarify the land use types in the urban unincorporated area that are eligible for a buffer reduction to include housing, mixed use, day cares, and social services, subject to applicable impact minimization measures consistent with Ecology guidance.

Increases in wetland buffer widths may also reduce flexibility around the placement of farm infrastructure as well as areas available for cultivation. Consistent with GMA goals and requirements, the County designates and protects agricultural lands. The County has adopted a long-standing policy framework through its Comprehensive Plan to provide incentives to support agriculture. Incentives include tax credits, expedited permit review, tax credits, reduced permit fees, and permit exemptions for activities complying with best management practices (BMPs) as well as raising and management of livestock consistent with industry BMPs and county, state, and federal regulations. The K.C.C. offers regulatory allowances for commercial agriculture and allows existing agricultural activities within wetland buffers to continue, with limitations for grazing set forth under the LMO (see Section 4.1), consistent with GMA goals to support agriculture and supportive policies in the King County Comprehensive Plan.

The current update strengthens protections for wetland functions and values while retaining provisions—with modifications—that address GMA goals for focusing urban development, designating and protecting Natural Resource Lands, and supporting affordable housing.

Ecology Buffer Width Assumptions

As noted above, consistent with Ecology guidance, K.C.C. uses a combination of the wetland category, the level of impacts from adjacent land uses, and the functions or special characteristics of the wetland that must be protected. Further, Ecology's recommended buffer widths (see Section 4.1) assume that wetland buffers are densely vegetated with native plant species appropriate for the ecoregion or that perform similar functions. King County's BAS review finds that King County's application of habitat score as a factor in setting buffer widths acts as a strong proxy for wetland vegetation, meaning that, in most cases, proposed buffers for wetlands with moderate to high habitat scores are expected to be well vegetated. Wetlands with low habitat scores, however, are more likely to have degraded buffers. Where buffers are unvegetated or vegetated with invasive species that do not perform needed functions, Ecology guidance recommends that buffers be widened or revegetated to ensure adequate buffer functions are provided. While BAS indicates that restoring dense, native vegetation where little or none exists is generally more effective than widening the buffer, this presents an additional cost to permit applicants who are not otherwise proposing buffer impacts and creates additional needs for County monitoring and code enforcement. Proposed updates to address degraded buffers, therefore, do not rely solely on buffer revegetation.

Ecology Guidance on Buffer Averaging

Ecology guidance for updates to development regulations indicates that buffer averaging may be reasonable if standard buffer widths are adequate and buffer averaging is not combined with other buffer reductions (Ecology 2022). Ecology also states that the width of buffers may be averaged if this will improve the protection of wetland functions or if it is the only way to allow for reasonable use of a parcel (Ecology 2022).

King County's use of buffer averaging creates regulatory flexibility in support of housing development, which is a GMA goal (see Section 1.1). This approach largely maintains environmental protections for wetland functions and values while supporting housing development in King County.

Buffer Reduction for Housing and Services in the Urban Growth Area (UGA)

To support housing development in urban areas, a GMA goal (see Section 1.1), King County may allow a 25 percent reduction of the required buffer width for high-impact land use intensity to the required buffer width for moderate-impact land use intensity

when residential parcels are located within the UGA, provided it meets criteria in K.C.C. 21A.24.325.C.6. Ecology guidelines allow buffer reduction for a variety of high-intensity land uses if the recommended impact minimization measures for the particular type of use are applied. Proposed updates would tie this buffer reduction allowance to certain high-intensity land uses (housing, mixed-use, daycares, and social services) in the urban unincorporated area, provided certain conditions are met, including increasing the density of vegetation in the buffer and locating noise-generating activities away from the wetland. The required conditions are designed to reduce disturbance to wildlife from human activities and impacts from increased stormwater generation. Providing code flexibility for these specific land use types advances policy goals to support housing development in urban areas together with needed supportive services.

King County's approach to reducing buffer widths for residential parcels in the UGA creates a regulatory allowance in support of housing development. This approach reduces but does not eliminate environmental protections for wetland functions and values while supporting housing development in King County.

Buffer Reduction and Agricultural Regulatory Allowances

Ecology guidance recommends that most agricultural land uses (dairies, nurseries, greenhouses, growing and harvesting crops requiring annual tilling, and raising and maintaining animals, etc.) be classified as having a high-intensity land use impact, and that less intensive agricultural land uses (orchards, hay fields, light or rotational grazing, etc.) be classified as having a moderate-intensity land use impact (Ecology 2018). This classification would require most newly permitted agricultural land uses in unincorporated King County (UKC) to adhere to high-intensity land use buffers to ensure protection of wetland functions and values. However, Ecology guidance also recognizes the potential need to tailor regulations to the circumstances of the jurisdiction, noting that "the recommendations in this document are intended to provide guidance for all local governments, but they may need to be tailored to fit individual circumstances. Factors to consider include the nature and extent of the wetland resources at risk, a city or county's rate of growth, the nature and level of impact from land uses in the jurisdiction, and the staffing resources available for a jurisdiction to implement and administer its CAO" (Ecology 2022).

King County classifies agricultural land uses as having either a low- or moderate-intensity land use impact. Specifically, commercial agricultural uses carried out in accordance with an approved FMP and in accordance with conditions in K.C.C. 21A.24.045.D.53 and K.C.C. 21A.24.045.D.54 are classified as having a low-intensity land use impact, based on the assumption that having an FMP is likely to reduce environmental impacts. King County's policies and codes encourage the development of FMPs based on site conditions, agricultural and livestock management activities, and application of BMPs.

King County Public Rule (PUT 8-21) establishes procedures for development, review, and approval of FMPs that are used as the basis for modifications to standards in

K.C.C. Chapters 21A.24 (Critical Areas), 16.82 (Clearing and Grading), and 9.04 (Stormwater Management) in application to agricultural development activities. The intent is to protect critical areas by allowing landowners who are engaged in agriculture to undertake a specified set of activities using the proven standards, BMPs, and planning systems developed by Natural Resource Conservation Service (NRCS) applied by KCD through the FMP development process and reviewed and approved by the King County Department of Natural Resources and Parks (DNRP). The Farm Management Plan Public Rule was adopted in 2005. Updating this rule to further clarify the review, approval, and registration process for FMPs used as the basis for application of critical areas protections is recommended to improve transparency, ensure application of the most current NRCS BMPs for protection of critical areas functions and values, and to support application of a Monitoring and Adaptive Management Framework for Critical Areas.

Development of an FMP based on site conditions and specific agricultural uses can support and incentivize consistent and effective application of BMPs to agricultural activities (e.g., manure management, routing of drainage away from creek, riparian plantings). These same agricultural land use activities are classified as having a moderate-intensity land use impact when carried out without an approved FMP or when not qualifying as a commercial farm.

As noted in Section 1.2, King County continues to have significant agricultural land supporting a local food economy. King County includes approximately 48,000 acres of farmland, including 41,000 acres in Agricultural Production Districts (APDs) in the Lower Snoqualmie, Green, and Sammamish river valleys as well as on the Enumclaw Plateau. Agriculture is the predominant land use in these districts, which also provide critically important salmon habitat and are subject to natural floodplain processes.

The intensity of agricultural land use in King County as classified by Ecology wetland guidance is limited by zoning, development codes, and Farmland Preservation Program (FPP) easement restrictions. Additionally, because most farms in King County are small (average size about 30 acres), family-owned businesses that focus on specialty crops with reduced inputs, much of King County’s agriculture activity is referenced in Ecology guidance as moderate intensity.

Per K.C.C. 21A.04.030, the purpose of the agricultural zone is to preserve and protect irreplaceable and limited supplies of farmland well suited to agricultural uses by their location, geological formation, and chemical and organic composition and to encourage environmentally sound agricultural production. K.C.C. 21a.04.030 therefore establishes residential density limits; allows for uses related to agricultural production and limits nonagricultural uses to those compatible with farming or requiring close proximity for the support of agriculture; and allows for residential development primarily to house farm owners and on-site agricultural employees and their families. K.C.C. 21A.04.030 also states that the use of agricultural zoning is appropriate for lands within APDs designated by the Comprehensive Plan and for other farmlands deemed appropriate for long-term protection. The location of APDs in river and stream floodplains, where development in

flood hazard areas is subject to significant restrictions on fill and new buildings, also has the effect of limiting the intensity of agricultural land uses.

Another factor limiting the intensity of agricultural land uses—especially new buildings and impervious surface—is King County's FPP, which, to date, has purchased easements on 16,127 acres of agricultural lands. Those easements typically remove development rights and place limitations on activities that make land unfarmable. Specifically, easements greatly limit total "non-tillable" acreage, which restricts future development, prohibits mining, and prohibits activities likely to cause erosion or contamination of surface and subsurface waters. FPP easements also require that a farm operator obtain an FMP, reviewed and approved by King County, that includes BMPs developed to minimize environmental impacts from farm operations.

The United States Department of Agriculture (USDA) Agriculture Census is conducted every 5 years, most recently in 2022. This census is based on voluntary reporting and tends to underrepresent small producers who are less likely to respond to the survey. However, because the survey is repeated over time it still provides useful information on trends in farm numbers, type, and size. According to the 2022 USDA Agriculture Census, the average farm size in King County is 29 acres; nearly half the farms are under 9 acres; 41 percent are under 49 acres; and only 9 percent are 50 acres or more. The number of dairy farms in King County has declined steeply from an estimated peak of over 4,000 dairy farms in the 1940s, to 26 farms in 2022, and to 13 farms in 2025. The largest number of farm operations by type are specialty crops or diversified vegetables, berries, or flowers. These small-scale operations rely heavily on hand-planting and hand-harvesting, which reduces soil compaction and fuel use and often incorporates no-till or no-dig practices to minimize soil disturbance as well as actions to build soil health through use of compost, cover crops, and pollinator strips. These types of BMPs are reviewed in development of FMPs.

King County's approach to classifying levels of land use intensity for agriculture for the purposes of applying wetland buffers accounts for APD classification, zoning, other development regulations, land conservation programs (like the FPP program), and market trends that already place significant limits on the footprint and intensity of new agricultural development. The County's continued treatment of agricultural development as moderate or low intensity reflects these limitations while simultaneously advancing GMA goals for designating and protecting agricultural resource lands and the environment, and implementing long-standing Comprehensive Plan policies supporting local agriculture and food production.

4.1.3 Regulatory Updates

Based on BAS review and King County comprehensive planning considerations, King County is updating the K.C.C. with increased buffer widths for Category I and IV wetlands. King County is not updating buffer widths for Category II and III wetlands, which are largely consistent with updated BAS for wetlands. These changes to the K.C.C. help ensure that rare habitats are not lost in King County and align County

regulations with Ecology's moderate-risk approach to protecting wetland functions (see Section 4.1.1 and Section 4.1.4).

Proposed buffer widths will increase for certain Category I wetlands that provide rare habitat and wetland functions and values that are generally difficult or impossible to replace through restoration or mitigation activities. These wetlands are classified by the Washington State Wetland Rating System as "wetlands with special characteristics," which include bogs, estuarine, coastal lagoons, or wetlands of high conservation value (WHCV). Depending on the intensity of the proposed land use, buffers for bogs and WHCVs are proposed to increase by 25 to 50 feet and buffers for estuarine and coastal lagoons by 50 to 100 feet.

- Bogs have layers of peats or mucks that total at least 16 inches thick or that are floating on water or overlying bedrock/hardpan if less than 16 inches; and either (1) more than 70 percent cover of mosses along with other bog-associated species or (2) are forested with bog-associated tree species along with more than 30 percent cover of listed bog-associated species in the understory. The total number of bogs in UKC is not precisely known but is expected to be fewer than 100.

- Category I Estuarine Wetlands have salt marsh vegetation extending over more than 1 acre and meet at least two out of these three criteria: (1) wetland is relatively undisturbed and has less than 10 percent cover of non-native plant species; (2) at least 3/4 of the landward edge is relatively undisturbed vegetation; (3) at least two of the following are present: tidal channels, open water depressions, or contiguous freshwater wetlands. In UKC, estuarine wetlands would be limited to a small number of coastal areas on Vashon Island, likely fewer than ten wetlands exist.

- Category I Coastal Lagoons lie in a depression with open water that is adjacent to marine waters for at least part of the year, contains saline or brackish water during most of the year, retains some surface water at low tide during spring tides, is relatively undisturbed with less than 20 percent aggressive plant species, has 100-foot buffer of relatively undisturbed vegetation along at least 3/4 of landward edge, and is larger than 1/10 acre (4,350 sq. ft.). Coastal lagoons are expected to be quite rare (three or fewer) in UKC, given the specific conditions required, and they would be limited to Vashon Island.

- Wetlands of High Conservation Value (WHCV) are those inventoried by Washington Department of Natural Resources' (WDNR's) Washington Natural Heritage Program (WNHP) as either having high-quality undisturbed plant communities or supporting rare or sensitive plant populations. A very rough GIS analysis indicated there may be around 208 WHCV wetlands in UKC based on mapped WNHP wetlands, with about half of these located on public lands.

The proposed changes help ensure that wetland functions and values are not lost in King County (see Section 1.2.1). Increasing protections for estuarine wetlands and coastal lagoons, which are important habitats for salmon and other fish, also helps demonstrate King County's special consideration of anadromous fisheries (see Section 1.2.2). Increasing protections for bogs aligns with King County's policy to protect habitats of local importance (see Section 6.1), which include sphagnum-dominated peat bogs.

Category IV wetlands are more common in King County, especially in urban areas where they are subject to increased indirect impacts such as adjacent light and noise pollution, often contain non-native and invasive plant species, and often lack intact vegetated corridors or habitat patches connecting adjacent habitat. King County is increasing buffer widths and clarifying buffer reduction provisions for these wetlands to help ensure that habitat functions and values are adequately protected at the watershed scale (see Section 1.2.1). These increases also address Ecology's recommendation (see Section 4.1) that wetland buffers with limited native vegetation be planted with native species or widened. This change better aligns King County with Ecology guidance for a moderate-risk approach to wetland management without introducing the need for permit applicants to plant and maintain Category IV wetland buffers with native plant species.

Category I, II, and III wetlands are more likely to have well-vegetated buffers. However, in cases where wetland buffer is unvegetated or poorly vegetated to an extent that does not provide adequate buffer functions, the current update includes a provision that allows the department to either increase a poorly vegetated buffer to the width that would be required for the next higher land use impact intensity, or to require the permit applicant to implement a buffer revegetation plan. The applicant may select which of these options to apply. This update better ensures that the assumptions guiding wetland buffer widths are met, thereby reducing the risk of a prescribed buffer not providing adequate protection.

Development regulations in the K.C.C. will continue to designate wetland buffer widths, or the level of protection for wetland functions, based on wetland category and the intensity of the impact of adjacent land use, designated as high, moderate, or low impact. Updates to wetland buffer widths are shown in Table 4.3. For ease of interpretation, updates to values in this table are shown as being struck and replaced in parentheses.

Table 4.3 Updated wetland buffer widths.

Wetland Category and Characteristics	Intensity of Adjacent Land Use		
	High Impact	Moderate Impact	Low Impact
Category I			

Wetland Category and Characteristics	Intensity of Adjacent Land Use		
	High Impact	**Moderate Impact**	**Low Impact**
Wetlands of High Conservation Value	~~250 feet~~ (300 feet)	~~190 feet~~ (225 feet)	~~125 feet~~ (150 feet)
Bog	~~250 feet~~ (300 feet)	~~190 feet~~ (225 feet)	~~125 feet~~ (150 feet)
Estuarine	~~200 feet~~ (300 feet)	~~150 feet~~ (225 feet)	~~100 feet~~ (150 feet)
Coastal Lagoon	~~200 feet~~ (300 feet)	~~150 feet~~ (225 feet)	~~100 feet~~ (150 feet)
Forested	Buffer width to be based on score for habitat functions or water quality functions		
Habitat score 8 to 9 points (high level of function)	300 feet	225 feet	150 feet
Habitat score 6 to 7 (moderate level of function)	150 feet	110 feet	75 feet
Category I wetlands not meeting any of the criteria above	100 feet	75 feet	50 feet
Category II			
Estuarine	150 feet	110 feet	75 feet
Habitat score 8 to 9 points (high level of function)	300 feet	225 feet	150 feet
Habitat score 6 to 7 (moderate level of function)	150 feet	110 feet	75 feet
Category II wetlands not meeting any of the criteria above	100 feet	75 feet	50 feet
Category III			
Habitat score 8 to 9 points (high level of function)	300 feet	225 feet	150 feet
Habitat score 6 to 7 (moderate level of function)	150 feet	110 feet	75 feet
Category III wetlands not meeting any of the criteria above	80 feet	60 feet	40 feet
Category IV	~~50 feet~~ (60 feet)	~~40 feet~~ (45 feet)	~~25 feet~~ (35 feet)

King County will continue to include regulatory allowances in development regulations, including allowed alterations (K.C.C. 21A.24.045), buffer averaging (K.C.C. 21A.24.325.B.), and buffer reduction (K.C.C. 21A.24.325.C.6.). Proposed updates to buffer reduction would allow certain high-intensity land uses (housing, mixed-use,

daycares, and social services) in the urban unincorporated area to have wetland buffers reduced to those based on moderate-intensity land use. To limit impacts to wetland critical areas and satisfy the GMA requirement that counties ensure no net loss of critical areas functions and values, these regulatory allowances are subject to meeting conditions informed by Ecology guidance, including increasing the density of vegetation in the buffer and locating noise-generating activities away from the wetland. The required conditions are designed to reduce disturbance to wildlife from human activities and impacts from increased stormwater generation. Providing code flexibility for these specific land use types advances GMA goals to support housing development in urban areas together with needed supportive services.

King County is clarifying regulatory allowances for commercial agricultural activities in continuous existence. Proposed updates include clarification of criteria for verifying "commercial agricultural production" for the purpose of flexible application of code. This clarification is consistent with GMA goals and County Comprehensive Plan policies that support designation and protection of existing commercial agricultural land while limiting application of regulatory flexibility for non-commercial or lands with gardens or livestock for personal use only that do not have the same priority under the GMA. Proposed updates also clarify what constitutes agriculture in "continuous existence" to recognize intentional fallow periods of 7 years consistent with United States Department of Agriculture Natural Resource Conservation Service Guidance. The proposal retains provisions that allow for clearing of invasive non-native vegetation (like blackberries and reed canary grass) as part of maintaining the existing agricultural footprint. Clarifying the application of allowances to established commercial agriculture and not gardens and livestock-keeping for personal use reflects the County's intent to simultaneously address GMA goals to support agriculture and protect the environment and protect critical areas functions and values.

At the same time, the proposal clarifies standards applied to new or expanded footprint for commercial agricultural activities to protect established native vegetation in wetlands, wetland buffers, and riparian areas. The intent of prohibiting expansion into these critical areas and their buffers is to ensure no net loss of critical areas functions and values. Minimum buffer requirements for new livestock activities, including those with an FMP, are also strengthened to better protect wetlands and wetland buffers from water quality impacts (Table 4.4), and regulatory allowances are being updated with new conditions to limit impacts to wetland functions and values.

Table 4.4 Updated Livestock Management Ordinance grazing area buffer widths.

Wetland Category	Grazing Area Buffer Width with a Farm Management Plan (K.C.C. 21A.30.045)		Grazing Area Buffer Width without a Farm Management Plan (K.C.C. 21A.30.060)	
	Previous	Updated	Previous	Updated
Category I, II, or III (excluding grazed wet meadows)	0 – 25 feet	40 feet	50 feet	50 feet

Wetland Category	Grazing Area Buffer Width with a Farm Management Plan (K.C.C. 21A.30.045)		Grazing Area Buffer Width without a Farm Management Plan (K.C.C. 21A.30.060)	
	Previous	Updated	Previous	Updated
Category IV (excluding grazed wet meadows)	0 feet	20 feet	0 feet	25 feet

4.1.4 Risk Assessment of Regulatory Updates

Through the update of the Comprehensive Plan and CAO, as well as commitments to companion nonregulatory actions, the County seeks to simultaneously address GMA goals (see Section 1.1), some of which can be in conflict, while ensuring no net loss of ecological functions and values at an ecosystem scale (see Section 1.2). To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs to reduce risk of impacts to critical areas functions and values.

King County's approach to managing risks to critical areas functions and values is discussed in Section 3.2.

Wetland Buffer Widths

King County's BAS review for wetland buffer widths was informed by Washington State guidance (see Section 2.1), Ecology BAS documents (see Section 2.2.1), and other published resources and peer-reviewed literature as well as observations of County staff reviewing permits and collecting water quality and habitat monitoring data. The BAS review process identified the need to widen buffers for select wetlands (see Section 4.1.3).

Regulatory updates maintain wetland buffer widths for Category II and III wetlands are largely consistent with Ecology's updated BAS for wetlands. For wetlands that are more rare or difficult to replace (Category I), or where buffer assumptions are less likely to be met (Category IV), the County is proposing to increase buffer widths. Overall, these updates to wetland buffer widths generally align with Ecology's buffer recommendations, which are based on a moderate-risk approach to protecting critical areas functions and values (Ecology 2022). Widening buffers for Category I wetlands reduces the risk of losing rare wildlife habitat and wetland functions and values that are generally difficult or impossible to recreate through restoration or mitigation activities. Widening buffers for more common Category IV wetlands accounts for Ecology regulatory buffer assumptions (see Section 4.1.2) and helps ensure that water quality functions and values are sufficiently protected at the site level and that wildlife habitat functions are better protected at the watershed scale. Ecology guidance for wetland buffers assumes they are well vegetated. Although Category I, II, and III wetlands are more likely to have well-vegetated buffers, King County is also adding a provision to the existing buffer modification provisions to address situations where any wetland buffer is unvegetated or poorly vegetated to an extent that does not provide adequate buffer

functions. The provision allows the department to either increase a poorly vegetated buffer to the width that would be required for the next higher land use impact intensity or to require the permit applicant to implement a buffer revegetation plan. The applicant may select which of these options to apply. This update better ensures that the assumptions guiding wetland buffer widths are met, thereby reducing the risk of a prescribed buffer not providing adequate protection.

Buffer Averaging

King County is maintaining general regulatory flexibility in the form of buffer averaging to support a variety of land uses in UKC (see Section 4.1.2). King County limits ecological risks associated with buffer averaging by requiring permit applicants to satisfy avoidance criteria (K.C.C. 21A.24.125) and by prohibiting permit applicants from combining buffer averaging with buffer reduction allowances. Permit applicants are additionally required to mitigate indirect impacts to wetlands and to demonstrate that buffer averaging will result in equal or greater wetland buffer functions and values. This approach to providing regulatory flexibility through buffer averaging is well aligned with Ecology's recommended moderate-risk approach to wetland critical areas management (Ecology 2022).

Buffer Reduction

King County is maintaining but is also clarifying regulatory allowances that allow for the reduction of wetland buffers in certain circumstances. These allowances support housing development in the County's unincorporated UGA (see Section 4.1.2) as well as commercial agriculture in UKC (see Section 4.1.2).

Buffer reductions of 25 percent are allowed for buffers in the UGA for developments with residential uses, mixed-use, daycares, and social services, reducing ecological protections in areas where high-intensity land uses are common and increasing risks to wetland functions and values. King County limits this risk by requiring permit applicants to implement additional on-site protection measures to minimize wetland impacts (K.C.C. 21A.24.325.C.6), including an updated K.C.C. requirement to plant an area of dense, native vegetation within the edge of the remaining buffer equal to the area by which the buffer was reduced. By adding this new planting condition and increasing buffer widths for Category I and IV wetlands, this buffer reduction allowance is aligned with Ecology's recommended moderate-risk approach to wetland critical areas management (Ecology 2022).

King County's wetland buffers align with Ecology guidance for moderate-intensity agriculture that does not qualify as commercial or have an approved FMP. However, King County's proposed standards for commercial agriculture depart from Ecology guidance where they apply a moderate-intensity land use classification to agricultural activities that Ecology considers to be high-intensity, and apply a low-intensity land use classification to commercial agricultural uses carried out in accordance with an approved FMP in accordance with K.C.C. 21A.24.045.D.53 and K.C.C.

21A.24.045.D.54. This approach to commercial agriculture departs from BAS for certain types of activities and absent mitigating regulatory measures and nonregulatory programs likely presents a high risk to wetland functions and values where it is applied. The policy rationale for this departure is meeting GMA goals to designate and protect agriculture lands and long-standing Comprehensive Plan policies supporting incentives, technical assistance, and regulatory flexibility for agriculture (see Sections 1.2.3 and 4.1.2). As noted above, APD designation, zoning, other development restrictions (e.g., floodplain development regulations), significant decline in number of commercial dairy operations in King County, and the nature of agriculture in King County lessen the overall intensity of agricultural land uses and reduce the risks of impact for this departure. Further, the requirement to develop and implement an FMP as a condition of classification of agricultural activities as low intensity for purposes of establishing the wetland buffer also reduces environmental risk by applying site-specific BMPs for water quality.

The proposed updates further limit risk of regulatory allowances for agriculture by updating and clarifying requirements for existing farms in K.C.C. 21A.24.045.D.53. Code updates clarify the definition for “continuous existence,” stating that a fallow period is not to exceed 7 years. Once a 7-year fallow period for a grazed wet meadow or buffer that was previously grazed or tilled is exceeded, the agricultural activity is no longer considered to be in continuous existence and the wetland and buffer areas must be protected and cannot be cleared or graded under this provision. Language in K.C.C. 21A.24.045.D.54 has been updated to clarify that code applies to commercial agriculture and that new or expansion of existing agricultural activities are prohibited where a wetland, wetland buffer, or a riparian area contains a predominantly native forest overstory, shrub, or herbaceous layer. King County is also updating the LMO K.C.C. Chapter 21A.30 to reduce grazing impacts to wetland functions and values to a greater extent than the previous LMO. In wetland buffers that have been previously cleared for agriculture and therefore where grazing is allowed, the LMO requires livestock to be excluded from a portion of the wetland buffer closest to the wetland edge, called the grazing area buffer, except where the wetland is a grazed wet meadow. The LMO updates increase the width of the grazing area buffer required for properties with an FMP and establish a grazing area buffer for Category IV wetlands, although these increases are triggered with new livestock introduction and application of the updated LMO. While wetland protection provisions in the LMO are being strengthened with this update, they still represent a departure from BAS. The policy rationale for this departure is a combination of GMA requirements to designate and support agriculture, Comprehensive Plan policies supporting local agriculture and food production, and the intent to incentivize farm management planning and application of BMPs through FMP technical assistance and cost-sharing programs for livestock fencing.

It is expected that reduced buffer widths based on lower land use intensity classifications offered to support agricultural land uses where an FMP has been developed present a moderate to high risk to wetland critical areas functions and values in watersheds where agriculture is the predominant land use. The intent is to reduce impacts to critical areas by allowing landowners who are engaged in agriculture to

undertake a specified set of activities using BMPs and planning systems developed by NRCS, applied by KCD through the FMP development process, and reviewed and approved by King County DNRP. As noted above, King County Public Rule (PUT 8-21) establishes procedures for development, review, and approval of FMPs that are used as the basis for modifications to standards in K.C.C. Chapters 21A.24 (Critical Areas), 16.82 (Clearing and Grading), and 9.04 (Stormwater Management) in application to agricultural development activities. Proposed code updates would require DNRP to update this rule following adoption of the CAO updates and by the end of 2026 to further clarify the review, approval, and registration process for FMPs used as the basis for application of critical areas protections to improve transparency, ensure application of the most current NRCS BMPs for protection of critical areas functions and values, and to support application of a monitoring and adaptive management (M&AM) framework for critical areas.

4.1.5 Nonregulatory Programs

King County employs a broad array of nonregulatory programs at the ecosystem scale to protect critical areas and reduce risk to critical areas functions and values (see Section 3.3). These nonregulatory investments will improve outcomes for species and critical areas, advancing King County's progress in satisfying GMA goals for environmental protection, shoreline management, climate resiliency, community coordination, and permitting (see Section 1.1). King County coordinates with communities and other partners to guide investment in nonregulatory programs that restore and protect natural resources, including critical areas. Nonregulatory programs that offer protections to wetlands are discussed at a summary level below.

Wetland Mapping

In 2024, King County completed an update to its wetland inventory and maps to more accurately reflect the location, extent, class, functions, and ecological integrity of wetlands present in King County. This new wetland inventory was prepared in accordance with the U.S. Fish and Wildlife Service's National Wetland Inventory (NWI) standards. Based on the latest Geographic Information System (GIS) technology, remote sensing, and field surveys, the new maps are significantly more comprehensive and accurate than previous versions. An additional map includes Potentially Restorable Wetland (PRW) inventory to identify opportunities for restoring wetlands. The updated wetland maps are publicly available online through King County's interactive mapping tools, the King County Watershed Toolbox, and King County iMap, and will be continually updated for accuracy.

Updates to these advisory maps inform community members and King County permitting staff of which wetland critical areas development regulations may apply to a given property. In turn, these updated maps improve King County's ability to effectively implement and enforce development regulations that protect wetlands while supporting King County's ability to issue development permits in a fair and timely manner. Updated maps may also inform future priorities for implementing the County's Land Conservation

Initiative (LCI); for example, by seeking permanent protection of parcels with newly mapped wetlands.

Farm Management Plans

Farm Management Plans (FMPs) are property-specific plans composed of BMPs that can help protect critical areas while supporting continued agriculture operations. FMPs are generally voluntary but are a requirement for some County cost-share assistance, tax incentives, and pathways for regulatory flexibility for agricultural development and livestock.

The King Conservation District (KCD), which works with farm owners and operators to develop FMPs, takes into consideration the size of the farm, type(s) of soils, slope of the land, proximity to streams or water bodies, type(s) of livestock or crops, and resources such as machinery, buildings, and available finances. Specific technical assistance and projects are based on the NRCS's list of approved BMPs. Examples of actions and BMPs for farms include: stream-side fencing, gutters and downspouts, composting manure, pasture management and renovation, weed management techniques, creating sacrifice areas, cross fencing, and pasture rotation of livestock.

King County has an existing Public Rule (PUT 8-21) that establishes procedures for development, review, and approval of FMPs that are used as the basis for modifications to standards in K.C.C. Chapters 21A.24 (Critical Areas), 16.82 (Clearing and Grading), and 9.04 (Stormwater Management) in application to agricultural development activities. The intent is to protect critical areas by allowing landowners who are engaged in agriculture to undertake a specified set of activities using the proven standards, BMPs, and planning systems developed by NRCS, applied by KCD through the FMP development process, and reviewed and approved by King County Department of Natural Resources and Parks (DNRP). The Farm Management Plan Public Rule was adopted in 2005. Planned updates to this rule will further clarify the review, approval, and registration process for FMPs used as the basis for application of critical areas protections and will improve transparency, ensure application of the most current NRCS BMPs for protection of critical areas functions and values, and to support application of a monitoring and adaptive management framework for critical areas. The current CAO updates require DNRP to update the Farm Management Plan Public Rule in 2026, to establish an inventory of FMPs reviewed as a condition for application of CAO and Livestock Ordinance Provisions or qualification for Public Benefit Rating System tax incentives, and to publish summary information. The County will invite Tribal consultation and community engagement on the Public Rule Update. The County plans to update the Farm Management Plan Public Rule following adoption of the current Critical Areas Ordinance update in 2025, working in coordination with the KCD, King County Agriculture Commission, Salmon Recovery Forums, Ecology, WDFW, and tribes.

Livestock Best Management Practices and Programs

King County operates a number of nonregulatory programs to ensure the continued economic vitality of agriculture in the County while reducing impacts to water quality and critical areas. This includes offering cost sharing for implementation of livestock BMPs aimed at reducing critical areas impacts on agricultural properties with an approved FMP. These BMPs include installing fencing to exclude livestock from portions of critical areas or their buffers, revegetating critical areas and critical areas buffers, improving stream crossings, and developing manure management systems.

This nonregulatory program improves outcomes for species and critical areas and advances King County's progress in satisfying GMA goals for maintaining and enhancing natural resource industries, environmental protection, shoreline management, and climate resiliency (see Section 1.1).

Land Conservation in King County

King County operates nonregulatory open space acquisition programs, such as the Land Conservation Initiative (LCI), using funding from King County's Conservation Futures grant program and other sources. The LCI is a regional collaboration between King County, cities, business associations, agricultural communities, environmental partners, and other groups aimed at preserving the County's last, most important natural lands and urban green spaces over the next 30 years. King County has mapped and prioritized 65,000 acres of land for protection in six categories, including urban green space, trails, natural lands, rivers, farmlands, and forestlands. New protections called for under the LCI will add to successful conservation efforts that have permanently protected more than 190,000 acres of the King County landscape, including forests, farms, river valleys, wetlands, upland natural areas, and parks for people.

The extent of protection LCI acquisitions provide for critical areas functions and values varies across categories. Lands purchased through voluntary conservation transactions in most categories of the LCI benefit both ecosystems and people. Urban green space acquisitions that ensure lower-income communities gain better access to natural lands and parks often expand protective buffers around critical areas beyond regulatory protections. Adding land and removing infrastructure from upland and riparian natural areas and river corridors helps to create and maintain habitat corridors of ecologically intact land where natural process can unfold. Conservation easements protecting working forests and farms support natural resource economies and limit development and associated infrastructure expansions in rural and resource areas, which can reduce pressures of nearby development on critical areas.

While not every parcel of land protected under LCI has critical areas, permanent protection of ecological functions and values is often a key reason for seeking permanent protection. For example, of the more than 850 parcels protected under LCI since 2016, more than 65 percent have some portion of the parcel within 200 feet of a

river or stream, and more than 85 percent of the parcels intersect at least one type of regulated critical area. With recent updates to advisory wetland maps, the reported percentage of LCI parcels intersecting mapped critical areas is likely to increase given that the updated maps show previously unmapped wetlands.

LCI enhances protections for critical areas while advancing King County's progress in satisfying GMA goals for urban growth, reducing sprawl, environmental protection, shoreline management, climate resiliency, open space and recreation, natural resource industries, public facilities and services, and community coordination (see Section 1.1).

Habitat Restoration Projects

Since the 1999 federal Endangered Species Act listings of Chinook salmon and bull trout, King County has supported the development and implementation of federally approved watershed-based salmon conservation plans in each of its major watersheds. Over the last 25 years, King County and salmon recovery partners—such as cities, Tribes, and nongovernmental organizations—have implemented a significant number of salmon habitat restoration projects called for in these plans. These plans recommend long-term salmon habitat restoration efforts, such as floodplain restoration, riparian restoration, fish passage barrier removals, and wetland restoration along salmon-bearing streams and rivers. To date, hundreds of acres of river floodplains have been reconnected through the removal of levees and revetments, more than 1,000 acres of riparian restoration have taken place through the collective actions of many partners, the marine shorelines of King County on Vashon and Maury islands are being restored through the removal of bulkheads to enhance habitat for forage fish that salmon feed on as they migrate, and the County has undertaken a strategic approach to prioritizing and implementing fish passage barrier removals associated with County properties and facilities. The plans also call for investments in public education and outreach to engage the broader community in this vital effort. King County also conducts scientific investigations to better understand how salmon are using our rivers and streams as well as habitat project effectiveness monitoring to ensure salmon benefit from the projects that we construct and to improve future project implementation efforts. By implementing salmon habitat restoration projects, King County has improved riparian, floodplain, and wetland habitat conditions and critical areas along salmon-bearing streams and rivers. At the same time, these projects support human needs and human health by reducing flood risk to communities, reducing the effects of climate change through reforestation, and making our waters clean and swimmable.

Two recent examples of projects that stemmed from Watershed Resource Inventory Area (WRIA) planning efforts are the Riverbend Floodplain Restoration Project on the Cedar River and the Fall City Floodplain Restoration Project on the Snoqualmie River. Collectively, these projects created or enhanced over 200 acres of floodplain habitat, including riverine wetlands, in important reaches for salmon that include instream rearing and refuge, spawning, and off-channel habitat for Chinook, coho, and sockeye salmon; steelhead; and cutthroat trout.

In addition to benefits to salmon, these projects also:

- reduced flood risk by restoring natural floodplain storage and reconnecting river channels.
- improved wetland and riparian habitat for amphibians, birds, and other wildlife.
- enhanced water quality and sediment transport, supporting broader ecosystem functions and resilience.

In the next 5 years, King County has several floodplain and nearshore restoration projects planned and will restore an estimated 100 acres of floodplain and approximately 400 feet of marine shoreline on Vashon-Maury Island. These efforts reflect coordinated investments in salmon recovery, flood risk reduction, and climate resilience across WRIA priority areas.

Public Benefit Rating System

The County's Public Benefit Rating System (PBRS) (see Section 3.3) is a voluntary incentive program that provides property tax reductions for participating landowners who choose to make a voluntary but binding commitment to protect open space resources. Areas adjacent to wetlands and wetland buffers are one type of open space resource that can be protected through enrollment in the program. Enrollment of land in PBRS results in avoidance of impacts to areas adjacent to wetlands and buffers beyond what is required by regulations, protecting critical areas functions and values, and limiting the likelihood of future impacts. A point system determines a property's PBRS enrollment level, with points assigned to various open space resources, including protecting buffers to streams and wetlands, groundwater recharge areas, significant wildlife habitat, significant plant or ecological sites, and conserving farm and forestlands, among others (a full list of categories and possible points is on the program website). The program regularly monitors enrolled properties to ensure landowners maintain the open space resources in the same or better condition as when approved for enrollment.

In most circumstances, areas that are already required to be protected due to pre-existing regulations or land use actions are ineligible for enrollment in PBRS. For example, open space areas protected by a native growth protection easement, forest retention covenant or other covenants required as part of a development process or subdivision, or zoning regulations do not qualify. The program often protects areas adjacent to regulated critical areas and buffers, providing additional protection for critical areas functions and values through voluntary but binding nonregulatory means. Currently, more than 1,450 landowners and 14,900 acres participate in this program.

4.2 Wetland Compensatory Mitigation

King County defines mitigation in K.C.C. 21A.06.750 as "an action taken to compensate for unavoidable impacts to the environment resulting from a development activity or alteration after avoidance and mitigation sequencing is applied." King County's requirements for mitigation and monitoring are detailed in K.C.C. 21A.24.130. Additional

development standards are listed in K.C.C. 21A.24.335. Permit applicants seeking to mitigate unavoidable impacts must first demonstrate compliance with K.C.C. 21A.24.125. Consistent with guidance for wetland regulations, this means that development proposals must first limit adverse impacts to critical areas by avoiding, minimizing, or rectifying the impacts to a critical area or its buffer before seeking to compensate for adverse impacts through mitigation and monitoring.

Compensatory mitigation requirements for adverse impacts to wetlands can be found in K.C.C. 21A.24.340. Mitigation requirements are expressed as a ratio of area required to compensate for the area of impact (mitigation:impact). The ratio of mitigation is based on the category of wetland impacted and type of proposed mitigation. Previous wetland mitigation ratios in K.C.C. 21A.24.340 are shown in Table 4.5 and Table 4.6. The previous wetland buffer mitigation ratio was 1:1.

Table 4.5 Previous wetland mitigation ratios for direct impacts.

Category and Type of Wetland	Wetland Re-establishment or Creation	Wetland Rehabilitation	1:1 Wetland Re-establishment or Wetland Creation (R/C) and Wetland Enhancement	Wetland Enhancement Only
Category IV	1.5:1	3:1	1:1 R/C and 2:1 E	6:1
Category III	2:1	4:1	1:1 R/C and 2:1 E	8:1
Category II estuarine	Case-by-case	4:1 rehabilitation of an estuarine wetland	Case-by-case	Case-by-case
All other Category II	3:1	8:1	1:1 R/C and 4:1 E	12:1
Category I forested	6:1	12:1	1:1 R/C and 10:1 E	Case-by-case
All other Category I	4:1	8:1	1:1 R/C and 6:1 E	Case-by-case
Category I wetlands of high conservation value	Not allowed	6:1 rehabilitation of a wetland of high conservation value	Case-by-case	Case-by-case
Category I coastal lagoon	Not allowed	6:1 rehabilitation of a coastal lagoon	Case-by-case	Case-by-case
Category I bog	Not allowed	6:1 rehabilitation of a bog	Case-by-case	Case-by-case
Category I estuarine	Case-by-case	6:1 rehabilitation of an estuarine wetland	Case-by-case	Case-by-case

Table 4.6 Previous wetland mitigation ratios for temporary impacts.

Wetland Category	Permanent conversion of forested and shrub wetlands into emergent wetlands			Mitigation for temporal loss of forested and shrub wetlands when the impacted wetlands will be revegetated to forest or shrub communities		
	Enhancement	Rehabilitation	Creation or Restoration	Enhancement	Rehabilitation	Creation or Restoration
Category I	6:1	4.5:1	3:1	3:1	2:1	1.5:1
Category II	3:1	2:1	1.5:1	1.5:1	1:1	.75:1
Category III	2:1	1.5:1	1:1	1:1	.75:1	.5:1
Category IV	1.5:1	1:1	.75:1	Not applicable	Not applicable	Not applicable

4.2.1 BAS Review

King County's BAS review for wetland mitigation requirements was informed by Washington State guidance (see Section 2.1) and included review of King County's 2004 BAS report (see Section 2), BAS documents produced by Ecology (see Section 2.2), and other published resources and peer-reviewed literature. Ecology states that, "unavoidable impacts to wetlands must be offset by compensatory mitigation to achieve no net loss of wetland function" (Ecology 2022). The following sections discuss BAS review findings related to compensatory mitigation, including essential information from Ecology's Wetland Mitigation in Washington State Part 1: Agency Policies and Guidance (Version 2).

Compensatory Mitigation Methods and Ratios

Compensatory mitigation is the restoration, creation, or enhancement of wetlands for the purposes of offsetting unavoidable adverse impacts that remain after all appropriate and practicable avoidance and minimization has been achieved and includes one or more of the following methods (Ecology et al. 2021):

- **Restoration:** The process of assisting the recovery of an ecosystem that has been degraded, damaged, or destroyed (Gann et al. 2019).
    - **Re-establishment**: The manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historical functions [and environmental processes] to a former aquatic resource.
    - **Rehabilitation:** The manipulation of the physical, chemical, or biological characteristics of a site with the goal of repairing natural/historical functions [and environmental processes] to a degraded aquatic resource.
    - **Reclamation:** The process of assisting the recovery of severely degraded ecosystems to benefit native biota through the establishment of habitats, populations, communities, or ecosystems that are similar, but not necessarily identical, to surrounding and naturally occurring ecosystems.

- **Creation**: The manipulation of the physical, chemical, or biological characteristics of a site to develop a wetland on an upland where a wetland did not previously exist.
- **Preservation:** An existing high-quality wetland is preserved, protecting it from future loss or degradation. (Note: the K.C.C. does not allow preservation as a type of compensatory mitigation.)
- **Enhancement**: The manipulation of the physical, chemical, or biological characteristics of a wetland to heighten, intensify, or improve specific wetland function(s).

Wetland re-establishment and rehabilitation are Ecology's preferred approaches for compensatory mitigation because each results in restoration of environmental processes (Ecology et al. 2021). Because enhancement results in a net loss of wetland and buffer area, and, in some cases, can lead to a tradeoff of wetland functions, Ecology prefers it be used in combination with re-establishment and/or creation (Ecology et al. 2021).

Compensatory mitigation ratios are discussed in depth in Ecology's Wetland Mitigation in Washington State Part 1: Agency Policies and Guidance (Version 2). Table 4.7 introduces Ecology's recommended compensation ratios for permanent wetland impacts in western Washington.

Table 4.7 Ecology's recommended compensation ratios for permanent impacts in western Washington.

Category of Impacted Wetland	Re-establishment or Creation	Rehabilitation	Preservation	Enhancement
Category IV	1.5:1	3:1	6:1	6:1
Category III	2:1	4:1	8:1	8:1
Category II	3:1	6:1	12:1	12:1
Category I	4:1	8:1	16:1	16:1

There are several types of forested wetlands with special characteristics. Because forested wetlands may take more than 100 years to establish, Ecology recommends higher ratios for this type of Category I wetland in western Washington (Table 4.8).

Table 4.8 Ecology's recommended compensation ratios for forested wetlands in western Washington.

Category of Impacted Wetland	Re-establishment or Creation	Rehabilitation	Preservation	Enhancement
Category I forested	6:1	12:1	24:1	24:1

Ecology recommends the following mitigation ratios be used to regulate combination compensation in western Washington (Table 4.9). Combining different methods of compensation introduces greater complexity in calculating adequate compensation but can provide flexibility to those seeking to mitigate adverse wetland impacts.

Table 4.9 Ecology's recommended combination compensation ratios for wetlands in western Washington.

Category of Impacted Wetland	Re-establishment or Creation (R/C) plus Rehabilitation (RH)	Re-establishment or Creation (R/C) plus Preservation (P)	Re-establishment or Creation (R/C) plus Enhancement (E)
Category IV	1:1 R/C plus 1:1RH	1:1 R/C plus 2:1 P	1:1 R/C plus 2:1 E
Category III	1:1 R/C plus 2:1 RH	1:1 R/C plus 4:1 P	1:1 R/C plus 4:1 E
Category II	1:1 R/C plus 4:1 RH	1:1 R/C plus 8:1 P	1:1 R/C plus 8:1 E
Category I	1:1 R/C plus 6:1 RH	1:1 R/C plus 12:1 P	1:1 R/C plus 12:1 E

Direct and Indirect Impacts to Wetlands and Wetland Buffers

The 2008 Federal Mitigation Rule (73 Fed. Reg. 19594, April 10, 2008) defines adverse impacts as those impacts that change the chemical, physical, and biological conditions of a wetland. These adverse impacts can occur directly through alteration of a wetland or wetland buffer or indirectly through alteration of areas adjacent to a wetland or wetland buffer. Impacts include land use development activities that may result in reduced habitat, water quality, or hydrologic functions. Though indirect impacts degrade the functions and values of wetlands and wetland buffers, they generally do not result in a complete loss of wetland and buffer area functions. Therefore, indirect impacts may require less compensation than direct impacts (Ecology et al. 2021).

Assessing the cumulative effects of direct and indirect impacts to a wetland and direct impacts to a wetland buffer is critical to protecting wetland functions and values over time. Mitigation requirements should account for both direct and indirect impacts to wetlands and direct impacts to wetland buffers.

Ecology provides a method for assessing indirect wetland impacts, stating "where a wetland, the buffer, or both would be impacted, superimpose the recommended width of buffer from the edge of the proposed development extending into the wetlands. The superimposed area within the wetland would be the area of indirect impact" (Ecology et al. 2021).

Figure 4.1 illustrates a proposed development that would have permanent direct and indirect impacts on a wetland and wetland buffers.

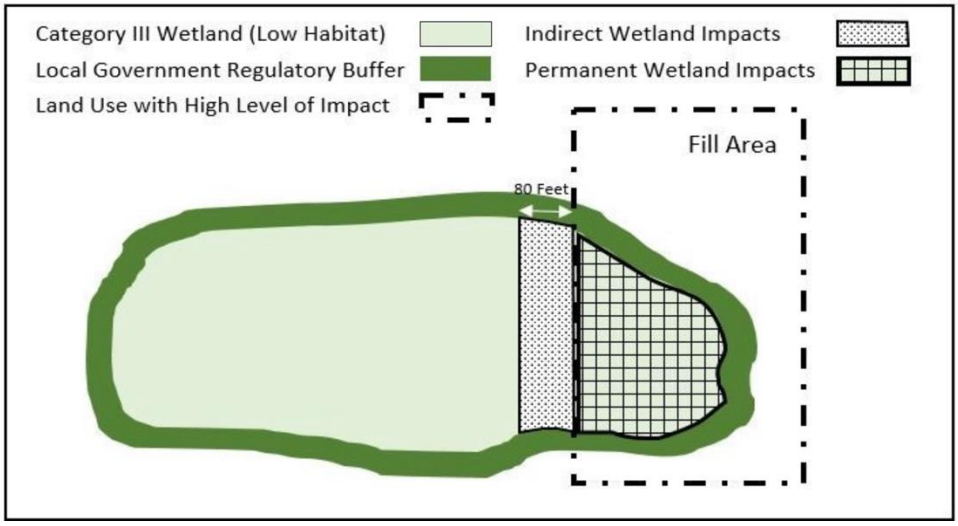

Figure 4.1 Direct and indirect wetland impacts Example 1 (Ecology et al. 2021).

Figure 4.2 illustrates a proposed development that would have permanent direct impacts to a wetland buffer and indirect impacts to the protected wetland.

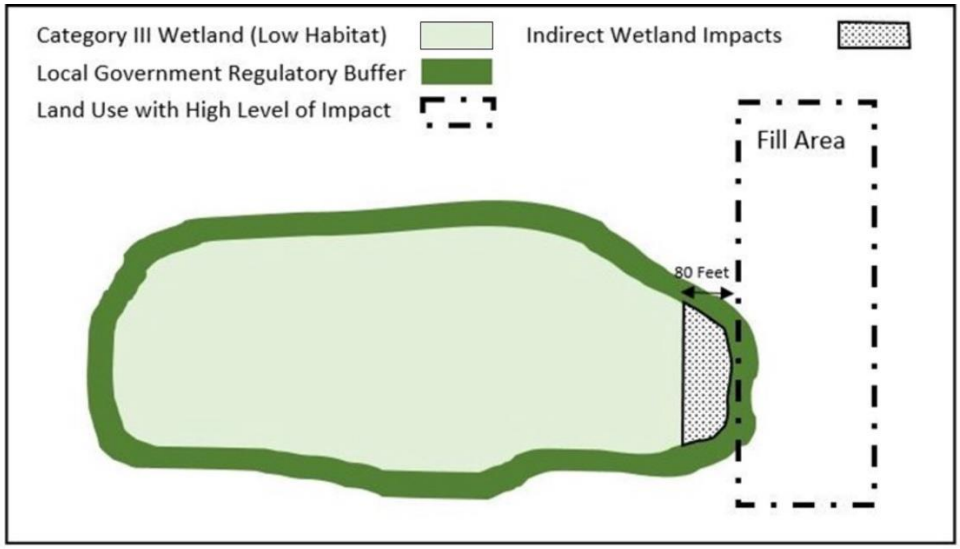

Figure 4.2 Direct and indirect wetland impacts Example 2 (Ecology et al. 2021).

When indirect impacts are proposed, typically required compensation is at one-half of the recommended ratio for permanent wetland impacts. When determining the amount of compensation needed for indirect impacts, an analysis of how the proposed actions will affect the functions of the remaining wetland and its buffer is required. The permitting agency may adjust the indirect impact ratio up or down, based upon case-specific circumstances (Ecology et al. 2021).

Ecology provides minimal guidance for mitigating impacts to wetland buffers but does describe the types of functions that buffers should provide (Ecology 2022). King County

currently requires a buffer mitigation ratio of 1:1, and mitigation typically occurs via enhancement of the remaining on-site buffer to increase the functions it provides, or occurs through addition of new buffer area at the edge of the standard buffer to increase the protected area providing buffer functions to the wetland.

Wetland Plant Biodiversity and Climate Change

Restoration of freshwater depressional wetlands can increase biodiversity relative to degraded wetlands. Restored wetlands showed 36 percent higher levels of provisioning, regulating, and supporting ecosystem services than did degraded wetlands (Meli et al. 2014). In fact, restored wetlands showed levels of provisioning and cultural ecosystem services comparable to those of natural wetlands. However, their levels of supporting and regulating ecosystem services were, respectively, 16 percent and 22 percent lower than in natural wetlands (Meli et al. 2014). Riparian wetland buffer restoration projects that incorporate a greater diversity of trees, including heat- and drought-tolerant species and varieties, may be more resilient to more extreme climate conditions while also helping to mitigate the impacts of heat and drought on wildlife by continuing to provide shade and resources (Seavy et al. 2009; Perry et al. 2015; Millar 2007). Wetland restoration on private property, while often small-scale and supported by minimal funding and expertise, can increase plant biodiversity and soil carbon with soil benefits increasing in saturated conditions, with the greatest gains occurring in riverine wetlands (Bentley et al. 2022).

Forecasts of future vegetation communities in the face of rapid global climate change point to highly dynamic changes to terrestrial vegetation. Long-lived trees and other woody plants are sensitive to land use legacies and are likely to be in disequilibrium with climate. Meaning that, as the climate warms, there may be lags in declines, establishment, and re-establishment. Lagged declines may occur at the trailing edge of a species' range. Lagged establishment may occur at the leading edge of a species' range. Large-scale forest mortality and re-establishment failures may result from extreme climate events (drought) or climate-driven disturbance (fire, pest outbreaks) (Franklin et al. 2016). "Assisted" or "managed" migration is an approach to addressing this problem through the deliberate movement and establishment of a new population of a species or genetic type outside its current geographic range to introduce better adaptive traits. The implementation of assisted migration does not come without economic, legal, political, ecological, and ethical issues (Jenkins and Jenkins 2017).

One approach for assisted migration is to plant a mixture of local seed sources along with seed sources from areas at lower elevations and located farther south. This could be combined with higher planting density plus thinning to allow for some selection of well-adapted trees depending on future climate conditions. Another approach is to develop genetically improved seedlings, a standard procedure in commercial forestry. Assisted migration is already being deployed in British Columbia, Canada (BC), where the degree of warming over the last 35 years has raised immediate concerns about native plants being poorly adapted to current future conditions. Seed transfer standards in parts of BC were changed starting in 2008 to allow moving seed of Douglas-fir and

other species 200 meters higher in elevation and one seed zone further north (up to 300 kilometers or two degrees of latitude). In addition, standards in BC were amended to allow planting western larch in some areas outside of its current range of occurrence, up to 10 percent of the species mix in new plantings (O'Neill et al. 2008). For landowners planting the next generation of trees, there appear to be a few basic options to consider with climate change in mind:

- Planting native seedling stock within current seed zones matching your planting site (status quo).
- Choosing a mix of seed origins, some from local seed zones, some from zones further south or lower in elevation.
- Planting genetically improved stock from existing tree breeding programs.

King County's Mitigation Reserves Program

King County's Mitigation Reserves Program includes a state and federally authorized In-Lieu Fee Mitigation Program that provides an option for permittees with unavoidable impacts to wetlands to pay a fee to King County when there are no mitigation opportunities on site. Fees collected are used to design and construct mitigation projects that restore wetlands in King County. Since 2012, the program has completed 96 mitigation credit sales, generating $58.7 million in revenue. Mitigation projects to offset the wetland and aquatic area impacts will result in the protection and restoration of more than 88 acres on eight mitigation sites. This programmatic approach to mitigation provides an efficient, streamlined option for permittees that reduces state and federal permitting times and results in larger mitigation projects that provide watershed-scale benefits.

4.2.2 Comprehensive Planning Considerations

In addition to BAS review, King County considered nonscientific information when updating wetland mitigation ratios. As King County updates its Comprehensive Plan policies and associated development regulations found in the K.C.C., it seeks to simultaneously address GMA goals (see Section 1.1), King County Comprehensive Plan priorities (see 4.1.2), and new state requirements to plan for and accommodate a range of housing types and affordability levels within the urban area while ensuring no net loss of critical areas functions and values at an ecosystem scale (see Section 1.2).

Increasing wetland mitigation ratios helps ensure that unavoidable adverse impacts to wetlands are reliably offset. This heightened regulatory standard expands environmental protections and helps King County meet the GMA requirement that local jurisdictions ensure there is no net loss of critical areas functions and values (see Section 1.2.1).

Increasing mitigation requirements may increase the costs of select development and land use practices on properties encumbered by wetlands or wetland buffers. Changes to compensatory mitigation ratios do not impact the costs of development and land use

that are able to address adverse impacts by avoiding, minimizing, rectifying, or eliminating adverse impacts.

4.2.3 Washington State Climate Change Mitigation Actions

Wetlands play a key environmental role by providing opportunities for increasing climate resiliency through wetland protection and restoration activities. Prioritizing wetland protection and restoration can enhance climate adaptation by contributing to carbon sequestration, plant and animal biodiversity, flood reduction, water quality improvement, and wildland fire risk reduction. King County's 2004 BAS review did not include consideration of climate change. Legislation passed and signed into law in 2023 (HB 1181) adds a climate goal to the GMA and requires local comprehensive plans to have a climate element with resilience and greenhouse gas emissions mitigation sub-elements. King County is required to comply with HB 1181 legislation by 2029. King County has incorporated consideration of climate change impacts in its Comprehensive Plan since 2004, and the current BAS review includes review of climate impacts and considerations. Additional updates to further implement HB 1181 will also occur as part of the 2029 Comprehensive Plan midpoint update.

4.2.4 Regulatory Updates

Based on BAS review and King County's comprehensive planning considerations, mitigation ratios in the K.C.C. are being updated to better align with Ecology's recommended mitigation requirements. Mitigation ratio updates are generally limited to compensatory mitigation ratios that combine re-establishment or creation and wetland enhancement mitigation methods. Mitigation ratios associated with the enhancement method of mitigation are relatively high as enhancement results in a loss of wetland area. Aligning with Ecology's recommendations for these ratios is necessary to ensure that King County protects wetland functions and values as required by the GMA (see Section 1.2.1).

Updated mitigation ratios in K.C.C. 21A.24.340 are shown in Table 4.10 and Table 4.11. For ease of interpretation, updates to values in these tables are shown as being struck and replaced in parentheses. Ratios for on-site wetland buffer mitigation have not been increased from previous code (1:1). Off-site wetland buffer mitigation is being increased from a ratio of 1:1 to 2:1. Compensation for indirect impacts to wetlands has been added to code at one-half of the recommended ratio for permanent wetland impacts based on the wetland category and type of mitigation.

Table 4.10 Updated wetland mitigation ratios for permanent impacts.

Category and Type of Wetland	Wetland Re-establishment or Creation	Wetland Rehabilitation	1:1 Wetland Re-establishment or Wetland Creation (R/C) and Wetland Enhancement (E)	Wetland Enhancement Only
Category IV	1.5:1	3:1	1:1 R/C and 2:1 E	6:1

Category and Type of Wetland	Wetland Re-establishment or Creation	Wetland Rehabilitation	1:1 Wetland Re-establishment or Wetland Creation (R/C) and Wetland Enhancement (E)	Wetland Enhancement Only
Category III	2:1	4:1	1:1 R/C and ~~2:1~~ (4:1) E	8:1
Category II estuarine	Case-by-case	~~4:1~~ (6:1) ~~rehabilitation of an estuarine wetland~~	Case-by-case	Case-by-case
All other Category II	3:1	~~8:1~~ (6:1)	1:1 R/C and ~~4:1~~ (8:1) E	12:1
Category I forested	6:1	12:1	1:1 R/C and ~~10:1~~ (20:1) E	Case-by-case
All other Category I	4:1	8:1	1:1 R/C and ~~6:1~~ (12:1) E	Case-by-case
Category I wetlands of high conservation value	Not allowed	~~6:1rehabilitation of a wetland of high conservation value~~Case-by-case	~~Case-by-case~~ (Not allowed)	Case-by-case
Category I coastal lagoon	Not allowed	~~6:1~~ (8:1) ~~rehabilitation of a coastal lagoon~~	~~Case-by-case~~ (Not allowed)	Case-by-case
Category I bog	Not allowed	~~6:1rehabilitation of a bog~~Case-by-case	~~Case-by-case~~ (Not allowed)	Case-by-case
Category I estuarine	Case-by-case	~~6:1~~ (8:1) ~~rehabilitation of an estuarine wetland~~	Case-by-case	Case-by-case

Table 4.11 Updated wetland mitigation ratios for conversions and long-term temporary impacts.

Wetland Category	Permanent conversion of forested and shrub wetlands into emergent wetlands			Mitigation for temporal loss of forested and shrub wetlands when the impacted wetlands will be revegetated to forest or shrub communities		
	Enhancement	Rehabilitation	Creation or Restoration	Enhancement	Rehabilitation	Creation or Restoration
Category I	~~6:1~~ (8:1)	4.5:1	3:1	~~3:1~~ (4:1)	2:1	1.5:1
Category II	~~3:1~~ (6:1)	~~2:1~~ (3:1)	1.5:1	~~1.5:1~~ (3:1)	~~1:1~~ (1.5:1)	.75:1
Category III	~~2:1~~ (4:1)	~~1.5:1~~ (2:1)	1:1	~~1:1~~ (2:1)	~~.75:1~~ (1:1)	.5:1
Category IV	~~1.5:1~~ (3:1)	~~1:1~~ (1.5:1)	.75:1	~~Not applicable~~ (1.5:1)	~~Not applicable~~ (.75:1)	~~Not applicable~~ (.25:1)

Ratios recommended by Ecology BAS documents apply to permittee-responsible, concurrent compensatory mitigation (Ecology et al 2021). Updates under consideration would incorporate additional Ecology guidance for determining mitigation amounts. Applicants will be allowed to apply the credit-debit method (Hruby 2012) as an

alternative to the ratios above, and this method can be used by applicants seeking credit for permitted advance mitigation projects (K.C.C. 21A.24.340.E). Updates also allow ratios to be reduced for wetland mitigation bank and in-lieu fee program credits approved as off-site compensatory mitigation when mitigation location and type criteria are met (K.C.C. 21A.24.340.F). Ratios for mitigation banks will follow the approved banking instrument, except that a minimum ratio of 1:1 will be set for wetland mitigation.

In addition to updating mitigation ratios, King County is updating development regulations for sites containing wetlands and wetland buffers (K.C.C. 21A.24.335). Previously, these development regulations limited wetland mitigation and restoration projects to the use of plants indigenous to the Puget Sound lowland unless otherwise authorized by a state or federal permit or approval. Because climate change impacts are making plants native to the Puget Sound lowland vulnerable to disease and die-offs, DNRP is developing guidance for use of climate-adaptive plants in approved mitigation or restoration projects, including publishing a list of approved climate-adaptive plants. DNRP will invite tribal consultation, public comment, and scientific peer review to inform this guidance and list, and may produce additional reports identifying climate-adaptive plants in the future as climate change continues to impact ecological conditions in the County. Updates to critical areas report requirements include clarifications to mitigation plan requirements. Permittee-responsible mitigation will require a minimum monitoring period of 5 years, whereas existing regulations did not specify a minimum period.

Wetland Compensatory Mitigation

King County's BAS review for wetland and buffer compensatory mitigation for direct and indirect impacts was informed by Washington State guidance (see Section 2.1) and Ecology BAS documents (see Section 2.2.1). This process confirmed that most wetland mitigation ratios in the K.C.C. align with those recommended by Ecology while identifying a limited number of ratios for updates to align with Ecology guidance.

The updates to wetland mitigation ratios described in Tables 4.10 and 4.11 bring development regulations in the K.C.C. into alignment with Ecology's recommended moderate-risk approach to wetland critical areas management. Updates to K.C.C. 21A.24.340.E-F reflect Ecology guidance regarding the potential benefits of considering functions in addition to area to calculate mitigation requirements and the potential benefits of programmatic mitigation (Ecology 2022; Ecology et al. 2021).

Additional updates increasing buffer mitigation requirements and introducing compensatory mitigation requirements for indirect impacts are consistent with BAS and help to align the K.C.C. with the State Environmental Policy Act (SEPA) that requires local governments to mitigate land use and development impacts on wetlands (including indirect impacts).

4.2.5 Risk Assessment of Regulatory Updates

Through the update of the Comprehensive Plan and CAO, as well as commitments to companion nonregulatory actions, the County seeks to simultaneously address the many GMA goals (see Section 1.1), some of which can be in conflict, while ensuring no net loss of ecosystem functions and values at an ecosystem scale (see Section 1.2). In advancing the multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs to reduce risk of impacts to critical areas functions and values.

Regulatory updates to both wetland buffer widths and mitigation requirements are consistent with a moderate risk approach. Updates to mitigation ratios and added provisions to allow use of the credit-debit method bring regulations closer in line with Ecology BAS guidance.

4.2.6 Nonregulatory Programs

King County recognizes the importance of protecting critical areas through both regulatory measures and nonregulatory programs. King County coordinates with communities and other partners to guide investment in nonregulatory programs that protect natural resources, including critical areas. Nonregulatory programs related to wetland mitigation are discussed at a summary level below. Regulations protecting critical areas are triggered by and applied to individual development proposals. The County's Land Conservation Initiative (LCI) and habitat restoration programs augment regulatory protections, particularly with respect to protecting and supporting habitat connectivity. For example, under the LCI, conservation planning occurs more intentionally at a watershed scale and prioritizes acquisition efforts to create contiguous areas of public ownership to protect forests, wetland complexes, and river corridors. "Avoidance" criteria are foundational to the County's regulatory protections, but where compensatory mitigation does take place, the investments are informed and augmented by investments in land conservation and habitat restoration.

Land Conservation Initiative

Under the LCI, King County permanently protects lands with wetlands and wetland buffers through voluntary conservation. This permanent protection ensures wetlands and wetland buffers will not be subject to future development proposals that may require compensatory mitigation. The extent of protection that LCI acquisitions provide for critical areas functions and values varies across categories. Lands purchased through voluntary conservation transactions in most categories of the LCI benefit both ecosystems and people. Urban green space acquisitions ensure lower-income communities gain better access to natural lands and parks often expand protective buffers around critical areas beyond regulatory protections. Adding land and removing infrastructure from upland and riparian natural areas and river corridors helps to create and maintain habitat corridors of ecologically intact land where natural processes can unfold. Conservation easements protecting working forests and farms support natural

resource economies and limit development and associated infrastructure expansions in rural and resource areas, which can reduce pressures from nearby development on critical areas.

While not every parcel of land protected under LCI has critical areas, permanent protection of ecological functions and values is often a key reason for seeking permanent protection. For example, of the more than 850 parcels protected under LCI since 2016, more than 65 percent have some portion of the parcel within 200 feet of a river or stream and more than 85 percent of the parcels intersect at least one type of regulated critical area. After advisory wetland maps are updated, the reported percentage of LCI parcels intersecting mapped critical areas is likely to increase given that the updated maps show previously unmapped wetlands.

Public Benefit Rating System

The County's Public Benefit Rating System (PBRS) (see Section 3.3) is a voluntary incentive program that reduces property tax for participating landowners who choose to leave open spaces in a natural condition. Areas adjacent to wetlands and buffers are among the types of open-space resources that can be protected through enrollment in the program. Enrollment of land in PBRS avoids impacts to areas adjacent to wetlands and regulated wetland buffers, protecting critical areas functions and values, and limits the likelihood of impacts that may require compensatory mitigation.

Wetland Mapping

In 2024, King County completed an update to its wetland inventory and maps to more accurately reflect the location, extent, class, functions, and ecological integrity of wetlands present in King County. This new wetland inventory was prepared in accordance with the U.S. Fish and Wildlife Service's National Wetland Inventory (NWI) standards. Based on the latest GIS technology, remote sensing, and field surveys, the new maps are significantly more comprehensive and accurate than previous versions. An additional map includes a Potentially Restorable Wetland (PRW) inventory to identify opportunities for restoring wetlands. The updated wetland maps are publicly available online through King County's interactive mapping tools, the King County Watershed Toolbox, and King County iMap, and will be continually updated for accuracy.

Wetlands Monitoring and Adaptive Management

King County protects critical areas, including wetlands and wetland buffers, through a variety of regulatory measures and nonregulatory programs. One of the nonregulatory programs the County undertakes is monitoring and adaptive management (M&AM) (see Section 3.5 for details).

An M&AM program consists of three parts: permit implementation monitoring, permit effectiveness monitoring, and ecological validation (i.e., status and trends) monitoring. Respectively, these parts determine whether code was implemented correctly and

consistently, identifies issues with projects and permits that emerge over time, and points to deficiencies in code or situations resulting in harm to critical areas. King County conducts all three of these elements in some form and, compared to other local governments, is particularly strong in ecological validation monitoring. However, all elements and their applications can be strengthened to achieve a fully functioning M&AM framework.

King County currently performs permit implementation monitoring. King County's Permitting Division has an online permit tracking system that supports online applications, e-payments, and digital plan reviews. Permitting staff review permits for completeness and compliance and perform inspections to confirm that mitigation is installed correctly. The permit tracking system is 13 years old and has limited functionality to easily query issued permits that impact critical areas functions and values. King County permit implementation monitoring would be strengthened with replacement of the online permitting system with an integrated system that better supports queries about specific permit conditions and implementation, from permit application through inspection and enforcement (if applicable), and establishment of a regular cycle for data review and reporting.

King County also performs permit effectiveness monitoring, though it is limited in scope. Permitting Division staff drive continuous improvements in processes. Inspectors train to work with applicants so the mitigation is correctly installed. K.C.C. 21A.24.130 requires financial guarantees and 3 to 5 years of monitoring and reporting for permits with critical areas impacts. Permit effectiveness monitoring would be strengthened with more capacity for ongoing inspection, analysis, and reporting relative to benchmarks and triggers for corrective actions when benchmarks are not met.

In addition, King County operates numerous long-term monitoring programs to detect changes in the water quality and aquatic food webs of lakes and Puget Sound. While these programs were not designed to evaluate critical areas regulations, they complement critical areas monitoring by providing context on changes in watershed and water quality conditions. In addition to these programs, the County routinely completes targeted studies focused on the causes of change in environmental conditions, particularly in streams and lakes. The County monitors flood risk, coastal and riverine flooding, channel migration zones, and groundwater flooding. The County routinely acts when critical areas show signs of damage. County programs invest heavily in conservation easements, acquisitions, and voluntary restoration in support of salmon recovery, green space, flood risk management, and climate change preparedness. All of these monitoring programs and studies could help determine the conditions of critical areas and that actions are being taken to mitigate losses so the County can show it is meeting the no net loss intent of the GMA.

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5 Riparian Areas (A Type of Fish and Wildlife Habitat Conservation Area)

Riparian areas are the transitional areas between terrestrial and aquatic ecosystems. Intact riparian areas are diverse, dynamic, and complex, supporting an abundance and variety of fish and wildlife. Riparian areas provide ecological functions, including stabilizing banks, controlling shade and temperature, removing pollution and purifying water, contributing nutrients and detritus, delivering habitat-forming large wood, providing habitat for aquatic and terrestrial animals, supplying terrestrial-based food, and more (Quinn et al. 2020). These ecological functions support both terrestrial and aquatic ecosystems and are especially important for anadromous fish species. While riparian areas also support a myriad of terrestrial wildlife, this section focuses on recent Best Available Science (BAS) guidance (Rentz et al. 2020), which does not directly address or assess how riparian areas support terrestrial wildlife. In addition to ecological functions, riparian areas also provide a variety of environmental services, such as flood flow attenuation, nutrient cycling, pollutant filtering, and carbon sequestration (Reid et al. 2005).

Several attributes influence how riparian areas function, including the width of riparian areas, vegetation height, longitudinal (upstream to downstream) and lateral (river to upland) connectivity, and vegetation species composition and diversity (Figure 5.1). Specifically, key riparian area functions, like large wood recruitment and shade, vary based on the width of mature forested riparian areas. The effectiveness of functions like pollution removal and sediment delivery are closely related to the residence time of water and connectivity of riparian areas (Quinn et al. 2020; Rentz et al. 2020). Riparian area functions decrease as land use fragments, reducing the width of riparian areas.

Protecting and restoring riparian areas is one of several strategies that provide special consideration for anadromous fish and their habitats (detailed in Section 1.2.8) (Knight 2009; Commerce 2023). Riparian vegetation connectivity, quality, and quantity are key to functioning salmonid habitat (Quinn et al. 2020; Rentz et al. 2020); therefore, riparian areas should be protected across all aquatic areas (Knight 2009). To meet the special consideration for anadromous fish, protection measures should consider providing for cool, well-oxygenated, unpolluted water; streambed gravels that are relatively free of fine sediments; instream structural diversity; unimpeded migratory access to and from spawning and rearing areas; and complex habitats that support food production (Commerce 2023). Riparian areas adjacent to both fish- and non-fish-bearing streams support these habitat functions either directly in fish-bearing streams or indirectly in non-fish-bearing streams by contributing water, sediment, nutrients, wood, and other materials downstream to fish-bearing streams. In addition to special considerations for anadromous salmonids, riparian area functions and values are important to all native fish species and their habitats, including at any life stage and at any time of year. All native fish and fish habitats should be considered when protecting and restoring riparian areas.

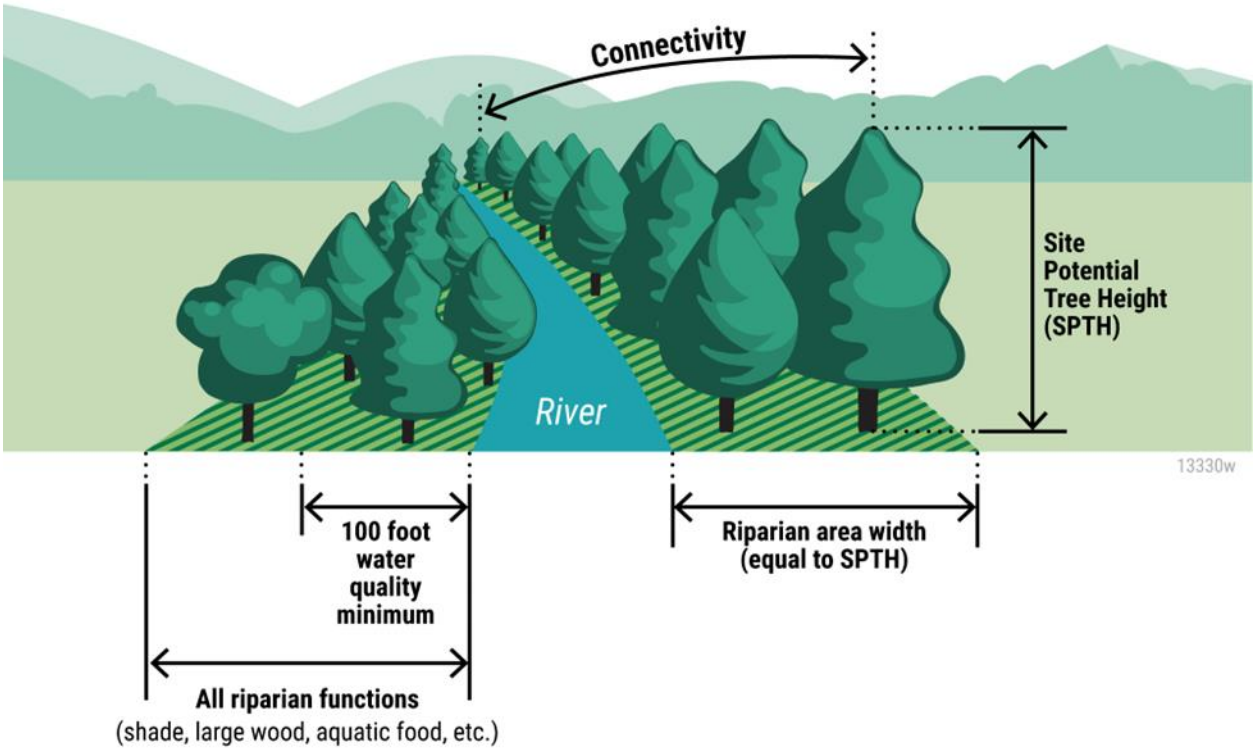

Figure 5.1 Key riparian concepts discussed and integrated into the BAS review.

Riparian areas are especially susceptible to climate impacts compared to upland forests as they tend to be highly exposed to extreme climatic events, including floods, droughts, and intense storms, which are expected to increase in frequency and intensity due to climate change (Capon et al. 2013). Climate change is expected to result in a warmer and drier climate, shifts in precipitation and hydrologic regimes, higher frequency and severity of droughts, decreased soil moisture, greater fire risk, increased insect outbreaks, loss of or shifts in riparian vegetation, and other impacts (Mote et al. 2005; Barnett et al. 2008; Mantua et al. 2010; Isaak et al. 2012; Mauger et al. 2015; Dwire et al. 2018). These climate impacts will negatively affect riparian vegetation presence, productivity, vigor, spatial extent, and community composition. Additionally, temperature increases associated with climate change will impact the extent and magnitude of riparian microclimate conditions, which will negatively affect associated plants and animals. Specifically, climate change is likely to alter the ability of riparian areas to moderate and cool air temperatures, which reduces the rate at which water in adjacent aquatic areas warms up.

Riparian area protection and restoration can help mitigate climate impacts. Protection measures that support wider and more contiguous riparian areas provide more shade to streams, greater microclimate benefits, decreased sensitivity of surface waters to warming during increasingly lower summer low flows, and bolstered resiliency to climate change (Quinn et al. 2020). Resiliency refers to the ability of the riparian area to absorb and recover from disturbances with limited loss of ecological function. Protection and

restoration strategies are especially important because riparian areas provide longitudinal habitat connectivity, link aquatic and terrestrial ecosystems, and create temperature refugia for fish and wildlife (Seavy et al. 2009).

King County has previously described riparian areas as “aquatic area buffers” or “riparian corridors” in Comprehensive Plan policies and the King County Code (K.C.C.) due to the protections they offer aquatic ecosystems such as shorelines, rivers, streams, and lakes. Riparian areas should be designated and protected as a Fish and Wildlife Habitat Conservation Area (FWHCA), rather than just a buffer to aquatic areas, because they are distinct ecosystems that provide benefits to adjacent aquatic areas and have inherent value as fish and wildlife habitat (Rentz et al. 2020). To provide clarity and align with concepts used in state guidance and best available science (BAS) documents, “aquatic area buffers” and “riparian corridors” will now be referenced as “riparian areas” in King County Comprehensive Plan Policies and the K.C.C.

Similar to the designation of riparian area as a FWHCA, Washington State BAS and guidance documents (Quinn et al. 2020; Commerce 2023) emphasize that floodplains are critical components of properly functioning aquatic and riparian ecosystems and provide critical habitats and functions for a variety of fish and wildlife. Specifically, BAS has shown that floodplains provide critical juvenile salmon rearing habitat, support life history diversity, promote elevated growth rates, and provide abundant, high-quality food resources (Sommer et al. 2001, 2005; Jeffres et al. 2008, 2020; Takata et al. 2017; Cordoleani et al. 2022). Based on the description of FWHCAs in Washington Administrative Code (WAC) 365-190-130(2) as well as several King County Comprehensive Plan policies (e.g., E-498a, S-635, based on 2016 Comprehensive Plan numbering), floodplains should be designated as their own FHWCAs and should be protected for ecological functions and values. While floodplains are an important component of properly functioning aquatic and riparian ecosystems, the topic of floodplains as FWHCAs is beyond the scope of the following riparian area protections discussion.

For clarity, riparian areas are discussed in Section 5 of this report. Wildlife habitat protections other than riparian areas are discussed in Section 6.

A condensed summary table of all riparian areas subsections is provided in Section 5.5.

5.1 Riparian Area Widths

King County riparian area widths are the distances that must be maintained between permitted land use activities and aquatic areas. The K.C.C. designates riparian area widths, or levels of protection for riparian and aquatic area functions, based on the location of the riparian area in relation to the urban growth boundary and the type of adjacent aquatic area. Riparian areas outside the Urban Growth Area (UGA), which includes rural and Natural Resource Lands, have greater widths than those found within the UGA. In addition, riparian area widths can be modified based on the presence of a

severe channel migration hazard area (CMHA) (see Section 5.2). Also, livestock activities can occur within previously cleared riparian areas, subject to the Livestock Management Ordinance (LMO). The K.C.C. has a variety of allowed alterations and reasonable use exceptions from permitted activities that allow reductions in width or fragmentation of riparian areas. The range of degradation from allowed alterations includes major and minor intrusions into riparian and aquatic areas.

King County's aquatic area definitions, found in K.C.C. 21A.24.355, are similar to the state's stream typing classification system and are summarized here: Type S aquatic areas are Shorelines of the State, as defined under the Shoreline Management Act and in K.C.C. Chapter 21A.25. Type F aquatic areas are perennial or ephemeral waterbodies known to contain fish or fish habitat. Type F aquatic areas include streams with a defined channel, with a bankfull width of 2 feet or greater and a gradient less than 20 percent. All channels found within mapped 100-year floodplains are considered type S or F. Type N aquatic areas are connected via perennial or ephemeral surface flow to type S or F aquatic areas but do not contain fish or fish habitat. Type O aquatic areas do not have a surface connection to type S, F, or N aquatic areas and primarily infiltrate into the ground.

Previous riparian area widths can be found in K.C.C. 21A.24.358. Riparian area widths for different aquatic area types within and outside the UGA are summarized in Table 5.1.

Table 5.1 Previous riparian area widths inside and outside the Urban Growth Area (UGA) for Unincorporated King County.

Aquatic Area Type	Description	Previous Riparian Area Width Inside UGA	Previous Riparian Area Width Outside UGA
Shoreline (S)	Shorelines of the State.	115 feet	165 feet
Fish (F)	Not S type; contain fish or fish habitat.	115 feet	165 feet
Non-fish-bearing (N)	Not S or F type; connected by surface water to S or F.	65 feet	65 feet
Other (O)	Not S, F, or N type.	25 feet	25 feet

King County offers regulatory allowances to applicants seeking permits for select agricultural activities. Regulatory allowances for livestock activities are detailed in the LMO and found in K.C.C. Chapter 21A.30. The regulatory allowances offered by the LMO are dependent on whether the applicant obtains a Farm Management Plan (FMP) that is approved by the County (Table 5.2).

Table 5.2 Previous Livestock Management Ordinance grazing area buffer widths.

Aquatic Area Type	Grazing Area Buffer Width with a Farm Management Plan (K.C.C. 21A.30.045)	Grazing Area Buffer Width without a Farm Management Plan (K.C.C. 21A.30.060)
Shoreline (S) or Fish (F)	0–25 feet	50 feet
Non-fish-bearing (N) or Other (O)	0 feet	0 feet

5.1.1 BAS Review

King County's current BAS review for riparian area widths was informed by Washington State guidance (see Section 2.1) and included review of King County's 2004 BAS report (see Section 2.0), BAS documents produced by Washington State Department of Fish and Wildlife (WDFW) (see Section 2.2) as well as other published resources (e.g., Washington State Department of Ecology 2021), the Federal Emergency Management Agency (FEMA) Biological Opinion (BiOp) model ordinance, peer-reviewed literature, and BAS syntheses (e.g., King County 2019). King County primarily used the comprehensive BAS documents produced by WDFW (Section 2.2.2) rather than conducting a separate extensive review of all relevant peer-reviewed riparian literature. Additionally, the County sought review of draft updates from Washington State Department of Ecology (Ecology) critical areas, shorelines, and wetland staff as well as WDFW land use planning staff.

Site Potential Tree Height and Riparian Area Width

The width of riparian areas is estimated by one 200-year site potential tree height (SPTH) (Figure 5.1), which is the average maximum height of the tallest dominant trees that are 200 years or more in age (FEMAT 1993; Reeves et al. 2018). Riparian area tree heights vary based on species, age, and site characteristics, including differences in elevation, soil nutrients and moisture, light and temperature regimes, and topography (Avery and Burkhart 2015). Two-hundred-year-old trees are used because the minimum age of old-growth forests is commonly understood to be "200 years or more" (Franklin and Spies 1991). Also, using SPTH for estimating riparian area widths is appropriate because several functions, including large wood recruitment, stream shading, and litter fall, are strongly associated with tree height (FEMAT 1993; Spies et al. 2013; Reeves et al. 2018). Protecting riparian areas within at least one 200-year SPTH to protect and maintain full riparian functions is well supported in the literature (Rentz et al. 2020).

To estimate SPTH for riparian areas across Washington State, WDFW used Natural Resources Conservation Service soil class data and growth curves for three tree species. These SPTH estimates are available online (WDFW SPTH Webtool). WDFW recommends that a site-by-site approach be used for SPTH determination; however, this approach would result in more than 50 different riparian area widths across King County (unpublished evaluation of WDFW SPTH data). Such a high number of riparian area widths would not only be difficult to implement from a permitting and enforcement point of view but would likely also cause confusion for community members.

Additionally, the WDFW webtool is based on soil class data that is too coarse for suitable application at a parcel scale but appropriate for broader evaluations of SPTH patterns. In addition, one of the three tree species WDFW used was not appropriate for the analysis. Subsequently, an alternative approach developed from WDFW SPTH data was used to estimate SPTHs for riparian areas in King County.

Estimation of Site Potential Tree Height for King County

As discussed above, a combination of soil class data and published tree growth curves can be used to estimate SPTH (e.g., WDFW's SPTH Webtool). However, for this approach to best represent SPTHs across riparian areas, appropriate scale and riparian tree species should be used. In King County, the WDFW SPTH webtool includes Douglas-fir, western hemlock, and red alder, which are only three of several large, tall, or dominant riparian trees in King County. WDFW included these three tree species because they have well-documented growth curves and similar data was lacking for other tall riparian trees. WDFW used red alder for areas with wetter soil types; however, tree species such as black cottonwood, western red cedar, and Sitka spruce are not only large, tall, or dominant riparian trees that thrive in wetter soils, but are likely more appropriate for SPTH estimation due to their size and age at maturity. Among the species included in the WDFW webtool, red alder is the least suitable because it is a relatively short-lived riparian tree, maturing at about 60 to 70 years and reaching a maximum age closer to about 100 years (Worthington and Ruth 1962; Harrington 2006). A more appropriate, longer-lived tree species for King County riparian areas would be black cottonwood, which can mature as early as 60 years, can occasionally live up to 200 years, and is frequent within riparian areas throughout King County. There is less published information on western Washington black cottonwood growth curves; however, suitable estimates can be made by estimating the height of existing tallest-largest trees in King County riparian areas. While western redcedar and Sitka spruce are typical riparian trees within King County and can grow taller than black cottonwood, our ability to establish reliable growth curves or average maximum heights is more limited.

King County used tree height data for Douglas-fir, western hemlock, and black cottonwood to estimate the range of SPTHs across unincorporated King County (UKC). The range in height across these riparian species helps determine an appropriate fixed width for riparian area protections. The range in heights for Douglas-fir and western hemlock was based on the WDFW SPTH geodatabase for areas in UKC. As mentioned, black cottonwood was used rather than red alder as a more-suitable tall-large riparian tree species. Black cottonwoods were identified across King County with aerial imagery and high-resolution Light Detection and Ranging (LiDAR), a remote sensing method used to examine the surface of the Earth. The maximum height of individual cottonwood trees was calculated using highest hit return LiDAR data through a desktop Geographic Information System (GIS) evaluation. Based on the WDFW SPTH geodatabase for Douglas-fir and western hemlock and the GIS-measured heights of black cottonwood, the SPTH for 200-year-old trees across riparian areas in King County range from 128 to 243 feet.

A large proportion of UKC streams are located within the Forest Production District (FPD) (Figure 5.2). Because the width of riparian areas in the FPD are largely set by Washington Department of Natural Resources' Forest Practices Rules (Title 222 WAC), these areas were not included in further analyses of SPTH data. Based on the WDFW data, the FPD primarily has western hemlocks, which are typically smaller than Douglas-fir and black cottonwood trees. Excluding the FPD generally shifted the average SPTHs higher due to the trees found outside the FPD. Across UKC, excluding the FPD, one-third of stream miles had an SPTH of less than 195 feet, one-third between 195 to 205 feet, and one-third was greater than 205 feet (Figure 5.3). Approximately 84 percent of UKC stream miles had an SPTH between 180 and 215 feet. Subsequently, based on this analysis, a riparian area width of 200 feet was determined to be representative of the SPTH range and a suitable width for riparian area protections. A width of 200 feet was selected because it was the center of the middle third of stream miles (195 to 205 feet) and because 200 feet was the average SPTH for Douglas-fir, western hemlock, and black cottonwood across riparian areas in UKC. Departures from this width across aquatic area types, in relation to the UGA boundary, and in the LMO are discussed in Sections 5.1.2, 5.1.3, 5.1.5, and 5.4.

Riparian Area Widths and Aquatic Area Types

As noted in Section 5.1, the K.C.C. designates riparian area widths based on aquatic area type. The BAS indicates there is "no evidence that full riparian ecosystem functions along non-fish-bearing streams are less important to aquatic ecosystems than full riparian ecosystem functions along fish-bearing streams" (Rentz et al. 2020). Specifically, non-fish-bearing streams support unique communities of aquatic and riparian-obligate wildlife and provide movement corridors for wildlife, provision fish-bearing streams with matter and energy, and provide cool water to downstream reaches (Knight 2009; Rentz et al. 2020). The BAS suggests that using aquatic area types based on fish presence for riparian area width alignment may no longer be appropriate. However, the County finds that it is a useful approach for differentiating application of other Growth Management Act (GMA) policy goals and applying special consideration for salmonids. Please see Sections 5.1.2 and 5.1.3 for additional information.

Riparian Area Widths Inside and Outside the Urban Growth Area (UGA)

The riparian functions of shade, bank stability, large wood recruitment, nutrient inputs, and pollutant removal operate similarly regardless of whether the aquatic area is inside or outside of the UGA (Rentz et al. 2020). WDFW guidance acknowledges that designating riparian area widths based on SPTH may be difficult to implement in urban areas; however, BAS indicates that there is no science-based reason to have different riparian widths inside the UGA versus outside the UGA. Additionally, riparian areas inside the UGA can provide important habitat because adjacent uplands within the UGA are often even more degraded than riparian areas, which means that riparian areas may be the only remaining areas where habitat functions are provided. Based on additional policy considerations and GMA goals, King County's regulatory updates would continue

to apply different riparian area widths to Type S and F streams within urban UKC than for areas outside the urban area. Please see Sections 5.1.2 and 5.1.3 for additional information regarding considerations that informed the proposed riparian area widths within the UGA.

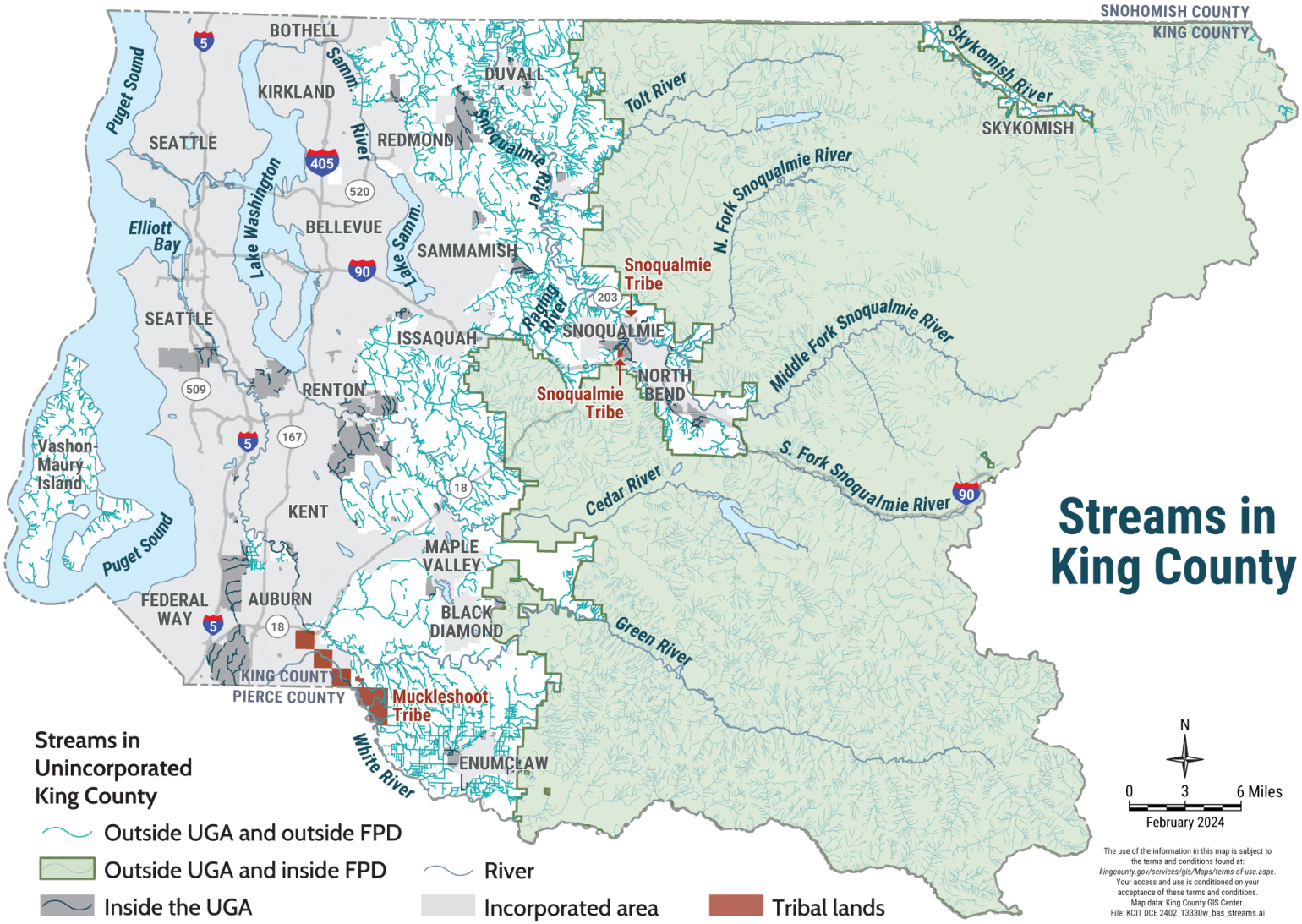

Figure 5.2 Streams in UKC, including those inside/outside the UGA and inside/outside the FPD.

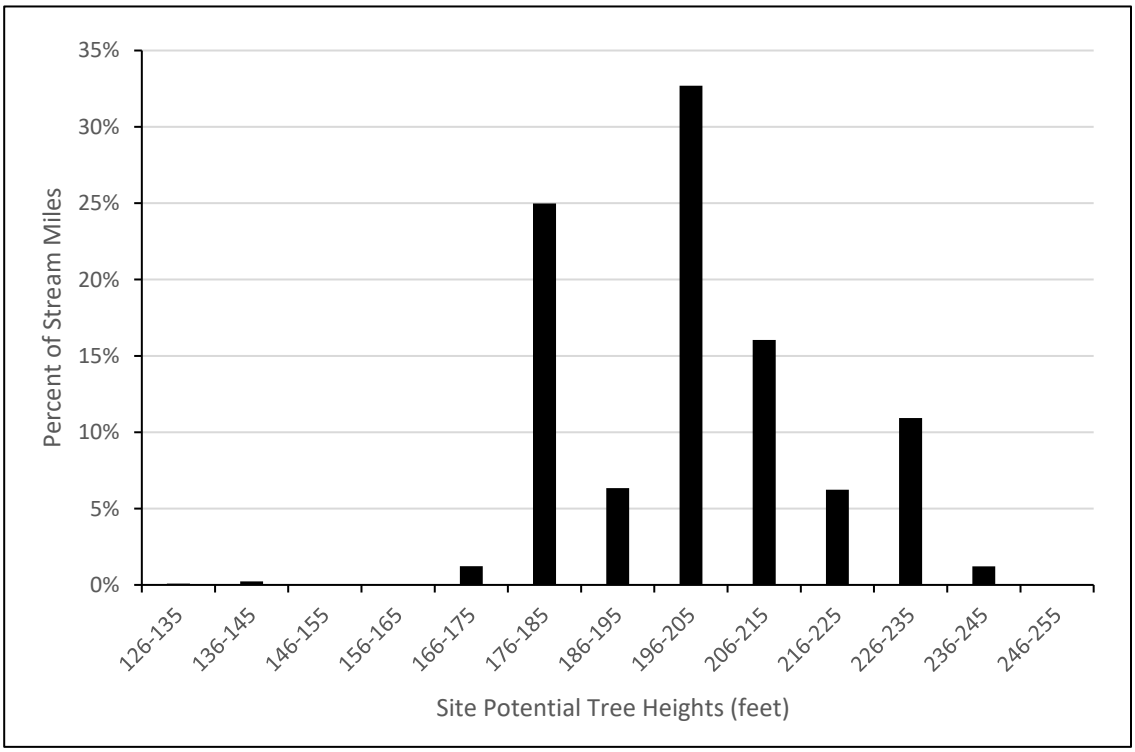

Figure 5.3 Percent of stream miles by site potential tree height of riparian areas for UKC, excluding the FPD.

Riparian Area Connectivity

Maintaining riparian area longitudinal (upstream to downstream) and lateral (river to upland) connectivity is not only important for riparian area functions but is key to functioning salmonid habitat and maintaining stream channel stability (Quinn et al. 2020; Rentz et al. 2020). Riparian area connectivity along aquatic areas is especially important for several riparian functions, including the removal of nutrients, pollutants, and sediment (Scarsbrook and Halliday 1999; Bunzel et al. 2014; Sweeney and Newbold 2014); water temperature control (Rutherford et al. 2004; Cole and Newton 2013); invertebrate prey (Davies and Nelson 1994; Stewart et al. 2001; Wooster and DeBano 2006); and protection of microclimate (Brosofske et al. 1997; Rykken et al. 2007).[1] Riparian area connectivity is especially important along headwater streams and creeks for several reasons. At the headwaters of the creek, water quality will tend to be at its best as it hasn't accumulated impacts from upstream areas like areas lower in the watershed. Degradation to headwater water quality is generally not improved or mitigated by downstream riparian areas. In addition, the headwater creek channels tend

[1]Microclimate is the smaller-scale climate produced by a combination of sunlight, air temperature, wind, precipitation, and humidity that can influence many ecosystem processes, including air, soil, and water temperatures (Brosofske et al. 1997; Moore et al. 2005).

to be very small and more susceptible and responsive to any impacts in the riparian area.

Despite the importance of connectivity to riparian area functions, there is little evidence-based guidance for managing connectivity and fragmentation aside from a general need to protect entire riparian networks to achieve nearly or completely contiguous riparian areas (Rentz et al. 2020). The impacts from activities along the outer portions of riparian areas (i.e., intrusions into riparian areas) are generally smaller than impacts from activities that entirely dissect riparian areas (e.g., roads, trails, and utility crossings, or livestock water access points) (Figure 5.4). These activities impact the functions of both riparian and aquatic areas. Riparian area connectivity and fragmentation are largely addressed through regulatory riparian area protections; however, direct consideration of connectivity is necessary when evaluating the potential impacts of development proposals that are allowed to intrude into or along riparian areas.

Minimum Riparian Area Widths

Guidance from WDFW recommends that the width of riparian areas should be a minimum of 100 feet (Rentz et al. 2020). While this width only provides a portion of several important riparian area functions, it does provide at least 95 percent pollution removal for phosphorous, sediment, and most pesticides, and 85 percent for surface nitrogen (Rentz et al. 2020; Quinn et al. 2020). The focus on water quality and pollution removal for the minimum riparian area width is based on extensive scientific evidence that riparian areas reduce pollutants, including sediments, excess nutrients, metals, organic compounds such as pesticides, and pathogens (Barling and Moore 1994; Tabacchi et al. 2000; Hickey and Doran 2004; Polyakov et al. 2005; Dosskey et al. 2010). Riparian area widths should be a minimum of 100 feet to be protective of these water quality and pollutant removal benefits. In addition to water quality benefits, a considerable portion of several other riparian functions are also achieved within 100 feet, including large wood recruitment, litter fall, and bank erosion resistance associated with tree roots (FEMAT 1993; Spies et al. 2013; Reeves et al. 2018).

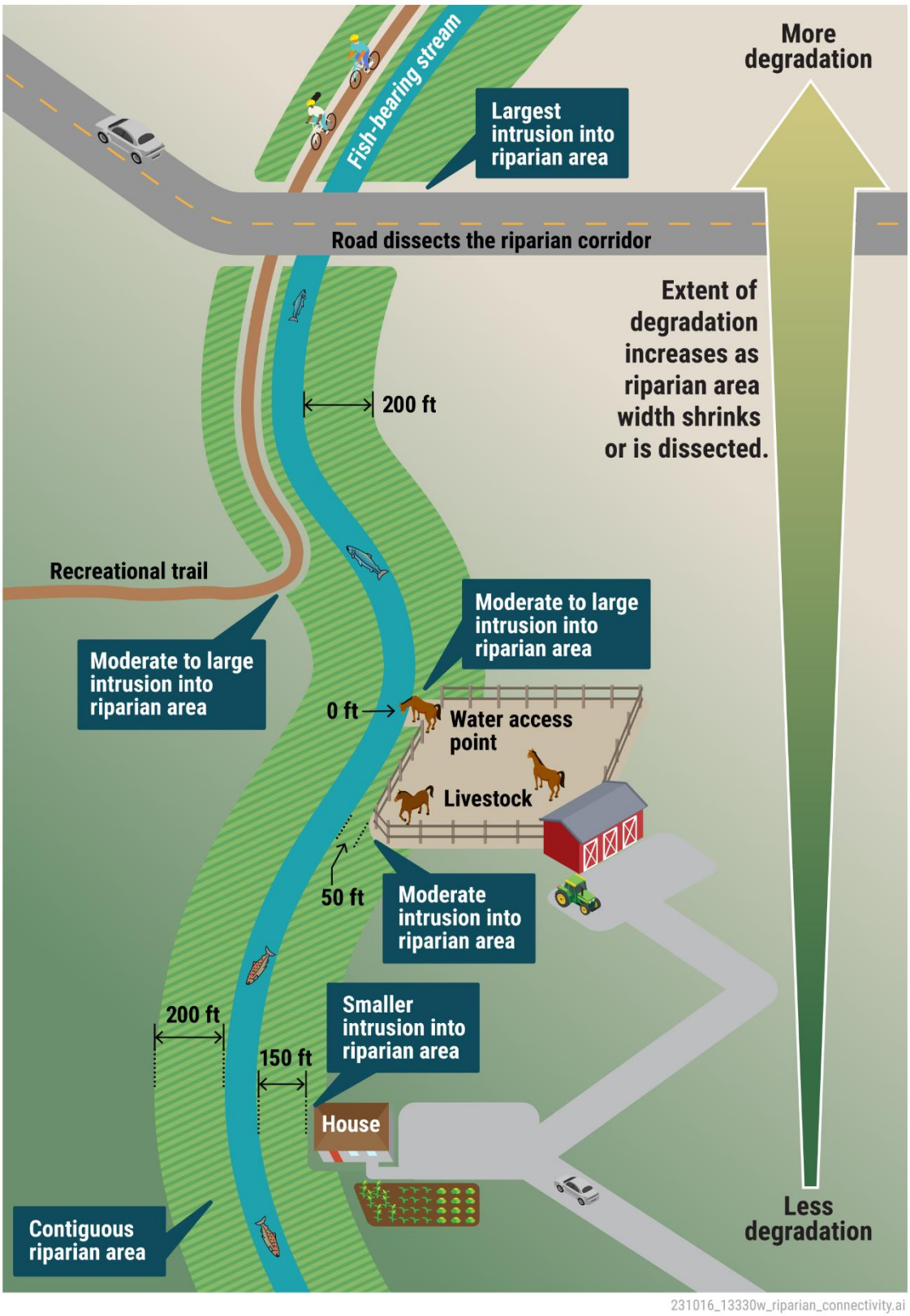

Figure 5.4 Types and relative scale of impacts to riparian area connectivity.

5.1.2 Comprehensive Planning Considerations for Critical Areas

In addition to BAS review, King County considered nonscientific information when updating critical areas protections, including riparian areas. Through the update of the Comprehensive Plan and Critical Areas Ordinance (CAO), as well as commitments to companion nonregulatory actions, the County seeks to simultaneously address the many GMA goals (see Section 1.1), some of which can be in conflict. This includes meeting state requirements to plan for and accommodate a range of housing types and affordability levels within the urban area, focusing new development in the urban area, recognizing property rights, and enhancing and supporting agriculture while ensuring no net loss of critical areas functions and values at an ecosystem scale (see Section 1.2). To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs to reduce risk of impacts to critical areas functions and values.

Urban Area GMA Goals and Growth Targets

GMA requires that the County designate a UGA to accommodate most of King County's forecasted growth and development. The UGA must allow for a range of urban densities and areas sufficient to accommodate a broad range of uses and the projected growth over the next 20 years. The GMA stipulates that population and employment growth be focused in urban areas to avoid sprawl, provide efficient and effective services and infrastructure, and protect critical areas.

Based on the 2021 Countywide Planning Policies' King County Jurisdiction Growth Targets (King County 2021), the County must plan for and accommodate a net gain of 5,412 new housing units in urban UKC through 2044. Of these, 1,292 units are in "unaffiliated" UKC outside of city Potential Annexation Areas. The County does not have a growth target for the rural area or Natural Resource Lands.

King County, consistent with GMA, has long-standing policies in its Comprehensive Plan intended to limit sprawl and focus new development in the urban area, including incorporated cities and their Potential Annexation Areas. The current annual growth rate in the rural area is approximately 1 percent, which helps to limit development impacts to aquatic areas. Areas within the County's UGA are characterized by higher density zoning and smaller lot sizes than areas outside the UGA and are largely built out. As a result, applications for remodels or redevelopment are the most common development application types. Increasingly, permit review includes identification of one or more critical areas. See Appendix B for more information on the percentage of applications where critical areas conditions are applied. The King County Comprehensive Plan supports planning for and accommodating housing that is affordable to all economic segments of the population, promoting a variety of residential densities and types; encouraging preservation of existing housing stock; and encouraging affordable, innovative, quality infill development and redevelopment in urban UKC. At the same time, the County has both policies and programs focused on protecting Natural Resource Lands and supporting agricultural and forestry uses.

Forty-two percent of UKC's development capacity is in areas with at least moderate risk of displacing current residents. This indicates that a significant portion of future development could displace existing communities if complementary actions are not taken to prevent it. Displacement risk is higher in urban UKC than in rural UKC.

Resource Lands – Agricultural Lands

Consistent with GMA goals and requirements, the County designates and protects agricultural lands. As noted in Section 1.2, King County continues to have significant agricultural land supporting a local food economy. King County includes approximately 48,000 acres of farmland, including 41,000 acres in Agricultural Production Districts (APDs) in the Lower Snoqualmie, Green, and Sammamish river valleys as well as on the Enumclaw Plateau. Agriculture is the predominant land use in these districts, which also provide critically important salmon habitat. The County has adopted a long-standing policy framework through its Comprehensive Plan to provide incentives to support agriculture, including tax credits, expedited permit review, reduced permit fees, permit exemptions for activities complying with best management practices, and the raising and management of livestock consistent with industry best management practices and county, state, and federal regulations.

5.1.3 Comprehensive Planning Considerations for Riparian Areas

Increasing the width of riparian areas heightens environmental protections by increasing the distance maintained between permitted land use activities and aquatic areas. However, increasing riparian area widths makes it harder to achieve other GMA goals. By increasing riparian area widths, the amount of land available is decreased for activities such as housing, agricultural operations, and other development. In urban areas characterized by smaller lot sizes, riparian areas may encompass entire lots and will increase the percentage of applicants needing to go through critical areas review and, potentially, an alterations exception process. In rural areas, increases in riparian area widths may reduce flexibility around the placement of farm infrastructure and may reduce availability of land for grazing of livestock. The following subsections describe comprehensive planning considerations specific to riparian areas.

Regulating Riparian Area Widths by Aquatic Area Type

King County agrees with Quinn et al. (2020) that a 200-year SPTH is an appropriate scalar for determining the width of riparian areas. Using SPTH as the only determinant of width results in highly variable riparian area widths because soil conditions and tree growth varies across watercourses and watersheds. During the 2004 review of BAS (King County 2004a, 2004b), King County determined that using fewer variable-width riparian areas based on aquatic area type (Table 5.1) reduced the complexity of implementation compared to a fully variable-width approach. King County finds value in continuing to align riparian area widths with aquatic area types because it corresponds to shoreline regulation, is supported by the prior BAS evaluation (King County 2004a, 2004b), and provides greater riparian protections for fish-bearing aquatic areas.

Establishing greater protections for riparian areas along fish-bearing streams demonstrates King County's special consideration for anadromous fish and their habitats, as required by WAC 365-195-925. Most streams in UKC outside of the FPD are Type S and Type F aquatic areas where the widest riparian area widths are applied. The Type N classification is much less prevalent, representing just under 2 percent of classified streams outside of the FPD.

Regulating Riparian Areas Inside and Outside the Urban Growth Area (UGA)

The County's existing CAO, adopted in 2004, includes different standards for riparian areas in the urban and rural areas based on land use designation (Table 5.1) to reflect GMA goals that focus growth in urban areas, limit sprawl outside the UGA where wetland and riparian areas are generally in better condition, and support agriculture.

King County stream maps updated in 2024 show that there are approximately 5,500 miles of mapped streams, or "stream miles," in UKC. The distribution of stream miles is summarized in Table 5.3 and shown in Figure 5.2.

Riparian areas are wider outside the UGA, where 98 percent of stream miles are found. Riparian area widths are smaller inside the UGA (Table 5.1), where 2 percent of stream miles are found. Approximately 400 miles (8 percent) of streams in UKC outside the UGA are located in areas zoned for agriculture.

Table 5.3 Stream distribution in Unincorporated King County.

Area of Unincorporated King County	Stream Miles	Percent
Inside the UGA	100	2%
Outside the UGA (Not within the Forest Production District)	1,300	24%
Outside the UGA (Within the Forest Production District)	4,100	74%
Total	5,500	100%

Type S and F, where the widest riparian area widths are applied, are the most prevalent stream type, representing 98 percent of classified streams. The Type N classification is much less prevalent, representing just under 2 percent of classified streams.

Riparian area protections based on aquatic area type and location inside or outside of the UGA reflect the County's intent to simultaneously address multiple GMA goals (see Section 1.1), some of which can be in conflict. This approach improves ease of implementation and interpretation for community members. Furthermore, the reduced

complexity helps King County to provide a fair, timely, and predictable permitting process.

Critical Areas Screening Trends and Housing Development

Most housing development permit applications processed by King County's Department of Local Services (DLS) now require a critical areas screening. King County reviewed housing development permit data (2019–2021) to determine what percentage of processed housing permits include critical areas conditions for riparian areas (see Appendix D). This analysis determined that 17 percent of the 933 housing permits processed included critical areas conditions for riparian areas. Any increase in riparian area width will result in greater encumbrances on parcels where riparian areas are already present while also increasing the number of parcels with a riparian area present.

Impacts of Increasing Riparian Area Widths on Parcels and Development Capacity in the Urban Unincorporated Area

The County prepared a high-level, theoretical GIS analysis of the potential impacts of the updated riparian area widths on potential property development within urban unincorporated King County (urban UKC). The analysis was conservative and likely overestimates the number of parcels impacted by riparian area widths. For example, for ease of analysis, all urban streams were assumed to be Type F or S streams, which have the widest riparian area width. Further, the analysis did not take into account site-specific application of exceptions through the permitting process, such as code allowances for clustering, buffer averaging, and provisions for Reasonable Use Exceptions.

The analysis found that 9.8 percent of analyzed parcels are potentially impacted by existing riparian area widths applied to Type S and F streams and that the proposed changes in riparian area widths from 115 feet to 180 feet could potentially impact an additional approximately 3.4 percent of parcels. It is important to note that although the updated riparian widths may result in a minimal decrease in potential for new housing units (less than 3 percent) in urban UKC, other factors may already affect development potential (for instance, limitations from existing development standards or the presence of other critical areas).

The County must still meet its adopted growth targets within the amount of land available for development. The land capacity analysis from the 2024 Comprehensive Plan estimated approximately 29,000 units of residential capacity in urban UKC, sufficient to accommodate the projected 5,412 units of housing growth from 2019–2044. Increasing the riparian area width will not affect King County's ability to accommodate planned growth in urban UKC. However, it could increase the number of parcels that may be newly impacted by riparian area protections, that may be required to prepare Critical Areas Determinations, and that may be subject to limits and conditions on allowed alterations.

Endangered Species Act (ESA) and National Flood Insurance Program (NFIP) Requirements

The Federal Emergency Management Agency (FEMA) requires that King County comply with the BiOp for Puget Sound to participate in the National Flood Insurance Program (NFIP). The BiOp requires certain changes in the implementation of the NFIP to ensure compliance with the Endangered Species Act (ESA). Additional information about the BiOp requirements may be found in guidance documents produced by the Washington State Department of Commerce (Commerce).

One pathway for demonstrating compliance with the BiOp is adoption of a FEMA BiOp model ordinance, which the County reviewed as a source of BAS for this report. Riparian area widths in the model ordinance range from 150 to 250 feet with a median value of 200 feet across categories. Larger widths are recommended for shorelines of the state and non-fish-bearing streams with unstable slopes. Smaller widths are recommended for non-fish-bearing streams with stable slopes, lakes, and fish-bearing aquatic areas less than 5 feet wide. King County's BAS review has determined 200 feet to represent site potential tree height and therefore is a suitable width for riparian area protections (see Section 5.1.1). This demonstrates that King County's proposed riparian area widths in the BAS report generally align with the FEMA BiOp model ordinance.

5.1.4 Regulatory Updates

Based on BAS review and comprehensive planning considerations, King County is updating the K.C.C. with increased riparian area widths for all aquatic areas both inside and outside the UGA. The update strengthens protection for riparian areas while continuing to support some tailoring of the application of standards to advance GMA goals for focusing growth in urban areas and supporting agriculture. King County will continue to designate riparian area widths based on adjacent aquatic area type. Designating riparian area widths based on aquatic area type (see Section 5.1.1) allows King County to efficiently and effectively regulate and protect critical areas functions and values while providing a fair, timely, and predictable permitting pathway (see Section 1.1).

Updated riparian area widths for different aquatic areas inside and outside the UGA are summarized in Table 5.4.

Table 5.4 Updated riparian area widths inside and outside the Urban Growth Area (UGA) for Unincorporated King County.

Aquatic Area Type	Description	Riparian Area Widths inside the UGA		Riparian Area Widths outside the UGA	
		Previous	Updated	Previous	Updated
Shoreline (S)	Shorelines of the state.	115 feet*	180 feet	165 feet	200 feet

Aquatic Area Type	Description	Riparian Area Widths inside the UGA		Riparian Area Widths outside the UGA	
		Previous	Updated	Previous	Updated
Fish (F)	Not S type; contain fish or fish habitat.	115 feet*	180 feet	165 feet	200 feet
Non-fish-bearing (N)	Not S or F type; connected by surface water to S or F.	65 feet	100 feet	65 feet	100 feet
Other (O)	Not S, F, or N type.	25 feet	50 feet	25 feet	50 feet

**The width is 165 feet in urban subbasins that were classified as having a 'high condition' in the 2005 CAO BAS analysis.*

Riparian Area Protections for Shoreline (S) and Fish (F) Type Aquatic Areas

King County's BAS review and analysis of SPTH along County streams determined 200 feet to be a suitable width for riparian area protections (see Section 5.1.1). King County is updating riparian area widths for shorelines and fish-bearing aquatic areas outside of the UGA to be 200 feet to align with the County's BAS review findings. Shorelines and fish-bearing streams are the predominant stream types in UKC outside of the Forest Production District.

The County is updating riparian area widths for shorelines and fish-bearing aquatic areas inside of the UGA to be 180 feet. This width reflects the lower end of the distribution of SPTH in UKC (see Section 5.1.1 and Figure 5.3). King County's recommendation for a relatively lower level of protection for riparian areas inside the UGA is also informed by comprehensive planning considerations (see Sections 1.2, 5.1.2, and 5.1.3) and supports the County's ability to satisfy the GMA goal that development be encouraged in urban areas (see Section 1.1). With this increase in the riparian area widths for all Type S and F streams in the UGA to 180 feet, the current code calling for a width of 165 feet for streams in "high" condition basins is no longer necessary and is proposed to be repealed.

Current updates heighten protections for shorelines and aquatic areas that contain fish or fish habitat in UKC. King County is updating the definitions of "fish" and "fish habitat" to increase protections of riparian area functions and values that are important to all native fish species and their habitats. These changes to the K.C.C. are based on review of BAS, GMA requirements that the County protect and ensure no net loss of riparian area functions and values (see Section 1.2.1), and demonstrate special consideration for anadromous fisheries (see Section 1.2.2) and consideration of other GMA goals to focus growth in urban areas and limit sprawl.

Riparian Area Protections for Non-fish-bearing (N) Aquatic Areas

King County's BAS review identified WDFW guidance that non-fish-bearing streams be offered equivalent levels of protection as shorelines and fish-bearing aquatic areas (see Section 5.1.1).

The updates would increase riparian area widths for non-fish-bearing aquatic areas both inside and outside the UGA from 65 to 100 feet. This width aligns with the WDFW recommendation that riparian area widths should be a minimum of 100 feet to support pollution removal and water quality functions (see Section 5.1.1). A key driver for King County's updates is that water temperatures across many aquatic areas in King County are at or above state water quality standards, especially in urban aquatic areas (King County 2023b). Protecting riparian vegetation throughout headwaters streams helps to maintain cooler water temperatures in those aquatic areas as well as in receiving aquatic areas. Protections were limited to 100 feet to reflect concurrent comprehensive planning considerations (see Sections 5.1.2 and 5.1.3).

The County's regulatory updates heighten protections for non-fish-bearing aquatic areas. Protecting non-fish-bearing aquatic areas is important as they provide water, sediment, nutrients, wood, and other materials to downstream fish-bearing aquatic areas. These changes to the K.C.C. improve alignment with BAS and increase protections to help satisfy GMA requirements that the County protect and ensure no net loss of riparian area functions and values (see Section 1.2.1) and demonstrate special consideration for anadromous fisheries (see Section 1.2.2). At the same time, the recommendation for smaller riparian area widths on Type N streams compared to Types S and F represents a departure from WDFW BAS findings that there is no evidence that full riparian ecosystem functions along non-fish-bearing streams are less important to aquatic ecosystems than full riparian ecosystem functions along fish-bearing streams

King County's recommendation is informed by comprehensive planning considerations (see Sections 5.1.2 and 5.1.3) and intent to meet multiple GMA goals by increasing protections for riparian areas, supporting focused development in urban areas, reflecting that the risk of displacement is higher in urban UKC, limiting regulatory impacts to agriculture, and supporting a timely and predictable permitting process (see Section 1.1).

Riparian Area Protections for Other (O) Aquatic Areas

King County is updating riparian area widths for other aquatic areas inside and outside the UGA. Type O aquatic areas do not have a surface connection to Types S, F, or N aquatic areas and primarily infiltrate into the ground. These aquatic areas are infrequently encountered and represent a small minority of aquatic areas in King County.

The County is strengthening protection of riparian area functions and values of Type O aquatic areas by updating riparian area widths both inside and outside of the UGA to 50

feet. This is half of the 100-foot value recommended by WDFW to support pollution removal and water quality functions (see Section 5.1.1).

King County's decision to depart from WDFW recommendations is informed by comprehensive planning considerations (see Sections 5.1.2 and 5.1.3) and the fact that these aquatic area types are uncommon and represent a small minority of streams in King County. Through this decision, the County is intending to satisfy multiple GMA goals by increasing protections for riparian areas, encouraging development in urban areas, limiting regulatory impacts to agriculture, and supporting a timely and predictable permitting process (see Section 1.1).

Updated Livestock Management Ordinance Grazing Area Buffer Widths

The Livestock Management Ordinance (LMO) (K.C.C. 21A.30) establishes standards for livestock management, including minimum lot size, maximum number of livestock, numbers of livestock on uncovered pasture, livestock exclusion (fencing), and manure storage. The primary purpose of LMO is to support the raising and keeping of livestock in a manner that reduces the adverse impacts of livestock on the environment, particularly on water quality and salmon habitat.

The portion of the riparian area that livestock are excluded from was previously called a buffer in the LMO but will be updated to be called an LMO grazing area buffer. To provide greater protection of riparian area functions and to reduce potential impacts to anadromous fish species, the County is increasing the widths of grazing area buffers (Table 5.5 and Figure 5.5). The increased grazing area buffer widths will generally be required for properties that are not currently in compliance with the LMO code when the code is updated, agricultural properties converting from crops to livestock, or when a new FMP is created. For grazing area buffers, the starting point of measuring the grazing area will be from the ordinary high water mark (OHWM) of the adjacent aquatic area and not from the severe CMHA as described in Section 5.2.

Table 5.5 Updated Livestock Management Ordinance grazing area buffer widths.

Aquatic Area Type	Grazing Area Buffer Width with a Farm Management Plan (K.C.C. 21A.30.045)		Grazing Area Buffer Width without a Farm Management Plan (K.C.C. 21A.30.060)	
	Previous	Updated	Previous	Updated
Shoreline (S) or Fish (F)	0–25 feet	40 feet	50 feet	50 feet
Non-fish-bearing (N)	0 feet	35 feet	0 feet	50 feet
Other (O)	0 feet	0 feet	0 feet	0 feet

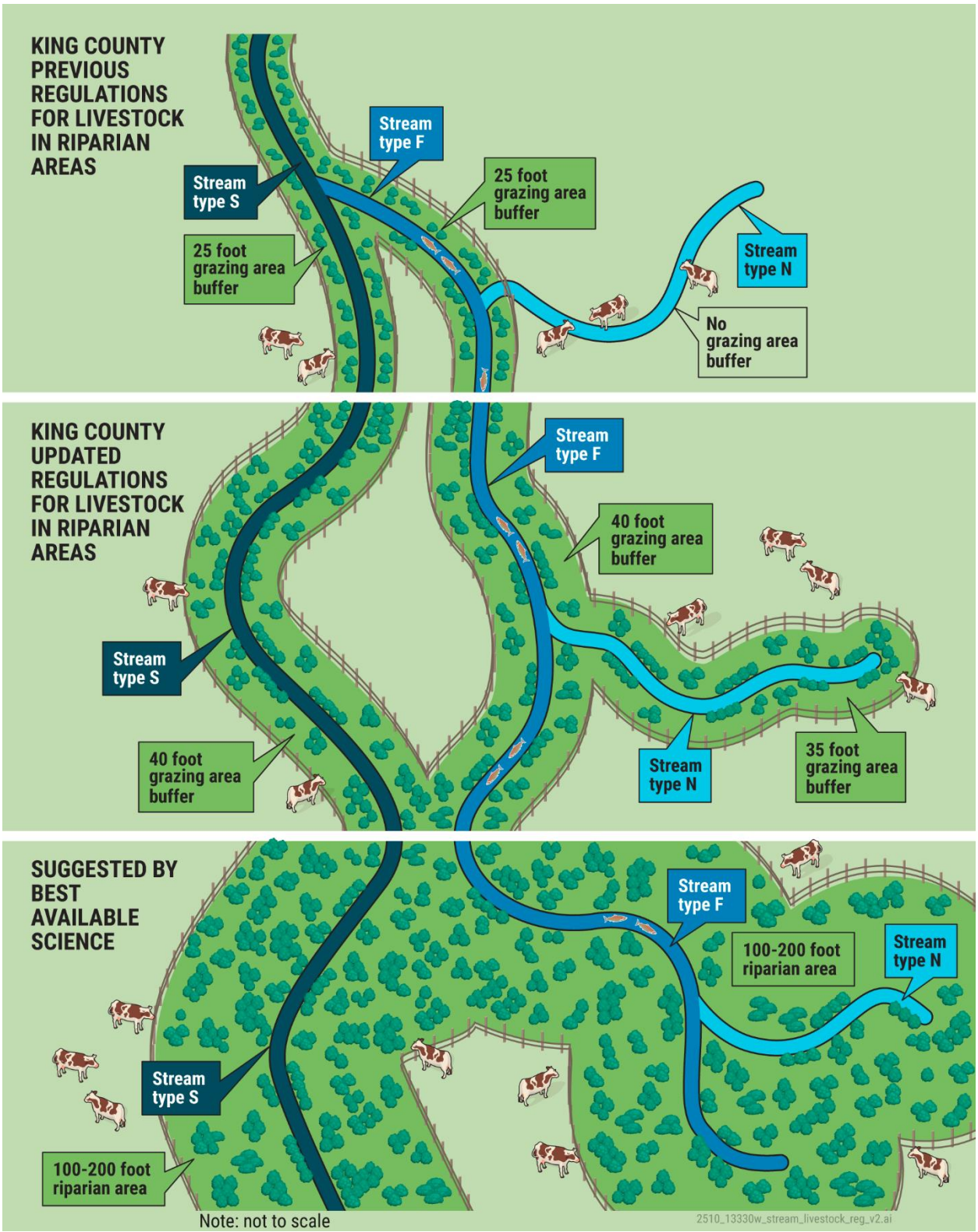

Figure 5.5 Riparian area protections and the Livestock Management Ordinance (LMO) across previous regulations, updated regulations, and BAS.

5.1.5 Risk Assessment of Regulatory Updates

The rationale for King County's riparian areas regulatory updates and how different levels of protection align with GMA requirements and comprehensive planning considerations is discussed previously in Sections 5.1.2, 5.1.3, and 5.1.4. The risks associated with these different levels of riparian area protections are discussed in this subsection.

The risk assessment in this subsection includes a short description of the risk and then uses four factors to describe different aspects of the risk. First is an evaluation of how well the County's updates align with BAS-specific riparian area functions based on the magnitude of the lost function or functions compared to a fully functioning, mature riparian area, with larger departures from BAS indicating a higher-risk approach. Second includes the time scale at which the risks operate, with short term being less than 10 years, moderate term being 10 to 25 years, and long term being greater than 25 years. Third, the physical scale at which the risk operates is described by whether the risk is associated with smaller individual sites, or if it applies to a larger area of the landscape. Fourth is a brief description of King County subject-matter experts' level of certainty or confidence associated with the risks. These factors were evaluated and described in the context of the qualitative level of risk, which were binned based on best professional judgement into low-, moderate-, or high-risk approaches.

Nonregulatory programs that reduce and mitigate risks to riparian areas are discussed in Section 5.1.5 (see also Section 3.3).

Riparian Area Widths Inside and Outside the Urban Growth Area (UGA)

As highlighted by King County (King County 2023a), improvements to development policies and regulations over the last 50 years, among other factors, appear to have benefitted stream health (measured through aquatic benthic (relating to or occurring on the bottom of a body of water, such as an ocean, lake, or stream) invertebrate communities) with newer development impacting aquatic communities less than older development. Stream health appears to have improved over the past two decades, despite increases in developed landcover, development intensity, and warming stream temperatures (King County 2023a). Researchers suggest that improvements may result from the net effect of protective stormwater, urban growth, and forestry regulations at the regional scale, especially those that reduce fine sediment delivery to waterbodies. Notably, researchers found that although measures of stream health were negatively correlated with percent impervious land cover, the change in stream health scores was unrelated to the change in development since monitoring began. This may indicate a decoupling in the relationship between stream health and development. Strengthening aquatic area protections, especially those preventing fine sediment delivery, will help prevent impacts to developing basins and sustain and accelerate improvements in stream health in developed basins. One of the primary drivers of stream health is the extent and condition of riparian vegetation (King County 2019b, 2023a; Quinn et al. 2020). Thus, regulatory updates for riparian areas include increased widths for all

aquatic areas both inside and outside the UGA across UKC (Table 5.4 and Table 5.5). Generally, Type S and F aquatic areas align with BAS outside the UGA and, to a lesser degree, inside the UGA. Riparian widths for Type N and O aquatic areas depart from BAS both inside and outside the UGA. Riparian area widths for livestock properties, which are primarily found outside the UGA, depart from BAS.

As previously noted, riparian area widths should be based on the SPTH of the tallest and/or most dominant riparian trees. The updated riparian area widths for Types S and F aquatic areas outside the UGA (excluding the FPD) is 200 feet, which aligns with BAS because it is representative of the middle third of SPTHs across stream miles in UKC and because it is the average SPTH for Douglas-fir, western hemlock, and black cottonwood across riparian areas in UKC (see Section 5.1.1). Therefore, King County has high certainty that the updated riparian area widths result in low risk to riparian area functions outside the UGA among Type S and F aquatic areas. The riparian area width for Type S and F aquatic areas inside the UGA is 180 feet, which largely aligns with BAS though to a lesser degree than for the widths outside the UGA. The riparian area width for Type S and F aquatic areas inside the UGA aligns with the lower end of appropriate SPTHs, with around 84 percent of King County stream miles having an SPTH between 180 and 215 feet. Evaluation of recent water quality trends data from King County (2023b) indicate that water quality in urban streams is lower than in rural streams. One possible explanation is that the existing lower riparian protections in those areas are inadequate to prevent harm. The updated and increased riparian area widths for aquatic areas inside the UGA may help to minimize further degradation to water quality in urban areas. While the updated riparian area widths will create higher protections, the risk to riparian functions is slightly greater inside the UGA because the riparian area widths align with the lower end of the range of appropriate SPTHs. However, this risk is considered only moderate at the county scale, because only a small number of stream miles are inside the UGA (2 percent of total stream miles across UKC). King County has high certainty that riparian areas adjacent to Type S and F aquatic areas will be well protected because the updated riparian area widths are based on King County-specific SPTHs and because the majority of the aquatic areas that the County regulates are Type S and F aquatic areas.

Across aquatic areas both inside and outside the UGA, there remains moderate to high risk for microclimate and wildlife because the updated riparian area widths are structured around a single SPTH, whereas full protection of these functions probably requires a width equivalent to two to three SPTHs. The risk to microclimate and wildlife is likely long term because areas outside of protected widths may be cleared or altered and not replaced over time. This results in a high confidence that full protection of microclimate and wildlife will not be achieved with the updated riparian area widths. The long-term risk for microclimate is likely magnified by the impacts of climate change. Climate change will likely result in warmer and drier conditions, which may decrease the health of riparian vegetation. To the extent that these climate change impacts cause riparian vegetation to die at higher rates, they will likely reduce the extent and magnitude of riparian microclimate conditions, altering the moderation and cooling of air and aquatic area temperatures. Reducing the extent of riparian areas can influence all

riparian functions but will likely have the most impacts on microclimate and wildlife, as these are generally the least protected functions with updated riparian area widths. Animals and plants that may be most impacted by altered microclimate conditions are those that are either extremely sensitive to environmental changes and/or those that are highly dependent on microclimate for their persistence.

Climate change will increase wildfire risk in riparian areas, which directly impacts riparian vegetation, especially along boundaries or edges. Additionally, climate change may increase the incidence of hazard trees and requests to remove them. Due to buildings being built near or within riparian areas in the past along with ongoing allowed alterations of new buildings in riparian areas, select strategies for fire risk reduction, including hazard tree removal and fire-fuel-free zones, will impact riparian vegetation and reduce riparian area extents. These impacts will become greater as the extent of fire risk reduction measures are increased.

BAS emphasizes that riparian areas along non-fish-bearing streams that flow into fish-bearing aquatic areas are important because they provide water, sediment, nutrients, wood, and other materials to downstream fish-bearing aquatic areas. The updated riparian area width for Type N aquatic areas (to 100 feet) aligns with the minimum width needed for the protection of pollution removal functions. King County has high confidence that the riparian area width for Type N aquatic areas results in lower risk for pollution removal functions because the width aligns with the minimum width necessary, as detailed in BAS.

However, the updated Type N riparian area width does not align with BAS for protecting all other riparian functions because it is well below the lower end of the range of SPTHs across UKC. The riparian area width for Type N aquatic areas applies both inside and outside the UGA. There remains moderate to high risk for functions like shade, leaf litter and detritus inputs, and large wood recruitment because, while a portion of these functions are achieved in the first 100 feet, full functions aren't achieved until the width of a full SPTH is reached. Additionally, impact to large wood recruitment remains a moderate rather than a high risk because the smaller stream width of Type N aquatic areas means that relatively smaller pieces of wood can be habitat forming compared to relatively larger wood in larger streams and rivers (Types S and F). There is high risk for microclimate and wildlife because of the reasons detailed for Type S and F aquatic areas; however, the risk is even greater because the 100-foot riparian area width for Type N aquatic areas differs even more from the widths needed for microclimate and wildlife (approximately 400–600 feet).

King County has moderate confidence that there will be low cumulative impacts from the narrower riparian area widths associated with Type N aquatic areas in the short term. The subject matter experts' confidence is only moderate because most Type N aquatic areas are not mapped and their extent across the landscape is poorly documented. Based on several fully classified smaller subbasins and best professional judgment, Type N aquatic areas are much less frequent than Type S and F aquatic

areas (less than 2 percent of typed streams), especially outside of the FPD; thus, the limited number of Type N aquatic areas results in less risk of cumulative impacts.

While a portion of riparian functions can be achieved in the first 100 feet, especially pollution removal, King County has high confidence that there is high risk to Type N riparian area functions over the long term because the areas between 100 feet and SPTH (approximately 200 feet) will lack protections. The long-term risk will be greatest for microclimate and wildlife because of the reasons discussed for Type S and F aquatic areas and furthermore because Type N riparian widths depart even more from fully protective widths. In summary, the overall risk to Type N aquatic areas is considered moderate to high because, aside from pollution removal, there remains considerable risk to other riparian area functions like shade, leaf litter and detritus inputs, and large wood recruitment.

The updated riparian area width for Type O aquatic areas (50 feet) does not align with BAS nor does it align with the minimum width necessary for pollution removal (i.e., 100 feet). King County has high confidence that, while some degree of functions will be achieved, there is at least moderate risk to pollution removal because the riparian area width for Type O aquatic areas is only half the minimum width recommended by BAS. Additionally, King County has high confidence that there is high risk for all other riparian functions because the Type O riparian area width is less than one-third of appropriate SPTHs. The narrower width provides minimal protections for all riparian area functions. However, the cumulative impacts of these lesser protections are likely minimal because Type O aquatic areas occur much less frequently than Type S, F, and N aquatic areas and because Type O aquatic areas do not have a surface water connection with other aquatic areas. While some portion of riparian functions can be achieved in the first 50 feet, King County has high confidence that there is high risk to riparian area functions over the long term because the areas between 50 feet and SPTH (approximately 200 feet) will lack protections. Similar to Type N aquatic areas, there is high long-term risk to microclimate and wildlife in Type O aquatic areas because of the reasons discussed for Type S and F aquatic areas and because Type O widths have the greatest departure from BAS across all updated riparian area widths. In summary, the overall risk to Type O aquatic areas is considered high because of the considerable risk to all riparian area functions. King County employs a broad array of nonregulatory programs to protect critical areas and reduce risk to critical areas functions and values (see Section 3.3 and Section 5.1.5).

Grazing Area Buffer Widths for the Livestock Management Ordinance

Informed by BAS review, King County is proposing to strengthen minimum riparian area protections under the LMO and to clarify application of provisions to previously cleared versus uncleared areas.

As noted in Section 5.1.3, the portion of the riparian area that livestock are excluded from was previously called a buffer in the LMO but will be updated to be called a grazing area buffer. This update was intended to resolve confusion with the existing K.C.C.

terminology. A grazing area buffer is measured from the OHWM and is a subset of the larger riparian area that is adjacent to the aquatic area, has previously been cleared, and where the LMO applies.

Water quality was recently evaluated for a limited number of agricultural streams, indicating that water quality in these streams is more degraded than streams associated with other land uses (King County 2023b). This higher degradation is associated with higher nutrients and fecal coliform concentrations. While current updates increase the grazing area buffer widths associated with livestock properties (see Table 5.5), they depart from BAS riparian area widths for all aquatic areas. The 50-foot grazing area buffer width for livestock properties is smaller than the updated riparian area widths for Type S, F, and N aquatic areas and continues to represent a departure from BAS. The departure from BAS is largest with respect to Type S and F aquatic areas where the grazing area buffer width is one-quarter or less than the updated riparian area widths. While some portion of riparian functions can be achieved in the first 50 feet, there is high confidence that there is high risk to riparian area functions over the long term because areas between 50 feet and SPTH (approximately 200 feet) will lack protections. It should be noted that the updated, wider riparian area widths set forth in Table 5.4 would apply if new grazing areas were proposed in critical areas that haven't previously been converted for agricultural use.

With proposed updates, the grazing area buffer width is being maintained at 50 feet for Type S and F streams without an FMP and is proposed to increase from 25 to 40 feet if a livestock owner obtains an FMP that outlines site-specific BMPs for livestock. A new requirement is adding grazing area buffers for new livestock uses on Type N streams with the buffer set at 50-feet without an FMP and 35 feet with an FMP. Where a landowner has previously complied with the LMO livestock exclusion requirements, they are presumed to meet the LMO requirements. Proposed grazing area buffer updates are summarized in Table 5.5. Note that existing code calls for an addition of 20 feet of diverse vegetation downslope of livestock confinement areas beyond the buffers summarized in Table 5.5. Finally, the update would retain provisions that support tailoring of grazing area buffers through development and implementation of an FMP based on site-specific conditions and livestock operations. Additional information and recommendations related to FMPs can be found in Section 3.3.3. The LMO grazing area buffer widths of 35 to 50 feet for Type S, F, and N aquatic areas are half or less than the minimum width suggested by BAS to address water quality functions. This creates high confidence that there is high risk to riparian area functions that protect water quality where this standard is applied. This is especially apparent when considering these relatively narrow riparian areas are adjacent to lands with large and congregated animals, resulting in a concentrated source of pollutants, which the 100-foot minimum riparian area width associated with pollution removal is intended to address. In addition, risk remains high because the increased grazing area buffer widths are not retroactive and will generally be required for properties that are not currently in compliance with the existing LMO code and for agricultural properties converting from crops to livestock.

Type O aquatic areas currently have no grazing area buffer protections so there is high risk for all riparian area functions; however, Type O aquatic areas are generally infrequent and the least common aquatic area across UKC. Additionally, Type O aquatic areas may have slightly lower risk for water quality functions in comparison to other aquatic areas because they are not connected via surface water to Type S, F, or N aquatic areas. However, by definition and classification, Type O aquatic areas all infiltrate into the ground and thus pose a potential risk to groundwater contamination.

Although LMO standards apply throughout UKC, risks associated with the LMO grazing area buffer widths occur mostly outside the UGA because of the LMO's requirements for minimum lot sizes and acreage for livestock, with higher risks within the Agricultural Production Districts due to the higher concentration of livestock properties. King County has high confidence that, with updates to the LMO, grazing area buffer widths will increase and there will continue to be impacts to water quality as the updated widths are less than the 100 feet recommend by WDFW pollutant removal functions. There is high certainty of high risk for microclimate and wildlife because proposed widths depart the most from widths needed to fully protect microclimate and wildlife.

5.1.6 Nonregulatory Programs

King County recognizes the importance of protecting critical areas through both regulatory measures and nonregulatory programs. King County coordinates with communities and other partners to guide investment in nonregulatory programs that protect natural resources, including critical areas. Nonregulatory programs that offer protections to riparian areas and aquatic areas are discussed at a summary level below. The following nonregulatory programs and measures reduce and mitigate the various risks discussed in Section 5.1.4.

Stream Mapping

King County has updated stream-type maps to more accurately illustrate the location, extent, and types of streams present in King County. These updated stream-type maps can inform landowners about the location and types of streams, support more complete and accurate permit applications, inform land conservation and habitat restoration programs, inform development of FMPs by King Conservation District (KCD), and support monitoring and adaptive management.

The updated stream data is available as of 2024 and online through King County's interactive mapping tool, King County iMap. In addition, over the next 5 years, it is expected that the U.S. Geological Survey will update stream maps across the United States with a higher resolution method.

This nonregulatory investment will improve outcomes for species and critical areas, advancing King County's progress in satisfying GMA goals for environmental protection, shoreline management, climate resiliency, community coordination, and permitting.

Livestock Best Management Practices

King County operates a number of nonregulatory programs to ensure the continued economic vitality of agriculture in the County while reducing impacts to water quality and critical areas. This includes offering cost sharing for implementation of livestock BMPs aimed at reducing critical areas impacts on agricultural properties with an approved FMP. These BMPs include installing fencing to exclude livestock from portions of critical areas or their buffers, revegetating critical areas and critical areas buffers, improving stream crossings, and developing manure management systems.

Farm Management Plans

The County's regulations, cost-sharing programs, and tax incentive programs encourage development of Farm Management Plans (FMPs) and application of BMPs.

The KCD, which works with farm owners and operators to develop FMPs, takes into consideration the size of the farm, type of soils, slope of the land, proximity to streams or water bodies, type of livestock or crops, and resources such as machinery, buildings, and available finances. Specific technical assistance and projects are based on the Natural Resource Conservation Service's (NRCS) list of approved BMPs. Examples of actions and BMPs for farms include: stream-side fencing, gutters and downspouts, composting manure, pasture management and renovation, weed management techniques, creating sacrifice areas, cross fencing, and pasture rotation of livestock. As reported by KCD, from 2015 to 2022 the Farm Team created 458 total FMPs. Data extracted from KCD's Landowner Incentive Program identifies 73 approved riparian buffer projects from 2015 to 2020 and the installation of 62 projects. This includes 23 buffer fences constructed during this time to exclude livestock from wetlands.

King County has an existing Public Rule (PUT 8-21) that establishes procedures for development, review, and approval of FMPs that are used as the basis for modifications to standards in K.C.C. Chapters 21A.24 (Critical Areas), 16.82 (Clearing and Grading), and 9.04 (Stormwater Management) in application to agricultural development activities. The intent is to protect critical areas by allowing landowners who are engaged in agriculture to undertake a specified set of activities using the proven standards, BMPs, and planning systems developed by the NRCS, applied by KCD through the FMP development process, and reviewed and approved by King County's Department of Natural Resources and Parks (DNRP). The Farm Management Plan Public Rule was adopted in 2005.

Updating the Farm Management Plan Public Rule to further clarify the review, approval, and registration process for FMPs used as the basis for application of critical areas protections is recommended to improve transparency, ensure application of the most current NRCS BMPs for protection of critical areas functions and values, and to support application of a Monitoring and Adaptive Management Framework for Critical Areas. The current CAO updates would require DNRP to update the Farm Management Plan Public Rule in 2026 to establish an inventory of FMPs reviewed as a condition for

application of CAO and Livestock Ordinance Provisions or qualification for Public Benefit Rating System tax incentives, and to publish summary information. The County will invite Tribal consultation and community engagement on the Public Rule update. The County will also coordinate the Public Rule update with the KCD, King County Agriculture Commission, Salmon Recovery Forums, Ecology, and WDFW. KCD indicates they will strengthen monitoring of FMPs and improve data sharing regarding types and implementation rate of BMPs included in FMPs, actions taken to encourage BMP implementation, and the number of plans developed and approved to provide regulatory flexibility for farmland owners.

Land Conservation in King County

King County operates nonregulatory open space acquisition programs, such as the Land Conservation Initiative (LCI), using funding from King County's Conservation Futures grant program and other sources. The LCI is a regional collaboration between King County, cities, business associations, agricultural communities, environmental partners, and other groups aimed at preserving the County's last, most important natural lands and urban green spaces over the next 30 years. King County has mapped and prioritized 65,000 acres of land for protection in six categories, including urban green space, trails, natural lands, rivers, farmlands, and forestlands. New protections called for under LCI will add to successful conservation efforts that have permanently protected more than 190,000 acres of the King County landscape, including forests, farms, river valleys, wetlands, upland natural areas, and parks for people.

Of the more than 850 parcels protected under LCI since 2016, more than 65 percent have some portion of the parcel within a 200-foot riparian corridor and more than 85 percent of the parcels intersect at least one type of regulated critical area. While not every fee or easement acquisition under the LCI is focused on ecological conservation (e.g., farmland and trail corridor protection may do little to protect critical areas functions and values beyond regulatory protections), in nearly all cases, LCI fee or easement acquisitions limit future development, stemming future development-related impacts. In many cases, where ecological protection isn't the primary reason for conservation, the County's ownership interest helps ensure regulatory compliance; for example, through fee ownership by a public agency or through regular easement compliance monitoring.

Looking forward, more than 75 percent of the parcels sought for future protection under the LCI have some portion of the parcel within a riparian corridor, measuring 200 feet on each side of the mapped centerline of a river or stream. In addition to protecting riparian areas and connectivity with wetlands and wildlife corridors beyond what would be required by regulations, acquisitions also make habitat restoration and stormwater treatment projects possible by restoring functions lost in prior decades.

Habitat Restoration

Since the 1999 federal ESA listings of Chinook salmon and bull trout, King County has supported the development and implementation of federally approved watershed-based

salmon conservation plans in each of its major watersheds. Over the last 25 years, King County and salmon recovery partners—such as cities, Tribes, and nongovernmental organizations—have implemented a significant number of salmon habitat restoration projects called for in these plans. These plans recommend long-term salmon habitat restoration efforts, such as floodplain restoration, riparian restoration, fish passage barrier removals, and wetland restoration along salmon-bearing streams and rivers. To date, hundreds of acres of river floodplains have been reconnected through the removal of levees and revetments, more than 1,000 acres of riparian restoration have taken place through the collective actions of many partners, the marine shorelines of King County on Vashon and Maury Islands are being restored through the removal of bulkheads to enhance habitat for forage fish that salmon feed on as they migrate, and the County has undertaken a strategic approach to prioritizing and implementing fish passage barrier removals associated with County properties and facilities. The plans also call for investments in public education and outreach to engage the broader community in this vital effort.

King County also conducts scientific investigations to better understand how salmon are using our rivers and streams as well as habitat project effectiveness monitoring to ensure salmon benefit from the projects we construct and to improve future project implementation efforts. By implementing salmon habitat restoration projects, King County has improved riparian, floodplain, and wetland habitat conditions and critical areas along salmon-bearing streams and rivers. At the same time, these projects support human needs and human health by reducing flood risk to communities, reducing the effects of climate change through reforestation, and making our waters clean and swimmable.

Two recent examples of projects that stemmed from WRIA planning efforts are the Riverbend Floodplain Restoration Project on the Cedar River and the Fall City Floodplain Restoration Project on the Snoqualmie River. Collectively, these projects created or enhanced over 200 acres of floodplain habitat in important reaches for salmon, including instream rearing and refuge, spawning, and off-channel habitat for Chinook, coho, and sockeye salmon, steelhead, and cutthroat trout.

In addition to benefits to salmon, these projects also:

- reduced flood risk by restoring natural floodplain storage and reconnecting river channels.
- improved wetland and riparian habitat for amphibians, birds, and other wildlife.
- enhanced water quality and sediment transport, supporting broader ecosystem functions and resilience.

In the next 5 years, King County has several floodplain and nearshore restoration projects planned and will restore an estimated 100 acres of floodplain and approximately 400 feet of marine shoreline on Vashon-Maury Island. These efforts reflect coordinated investments in salmon recovery, flood risk reduction, and climate resilience across WRIA priority areas.

Riparian Areas Monitoring and Adaptive Management

King County protects critical areas, including riparian areas, through a variety of regulatory measures and nonregulatory programs. One of the nonregulatory programs the County undertakes is monitoring and adaptive management (M&AM). An M&AM program consists of three parts: permit implementation monitoring, permit effectiveness monitoring, and ecological validation (i.e., status and trends) monitoring. Respectively, these parts determine whether code was implemented correctly and consistently, identifies issues with projects and permits that emerge over time, and points to deficiencies in code or situations resulting in harm to critical areas. King County conducts all three of these elements in some form and, compared to other local governments, is particularly strong in ecological validation monitoring. However, all elements and their applications can be strengthened to achieve a fully functioning M&AM framework. See Section 3.5 for additional details on these three elements.

King County performs extensive ecological validation monitoring for water quality and ecological health in streams, which are influenced by riparian area functions and values. King County has been monitoring stream health, as represented by benthic macroinvertebrate communities, for more than 20 years. This program is statistically robust; representative at the scale of sites, streams, and watersheds; and able to assess current conditions and detect changes in stream health. For example, one 2023 stream health study found that between 2002 and 2021, 25 percent of the streams monitored by DNRP improved while just 3 percent declined. Another 2023 study found that basins developed before the implementation of substantial stormwater regulations had worse stream health than basins with the same amount but more recent development. The findings of both studies are consistent with outcomes expected from protective growth management actions; effective regulations, such as riparian restoration and protection; behavioral shifts of local residents; or a combination of these factors.

In addition to in-person surveys and measurements, the stream health monitoring uses, when possible, streamflow data from King County's network of stream and weather measurement stations operated by King County.

Beyond status and trend monitoring, this program has generated numerous targeted studies on the effects of development age and forest clearing on stream health. The County has also completed two time-series studies of land cover change and environmental responses in nine lowland streams in rural, developing UKC. The results show that water quality conditions have degraded in some subbasins with rural development, but the study also documented that most clearing occurring within riparian areas was undertaken without permits. Thus, it is unclear if the degradation was caused by the broader regulatory protections that are lower than BAS would suggest or if unpermitted clearing is the cause of the degradation (Bower et al. 2025). These studies were intended to test whether streams were effectively protected from the impacts of development. King County is now developing an Integrated Stream Program that will measure stream health, water quality, stream flow, and temperature simultaneously at approximately 50 locations. Combined with land cover change analysis, this integrated

program will help to explain why stream conditions change over time, addressing a key limitation identified in the recent stream health study (King County 2023a).

In addition, King County operates numerous long-term monitoring programs to detect changes in the water quality and aquatic food webs of lakes and Puget Sound. While these programs were not designed to evaluate critical areas regulations, they complement critical areas monitoring by providing context on changes in watershed and water quality conditions. For example, a King County study found significant improvements in Lake Washington's water quality between 1998 and 2022 when peak winter/spring nitrogen and phosphorous concentrations decreased even as the watershed's population grew by 34 percent. During those 25 years, spring algae blooms decreased by 50 percent and summer water clarity increased by 3 feet. Multiple environmental protections potentially contributed to this progress, including stormwater upgrades, erosion controls, transitioning homes from septic systems to the regional sewer system, and behavioral shifts of local residents.

All of these monitoring programs and studies could help determine the conditions of critical areas and actions being taken to mitigate losses so the County can show it is meeting the no net loss intent of the GMA.

Snoqualmie River Valley Fish, Farm, and Flood

In 2013, King County launched a collaborative effort (Snoqualmie Fish, Farm, and Flood) to explore the issues that were creating obstacles and conflicts around salmon recovery, flood protection, and agriculture across agricultural areas of the Snoqualmie River valley. The Snoqualmie Fish, Farm, and Flood (also known as FFF) effort established several task forces, including a riparian Buffer Task Force, which was established in 2018. The Buffer Task Force was composed of interested parties from salmon recovery, agricultural production, and flood risk reduction backgrounds, and produced recommendations on the size and location of voluntary restoration of riparian area plantings in the Snoqualmie Valley Agricultural Production District (SVAPD). Plantings are intended to improve ecological conditions for salmon while limiting impacts to and the reduction of the agricultural land base.

The Buffer Task Force riparian restoration recommendations differ from riparian area protections in that they are voluntary and nonregulatory. They are not focused on protecting all riparian functions or full riparian functions but rather on providing meaningful ecological lift while minimizing the impact to and loss of agriculture lands. Because the recommendations are a compromise to achieve some riparian restoration, several recommendations depart from BAS for fully functioning riparian areas. Buffer Task Force recommendations use 20 distinct classifications of river, watercourse, and other aquatic areas rather than King County's water-typing model. The full range of Buffer Task Force recommendations can be found in the Balancing Fish, Farm, Floods in King County's Snoqualmie Watershed report (King County 2020). Several assumptions guided the work, including that recommendations would pertain only to

voluntary King County-funded plantings and not regulatory requirements, and that recommendations would not negate or dismiss existing regulations or BAS.

This nonregulatory effort to restore riparian areas in the SVAPD advances King County's progress in satisfying GMA goals for maintaining and enhancing natural resource industries, environmental protection, shoreline management, climate resiliency, and community coordination.

Public Benefit Rating System

The County's Public Benefit Rating System (PBRS) (see Section 3.3) is a voluntary but binding incentive program that provides property tax reductions for participating landowners who choose to leave open spaces in a natural condition. Areas adjacent to riparian corridors are one type of open space resource that can be protected through enrollment in the program. Enrollment of land in PBRS results in avoidance of impacts to areas adjacent to riparian corridors, protection of critical areas functions and values, and limiting the likelihood of future impacts. A point system determines a property's PBRS enrollment level, with points assigned to various open space resources, including protecting buffers to streams and wetlands, groundwater recharge areas, significant wildlife habitat, significant plant or ecological sites, and conserving farm and forestlands, among others (a full list of categories and possible points is on the program website). The program regularly monitors enrolled properties to ensure landowners maintain the open space resources in the same or better condition as when approved for enrollment.

In most circumstances, areas that are already required to be protected due to pre-existing regulations or land use actions are ineligible for enrollment in PBRS. For example, open space areas protected by a native growth protection easement, forest retention covenant or other covenants required as part of a development process or subdivision, or zoning regulations do not qualify. The program often protects areas adjacent to regulated critical areas and buffers, providing additional protection for critical areas functions and values through voluntary but binding nonregulatory means. Currently, more than 1,450 landowners and 14,900 acres participate in this program.

5.2 Riparian Area Boundaries

Riparian area protections (see Section 5.1) can be augmented by including a CMHA as part of the riparian area (Figure 5.6). K.C.C. 21A.24.358.A.1. uses the OHWM as the primary location to start measuring riparian area widths. However, where a channel migration zone (CMZ) is mapped, the riparian area protections are extended to the area within the severe CMHA when that area is larger than the riparian area width measured from the OHWM (K.C.C. 21A.24.358.A.2.). The K.C.C. does not currently measure riparian area widths from the outermost portion of the severe CMHA or the moderate hazard area and thus in most cases does not provide riparian protection within those areas.

5.2.1 BAS Review

King County's current BAS review of riparian area boundaries was informed by Commerce guidance documents, WDFW BAS, King County's 2004 BAS, and supplemental literature. King County primarily used the comprehensive BAS documents produced by WDFW (Section 2.2.2) rather than conducting a separate extensive review of all relevant peer-reviewed riparian literature.

WDFW BAS states that riparian areas should be measured from the outside edge of CMZs, which is equivalent to King County's severe and moderate CMHAs combined (Figure 5.6, bottom panel) (Rentz et al. 2020). A CMZ is the area within which a river channel is likely to move laterally over a given period. Where CMZs are not mapped, WDFW BAS states that riparian areas should be measured from the edge of the active channel (Rentz et al. 2020). The active channel is the portion of an aquatic area at the lower limit of continuous riparian vegetation, usually estimated based on the location of the OHWM (Rentz et al. 2020). Including the CMZ in riparian area protections is important because the lateral movement of a channel affects sediment erosion and deposition, local topographic relief, flood inundation patterns, the structural characteristics of the river bed, alluvial architecture, and riparian vegetation patterns, which, in turn, results in a complex arrangement of aquatic and riparian habitats across a river's floodplain (Naiman et al. 1993; Rapp and Abbe 2003).

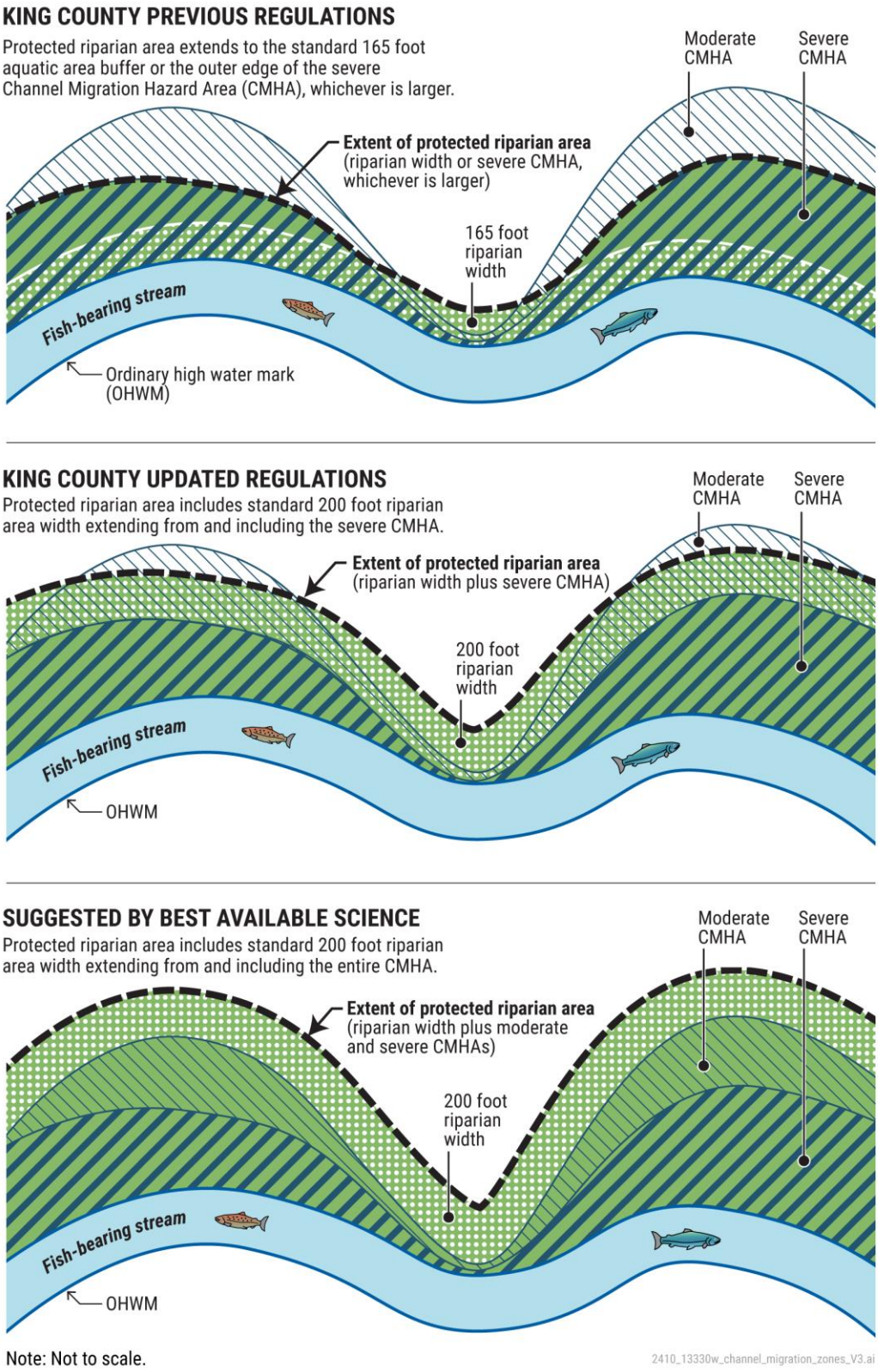

Figure 5.6 Riparian area protections and CMHAs across previous regulations, updated regulations, and BAS. King County classifies CMHAs as either severe (50 years of migration) or moderate (50 additional years).

Measuring riparian areas from the outer edge of the CMZ is appropriate because it accounts for river migration and acknowledges that the active channel will eventually move to and even past the outer edge of the CMZ. Maintaining riparian vegetation at the edge of the CMZ ensures that the functions of riparian areas are protected in current and future locations as rivers migrate (Rentz et al. 2020). If no riparian vegetation is maintained at the outer edge of the CMZ, ecological conditions will degrade as the river migrates and results in a loss of ecological function.

In King County regulations and maps, the CMZ is subdivided into two hazard areas—a severe CMHA and a moderate CMHA—rather than a single zone or hazard area, as described by WDFW (Rentz et al. 2020). King County's CMZ mapping methods have been updated since the County's 2004 BAS review (King County 2004a, 2004b). In the current classification method, the severe CMHA generally accounts for an estimate of 50 years of erosion from the current channel, with other areas added to account for rapid shifting of channel location or other imminent channel changes in areas with high migration rates. The moderate CMHA generally represents an additional 25 to 50 years of erosion from the active channel (Designation, Classification and Mapping of Channel Migration Zones, King County Public Rule 2020).

5.2.2 Comprehensive Planning Considerations

In addition to BAS review, King County considered nonscientific information when updating riparian area protections. Through the update of the Comprehensive Plan and CAO as well as commitments to companion nonregulatory actions, the County seeks to simultaneously address the many GMA goals (see Section 1.1), some of which can be in conflict. This includes meeting state requirements to plan for and accommodate a range of housing types and affordability levels within the urban area, focusing new development in the urban area, recognizing property rights, and enhancing and supporting agriculture while ensuring no net loss of critical areas functions and values at an ecosystem scale (see Section 1.2). To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs to reduce risk of impacts to critical areas functions and values.

Expanding riparian area protections in areas prone to channel migration heightens environmental protections and reduces risks to public health and safety. By increasing the area in which riparian area protections apply, the amount of land available for activities such as housing development and agriculture is decreased. Increases in riparian area widths may reduce flexibility around the placement of farm infrastructure. Existing grazing activities within riparian areas are allowed to continue under the K.C.C., with limitations set forth under the LMO (see Section 5.1).

CMZ Hazards and Mapping in King County

Channel migration is the natural process of stream and river channels moving across a floodplain as a river moves water, wood, and sediment (silt, sand, and gravel)

downstream over time. As water moves downstream, it scours and erodes the bank in some locations, and carries the sediment downstream to be deposited at other banks and point bars within the channel. Over years, decades, or centuries, this results in lateral migration—the gradual movement of the channel's path across the floodplain. Channel migration can also happen as an abrupt movement of the river to a new, typically more direct path, which is called an avulsion. An avulsion can happen as quickly as during a single flood event or gradually over years or decades. The rate of change is influenced by many factors, including the steepness of the channel, geology, sediment supply, stream flow, vegetation both in the floodplain and in the channel, and development. Channel migration, including the formation of new side channels and erosion of channel banks that causes trees to fall and form log jams and generally add complexity to stream and river channels, is also an important habitat-forming process.

Three principal Washington State programs require the management of channel migration:

- The Washington State Shoreline Management Act (SMA) requires local governments to identify and limit development within CMZs in Shorelines of the State, a jurisdictional area defined as those streams with a mean annual flow equal to or greater than 20 cubic feet per second (termed SMA streams). Specifically, the WAC states, "Applicable shoreline master programs should include provisions to limit development and shoreline modifications that would result in interference with the process of channel migration that may cause significant adverse impacts to property or public improvements and/or result in a net loss of ecological functions associated with the rivers and streams" (WAC 173-26-221 (2)(iv)(B).
- The Washington State Growth Management Act (GMA) requires local governments to classify, designate, and protect critical areas, including frequently flooded areas and geologically hazardous areas. Channel migration falls within these types of critical areas. Protection is intended to safeguard the public from hazards to health and safety, and to preserve the functions and values of the natural environment (WAC 365-196-830).
- The Washington State Flood Plain Management Act requires local governments to adopt and enforce floodplain management regulations to reduce the risk of flood damage to buildings and infrastructure. Regulatory approval for projects that would substantially improve, repair, or replace a residential structure within the floodway must be based on the flood characteristics at the site, including, "no evidence of flood-related erosion. Flood erosion will be determined by location of the project site in relationship to channel migration boundaries adopted by the local government" (WAC 173-158-076 (1)(b)).

Many areas in King County exist where channel migration may endanger houses, barns, roads, bridges, and other development and land uses that were built within the CMZ. While state law requires that these areas be designated and protected, state guidance describes a range of options for channel migration hazard identification and does not require detailed channel migration studies and mapping of all rivers and

streams. Nevertheless, King County has engaged in robust channel migration hazard mapping to maximize protection of public health and safety. To better understand natural channel migration processes and assess risks to public health and safety, King County initiated the study and mapping of CMZs along local rivers in the 1990s, hosting public meetings to review and gather comments on draft maps as they are produced.

Current CMZ maps are prepared using mapping methods specified in the King County Channel Migration Zone Public Rule (first adopted in 1999), consistent with the King County Flood Management Plan, Washington State Shoreline Management Act, and the Washington State Department of Ecology Channel Migration Assessment.

With significant investment from the King County Flood Control District, the County has completed or is developing detailed channel migration studies and mapping for the highest hazard areas and includes most major river mainstem reaches in UKC outside of the Forest Production District. In the last decade, King County has completed studies and maps for the following river reaches, which are Shorelines of the State:

- Greenwater River from River Mile 1.2 to the White River confluence
- Middle White River from Mud Mountain Dam to downstream of the State Route 410 bridge crossing
- Remapping of the Raging River from River Mile 8.5 to the confluence with the Lower Snoqualmie River
- South Fork Skykomish from the confluence of the Foss and Tye rivers to the King-Snohomish county line
- Remapping of the Tolt River from River Mile 6 to the river's confluence with the Snoqualmie River
- Cedar River from Landsburg to the river mouth in Renton

The County is currently finalizing a CMZ study and map for the 33 river miles of the Lower Snoqualmie River from the base of Snoqualmie Falls to the Snohomish County line and is near completing a channel migration study and map for 13.2 miles of the mainstem of Issaquah Creek.

King County prioritizes future mapping efforts based on risk to health and safety. Areas that remain to be mapped include larger creeks such as Newaukum, Covington, and Griffin creeks, and the Sammamish, Foss, and Tye rivers. These are considered low-risk areas either because channel migration is constrained by levees (Sammamish River, lower Green River) or lack of infrastructure and structures near the creek or river keep the safety risk level low (Foss and Tye rivers, most creeks).

A summary of channel migration hazard mapping, including mapping and regulatory standards, completed studies and maps, and current study and mapping efforts in King County, is available online and mapping is readily available to the public on the King County iMap GIS viewer.

National Flood Insurance Program (NFIP) Requirements

FEMA requires that King County comply with the FEMA BiOp for the Puget Sound to participate in the NFIP. The BiOp requires certain changes in the implementation of the NFIP to ensure compliance with the ESA. As King County reviews and proposes updates to critical areas regulations, it must continue to demonstrate that environmental protections, including riparian area widths and CMZ protections, regulations, policies, and nonregulatory actions, are sufficient to protect ESA-listed species. To demonstrate compliance with the BiOp, King County plans to complete a "programmatic checklist" that uses this BAS report as supporting documentation. Additional information about the BiOp requirements may be found in guidance documents produced by Commerce (see Section 2.1).

Based on the BAS review, the County is updating standards applied to new development in riparian areas and wetlands to strengthen protection of critical areas functions and values with special consideration to salmonids. To protect ESA-listed species and reduce risks to public health and safety, King County also maintains special development regulations for severe and moderate CMHAs. New development is not allowed within the severe CMHA, and new development may be restricted within the moderate CMHA. A summary of channel migration hazard regulations in King County is available online. Development regulations that offer protections to severe and moderate CMHAs are primarily found in K.C.C. Chapter 21A.24.

As described in Chapter 8, the County is planning a flood code update, and as part of this BAS review has identified updates to standards for frequently flooded areas to better support salmon habitat restoration and fish passage projects, which are key nonregulatory actions that are part of the County's strategy for ensuring no net loss of critical areas functions and values and for advancing commitments for salmon recovery.

Additionally, the 2024 Flood Management Plan, which was adopted as a functional plan of the King County Comprehensive Plan, includes policies that call for preserving and enhancing the natural functions of flood hazard areas, evaluating opportunities to relocate existing flood protection facilities farther from the water's edge to accommodate increased buffers, and implementing multi-benefit flood risk reduction projects. The plan's guiding principles, which are intended to help provide direction to the County's work, reference actively seeking opportunities to achieve net ecological gain in addressing flooding and channel migration.

5.2.3 Regulatory Updates

King County is updating the K.C.C. to expand riparian area protections to include more of the CMHA. As noted in Section 5.2, the existing riparian area protections in K.C.C. include the area within the severe CMHA if that area is wider than the protected riparian area width. The updated K.C.C. will extend riparian area protections outside the severe CMHA to include the riparian area width associated with the adjacent aquatic area, as measured from the outer edge of the severe CMHA where mapped. All currently

mapped CMZs are located along Type S aquatic areas, which equates to a 200-foot riparian area width or 200 feet from the outer edge of the severe CMHA, whichever is wider (Figure 5.6).

5.2.4 Risk Assessment of Regulatory Updates

The rationale for King County's riparian area regulatory updates and how different levels of protection align with GMA requirements and comprehensive planning considerations is discussed previously in Sections 5.2.2 and 5.2.3. The risks associated with these different levels of riparian area protections are discussed in this subsection. Nonregulatory programs and measures for reducing and mitigating risk are discussed in Section 5.2.5.

The risk assessment in this subsection includes a short description of the risk and then uses four factors to describe different aspects of the risk. First is an evaluation of how well the County's updates align with BAS-specific riparian area functions based on the magnitude of the lost function or functions compared to a fully functioning mature riparian area, with larger departures from BAS indicating a higher-risk approach. Second is the time scale at which the risks operate, with short term being less than 10 years, moderate term being 10 to 25 years, and long term being greater than 25 years. Third, the physical scale at which the risk operates is described by whether the risk is associated with smaller individual sites, or if it applies to a larger area of the landscape. Fourth is a brief description of the level of certainty or confidence associated with the risks. These factors were evaluated and described in the context of the qualitative level of risk, which were grouped into low-, moderate-, or high-risk approaches.

Updates to the K.C.C. do not fully align with BAS because riparian areas are not measured starting at the outer edge of the entire CMZ and some stream and river reaches prone to migration or movement have not yet been mapped. For areas with mapped CMZs, the riparian area width is proposed to be measured from the OHWM or outward from the edge of the severe CMHA, whichever is wider, rather than from the outer edge of the moderate CMHA (see Figure 5.6). Because the Public Rule, Designation, Classification and Mapping of Channel Migration Zones, King County 2020, indicates that King County should update CMZ maps every 20 years, the continual updating of the CMZ maps will likely reduce the risks to some degree by ensuring the protected areas shift with the river as it migrates over time. But between updates, some rivers could potentially migrate into or beyond the severe CMHA (e.g., sometimes within a single flood event) and into the larger riparian area. Where this occurs, the protected riparian area will be narrower than it should be, per BAS, for as long as it takes to update the mapped severe CMHA boundaries. This creates the situation where development could be permitted within an area that should have been protected, creating a future nonconforming use that will negatively impact the ability of the riparian area to properly function. The proposed increase in riparian area widths for Type S and F streams from 165 to 200 feet helps to reduce this risk.

The County's CMHA mapping program focuses on unconfined to moderately confined, low-gradient reaches of rivers and large tributaries where channel migration hazards both create risks to people and property and supports formation of complex, critical habitat for anadromous salmonids. Accordingly, King County has mapped CMHAs for priority reaches of the Greenwater, Green, White, Tolt, Raging, South Fork Skykomish, Snoqualmie Three Forks, and Cedar rivers. Mapping was completed for the Lower Snoqualmie River in 2024 (33 miles) and is underway for Issaquah Creek mainstem (13.2 miles). Updated protection for riparian areas would apply only to these areas with mapped severe CMHAs. All of these river and stream reaches are Shorelines of the State where local governments are required to identify channel migration areas and limit development.

Where CMZs are not yet mapped, King County's riparian area boundaries will continue to be measured from the OHWM. Though King County has mapped CMZs for priority reaches, there are other river and stream reaches naturally prone to migration that have not yet been mapped and will therefore not have the additional protection specific to areas of future channel migration. Within Shorelines of the State, where the CMZ has not been mapped by King County, the K.C.C. regulates the entire floodplain as a moderate CMHA. This approach is generally conservative as most mapped CMZs are less extensive than the floodplain but can include high bank areas that are outside the floodplain that are subject to erosion. Because moderate CMHA regulations generally require new structures to be located away from the hazard to the extent practical, this should provide some additional protection to riparian and aquatic area functions in areas where mapping has not been completed. However, moderate CMHA regulations would still allow some impacts such as clearing and grading. Thus, there is high certainty that King County riparian protections for streams that are likely to migrate but do not have adopted CMHA maps will be smaller than BAS suggests, which, absent any mitigating measures, could result in a net loss of ecological function over moderate-to-longer time frames as those rivers and streams migrate into under-protected areas. These risks are lessened to a certain extent because areas of channel migration often overlap with areas of special flood hazards or with wetlands where the County has additional limits on new development. Additionally, portions of streams with most active channel migration are frequently located in alluvial fans. The proposed regulations for alluvial fan hazard areas recognize them as riparian areas, and the development standards intentionally reflect CMZ standards and will also have the effect of limiting new development in riparian areas where the channel is likely to migrate.

In the long term, there is high confidence that there is moderate risk that riparian areas adjacent to migrating channels will not be fully protected. This is because K.C.C. does not measure riparian areas starting at the outer edge of the entire CMZ and because the severe CMHA only represents 50 years or less of channel migration and CMZ maps may only be updated approximately every 20 years. In addition, King County prioritizes mapping and remapping of CMZs based on risks to human safety and infrastructure, which means areas with low levels of human infrastructure and likely higher functioning riparian areas may go under protected. In summary, for riparian areas with mapped CMZs, there is low near-term risk and moderate long-term risk of degradation to riparian

and aquatic area functions because riparian area protections are limited to the 200 feet beyond the outer edge of the severe CMHA rather than the outer edge of the full CMZ.

5.2.5 Nonregulatory Programs

King County recognizes the importance of protecting critical areas through both regulatory and nonregulatory approaches. Such approaches reduce and mitigate the various risks discussed above in Section 5.2.4. King County coordinates with communities and other partners to guide investment in nonregulatory programs that protect natural resources, including critical areas. Nonregulatory programs that offer protections to riparian areas and aquatic areas are discussed at a summary level below.

Flood Management Plan Update

The 2024 Flood Management Plan includes policies that call for preserving and enhancing the natural functions of flood hazard areas, evaluating opportunities to relocate existing flood protection facilities farther from the water's edge to accommodate increased buffers, and implementing multi-benefit flood risk reduction projects. The plan's guiding principles, which are intended to help provide direction to the County's work, reference actively seeking opportunities to achieve net ecological gain in addressing flooding and channel migration.

Home Buyouts

Beginning in the 1990s, following a significant flood event and as part of the 1993 Flood Hazard Management Plan, the County identified areas where homes were at risk of deep, fast-flowing water and or channel migration, or had suffered repetitive damage, and prioritized these areas for home buyouts. These areas included the Tolt, Cedar, Snoqualmie, and Raging rivers. From 2013 to 2023, King County acquired 1,984 acres in mapped 1 percent-annual-chance floodplains and an additional 83.5 acres in 0.2 percent-annual-chance floodplains. Acquisition in these flood-prone areas permanently addresses the hazard from flooding and channel migration, protects functions and values of frequently flooded areas, and increasingly has provided opportunities to remove or set back roads and levees, which helps to permanently protect riparian corridors both within and outside of CMZs. Home buyouts on the Raging and Tolt rivers, carried out in areas with flood and channel migration hazards, have both eliminated the hazard and enhanced protection of salmon habitat.

Land Conservation Initiative and Parks Levy

The LCI includes a focus on riparian corridors of rivers and larger stream systems, which provides permanent protection and reduces risk of lessened protection of riparian areas as river and stream channels migrate. The LCI is described in more detail in Section 3.3.

While not every parcel of land protected under LCI has critical areas, permanent protection of ecological functions and values is often a key reason for seeking permanent protection. For example, of the more than 850 parcels protected under LCI since 2016, more than 65 percent have some portion of the parcel within 200 feet of a river or stream and more than 85 percent of the parcels intersect at least one type of regulated critical area. To further illustrate the benefit of voluntary conservation acquisitions under the LCI, in the last 5 years of LCI implementation, the County has protected land in riparian areas adjacent to marine waters (Vashon), all major rivers in the County (Snoqualmie, Cedar, Green, and White rivers), smaller rivers (e.g., Tolt and Raging rivers), many streams (e.g., Bear, Issaquah, May, and Soos creeks) as well as land adjacent to lakes (e.g., Cottage Lake, Paradise Lake, Lake Desire).

Stream Mapping

See Section 5.1.4 for discussion of updates to King County stream mapping.

5.3 Riparian Area Compensatory Mitigation

King County requires permittees to follow a mitigation sequence (K.C.C. 21A.24.125 and 21A.25.080) for any impacts to critical areas. Mitigation is a sequence of steps used to reduce the severity of negative impacts from activities that could individually or cumulatively impact an environment. Compensatory mitigation is the stage of the mitigation sequence where impacts to the functions and values of an environment are replaced through creation, restoration, or enhancement of similar environment(s). Compensatory mitigation is intended to offset unavoidable adverse impacts that remain after all appropriate and practicable avoidance and minimization has been achieved.

Previous King County requirements (K.C.C. 21A.24.380; framed as “aquatic area – specific mitigation requirements”) focused on addressing adverse impacts to both riparian and aquatic areas with specific compensatory mitigation ratios set to achieve equivalent or greater ecological functions. The compensatory mitigation ratios were set based on the area of mitigation to area of alteration. Compensatory mitigation ratios for riparian areas differ based on adjacent aquatic area type and whether mitigation takes place on site or off site (Table 5.6).

Table 5.6 Previous riparian area Compensatory Mitigation Ratios (area of mitigation to area of alteration).

Adjacent Aquatic Area Type	On-site Compensatory Mitigation Ratio	Off-site Compensatory Mitigation Ratio
Shoreline (S) and Fish (F)	1:1	3:1
Non-fish-bearing (N) and Other (O)	1:1	2:1

5.3.1 BAS Review

King County's current BAS review for riparian area compensatory mitigation was informed by WDFW BAS, King County's 2004 BAS report, BAS documents produced by Ecology (Ecology 2005, 2021), and supplemental literature.

BAS emphasizes that jurisdictions should acknowledge impacts to riparian areas from clearing, grading, and filling in addition to the direct and indirect impacts from allowed alterations or alteration exceptions (Rentz et al. 2020). When encroachment and impacts to riparian areas occur, the mitigation sequence (WAC 197-11-768) should be followed: 1) avoid impacts, 2) minimize impacts, 3) rectify impacts, 4) reduce or eliminate impacts, and 5) compensate for or mitigate impacts. When compensatory mitigation is necessary, an appropriate quantity of mitigation should be identified and generally equates to a ratio of area of impact to area of mitigation or compensation (i.e., the mitigation ratio) (Ecology 2021). The most detailed and comprehensive guidance for mitigation ratios pertain to wetlands and aquatic areas; however, the general principles and considerations are also broadly applicable to riparian area mitigation.

Mitigation ratios can be based on a range of factors, including compensation mechanism (e.g., restoration or preservation), equivalence of the mitigation (in-kind or out-of-kind), conservation significance (unique or common), location (on site or off site), time lags between project impacts and mitigation maturity (temporal loss), and risks of mitigation failure (uncertainty) (Moilanen et al. 2009; McKenney and Kiesecker 2010; Maron et al. 2012; Ecology 2021). Even with consideration of these factors, there can be unavoidable time lags before replacement functions are realized (Zedler and Callaway 1999; Hilderbrand et al. 2005; Morris et al. 2006), future functions could be less than estimated (Moilanen et al. 2009), and it may be inadequate to compensate immediate loss with hypothetical gains in the future (Moilanen et al. 2009; Quétier and Lavorel 2011). Given the complexity, there is less certainty around how large the mitigation ratios need to be to achieve no net loss of ecological functions.

Generally, the greater the mitigation ratio, the higher the likelihood of mitigation success. The amount of mitigation should almost always be greater than the area of impact (i.e., greater than a 1:1 ratio) and the most common reason cited for successful mitigation is having relatively high mitigation ratios (Quigley and Harper 2006; Moilanen et al. 2009; Moilanen and Kotiaho 2021). A basic mitigation ratio of 3:1 can help account for replacement, risk of failure, and temporal loss (Ecology 2005; Ecology 2021). Mitigation ratios below 3:1 are considered to be generally inadequate to support mitigation success (Minns and Moore 2003; Quigley and Harper 2006; Bradford 2017; Moilanen and Kotiaho 2021). Additionally, off-site mitigation ratios should be even greater due to the chance that off-site areas are too dissimilar to support the same conditions, functions, and biodiversity that was lost (Tallis et al. 2015). However, off-site mitigation that occurs at larger scales and provides contiguous, well-functioning areas may provide similar or greater benefits than small-scale or fragmented on-site mitigation.

Pairing riparian area mitigation ratios with additional ecological enhancements provides near-term compensation for lost functions and greater confidence in mitigation success. Ecological enhancements can improve the processes, structure, and functions of riparian and aquatic areas and can help to directly offset temporal loss of functions. Enhancements can include, but are not limited to, placing large wood in aquatic, riparian, and floodplain areas; restoring main-channel, off-channel, or floodplain habitat; removing fish passage barriers or aquatic area crossings; removing shoreline armoring; planting areas lacking native vegetation, including those contiguous and adjacent to riparian areas; removing and managing invasive or noxious plant species; adding wildlife snags; removing floodplain fill; mitigation banking; and others (Knight 2009; Maron et al. 2012; ELI 2016; Ecology 2021).

King County continues to follow the mitigation sequence as outlined in WAC 197-11-768, and K.C.C. 21A.24.125 and 21A.25.080. When impacts to aquatic and riparian areas require compensatory mitigation, the mitigation must achieve equivalent or greater biological functions than the area impacted by development (K.C.C. 21A.24.380). The K.C.C. emphasizes that riparian area compensatory mitigation should be on site when practical. In some circumstances, mitigation can be undertaken outside of the regulatory riparian area (i.e., riparian area addition) or by adding to existing regulatory riparian areas that are narrower than what BAS would suggest. Riparian area addition results in a wider riparian area that can function to offset proposed impacts as some regulatory areas are narrower than BAS would recommend. When off site is necessary, the compensatory mitigation should be within the same drainage basin or shoreline reach and should have greater mitigation ratios than on-site mitigation. King County (2004b) previously highlighted that appropriate mitigation ratios paired with enhancements may provide greater confidence in mitigation success.

5.3.2 Comprehensive Planning Considerations

In addition to BAS review, King County considered nonscientific information when updating riparian area widths. As King County updates its Comprehensive Plan policies and associated development regulations found in the K.C.C., it seeks to simultaneously address GMA goals (see Section 1.1), King County Comprehensive Plan Priorities (see Section 3.1.1.), and new state requirements to plan for and accommodate a range of housing types and affordability levels within the urban area while ensuring no net loss of ecosystem functions and values at an ecosystem scale (see Section 1.3). These goals and priorities include planning for and accommodating housing needs, focusing new development in the urban area, property rights, and enhancing and supporting agriculture. To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs to reduce risk of impacts to critical areas functions and values.

Increasing riparian area mitigation ratios helps ensure that unavoidable adverse impacts to riparian areas are appropriately offset. These heightened regulatory requirements expand environmental protections and help King County meet the GMA requirement that local jurisdictions ensure no net loss of critical areas functions and values.

Increasing mitigation requirements may increase the costs of select development and land use practices on private properties encumbered by riparian areas. Changes to compensatory mitigation ratios do not impact the costs of development and land uses that are able to address adverse impacts to riparian areas through mitigation sequencing steps, including avoiding, minimizing, rectifying, or eliminating adverse impacts to riparian areas. Maintaining riparian area mitigation ratios also enables King County to allow for reasonable use of private property (see Section 3.1.3).

5.3.3 Regulatory Updates

King County is updating the K.C.C. to include riparian area mitigation criteria specific to the functions, values, and design criteria for riparian areas as well as revising both on-site and off-site compensatory mitigation ratios. Riparian area compensatory mitigation ratios will increase for all aquatic area types, both on site and off site (Table 5.7). In addition, on-site mitigation will include a new alternative pathway to mitigate impacts that includes smaller compensatory mitigation ratios combined with a choice of required supplemental actions (Table 5.8). These updates are informed by King County's BAS review and help ensure mitigation actions account for impacts to critical areas functions and values (see Section 1.2.1). Finally, updates clarify that the minimum monitoring period is 5 years for permittee-responsible mitigation.

Table 5.7 Updated riparian area Compensatory Mitigation Ratios (area of mitigation to area of alteration).

Adjacent Aquatic Area Type	On-site Compensatory Mitigation Ratio		Off-site Compensatory Mitigation Ratio	
	Previous	Updated	Previous	Updated
Shoreline (S)	1:1	3:1	3:1	4:1
Fish (F)	1:1	3:1	3:1	4:1
Non-fish-bearing (N)	1:1	3:1	2:1	4:1
Other (O)	1:1	2:1	2:1	3:1

Table 5.8 Alternative On-site Mitigation Ratios with required supplemental actions.

Adjacent Aquatic Area Type	Impacts to wood vegetation (Trees and Shrubs)	Impacts to Non-woody Vegetation or Unvegetated areas
S, F, and N	2:1 ratio with at least one primary action or three secondary actions	1.5:1 ratio with at least one primary action or two secondary actions
O	1.5:1 ratio with at least one primary action or two secondary actions	1:1 ratio with at least one primary or secondary action

Primary actions:

a) Placing large wood in adjacent aquatic areas when not installed for shoreline stabilization or flood protection facilities;
b) Removing a fish-passage barrier, if not required by the development permit;
c) Removing an aquatic area transportation crossing, such as roads, bridges, or trails, and revegetating as appropriate. Utility-only crossings are not included under this action;
d) Removing shoreline armoring, revetments, or levees; or
e) Other similar actions as determined by the department.

Secondary actions:

a) Planting native trees and shrubs or climate-adaptive plants in areas of riparian area additions lacking native vegetation that are adjacent to and contiguous with existing riparian areas within an area equal to one-half of the area of impact. This action cannot be applied where the riparian area addition requires enhancement to achieve equal function to the impact area;
b) Placing large wood in riparian areas or an adjacent floodplain;
c) Treating or removing invasive and noxious plant species within an additional area equal to one-half of the area of impact and replanting with native species as necessary to prevent regrowth of noxious species. This action may only be applied if at least one other secondary action is also implemented;
d) Installing wildlife snags or similar wildlife nesting or rearing habitat;
e) Removing floodplain fill and replanting with native vegetation or climate-adaptive plants as appropriate; or
f) Removing a fish passage barrier.
g) Other similar actions as approved by the department.

5.3.4 Risk Assessment of Regulatory Updates

The rationale for King County's riparian area regulatory updates and how different levels of protection align with GMA requirements and comprehensive planning considerations is discussed previously in Sections 5.3.2 and 5.3.3. The risks associated with these different levels of riparian area protections are discussed in this subsection. Nonregulatory programs and measures that reduce and mitigate risk are discussed in Section 5.3.5.

The risk assessment in this subsection includes a short description of the risk and then uses four factors to describe different aspects of the risk. First is an evaluation of how well the County's updates align with BAS-specific riparian area functions based on the magnitude of the lost function or functions compared to a fully functioning mature riparian area, with larger departures from BAS indicating a higher-risk approach. Second is the time scale at which the risks operate, with short term being less than 10 years, moderate term being 10 to 25 years, and long term being greater than 25 years. Third, the physical scale at which the risk operates is described by whether the risk is associated with smaller individual sites or if it applies to a larger area of the landscape. Fourth is a brief description of staff's level of certainty or confidence associated with the risks. These factors were evaluated and described in the context of the qualitative level

of risk, which were grouped based on best professional judgement into low-, moderate-, or high-risk approaches.

Updates to the K.C.C. for riparian area compensatory mitigation are informed by BAS and best professional judgement because there is no specific WDFW guidance on riparian area mitigation ratios. As recommended by WAC 365-195-920, with limited guidance and information, a precautionary approach should be taken for critical areas protections. King County followed this approach when determining updated riparian area compensatory mitigation ratios. Previous King County riparian area mitigation ratios do not align with BAS because they do not account for temporal loss and uncertainty in mitigation success (risk of failure). King County's updates for riparian area mitigation ratios are in better alignment with BAS because they are within the range of mitigation ratios in BAS that account for replacement of lost or impacted area, temporal loss, and uncertainty in mitigation success. Increasing riparian area mitigation ratios will help support mitigation success in achieving equivalent or greater functions. Additionally, having different mitigation ratios based on aquatic area types helps to align mitigation with expected functions likely achieved for each aquatic area type.

Higher off-site mitigation ratios than on-site ratios align with BAS because there is even greater uncertainty with off-site mitigation as areas may or may not provide similar functions and conditions as on-site areas. Previous King County off-site riparian area mitigation ratios were greater than on-site ratios to prioritize on-site mitigation and to partially account for uncertainty in off-site conditions and success. However, further increasing off-site mitigation ratios will provide even greater certainty and help mitigate for temporal loss of riparian area functions and values. Off-site mitigation that occurs at larger scales can provide contiguous, well-functioning areas, which may provide comparable benefits. Having higher off-site mitigation ratios will help ensure that mitigation occurring off-site is at an appropriate scale and extent.

As highlighted in BAS, pairing mitigation ratios with supplemental actions can provide near-term compensation for lost functions and greater confidence in mitigation success. The alternative compensatory mitigation strategies added to the K.C.C. will provide flexibility for applicants with reduced area-based mitigation ratios. However, these ratios are paired with required supplemental actions to ensure adequate compensatory mitigation. Including supplemental actions will help to offset the lower area-based mitigation requirements because the specific supplemental actions are known to directly benefit riparian and aquatic-area functions.

BAS emphasizes that use of mitigation to achieve no net loss of functions is difficult and generally comes with a high risk of failure. The BAS review indicated that there is uncertainty around how large mitigation ratios should be to achieve no net loss. A comprehensive accounting for all relevant mitigation factors would result in very large mitigation ratios. Generally, increasing mitigation ratios reduces risk and improves the likelihood of mitigation success. King County's updated mitigation ratios have increased to better incorporate temporal loss and uncertainty in mitigation success; however, updated ratios have moderate, longer-term risk to impaired or lost riparian functions.

Moderate risk remains because potential future functions may be less than expected or inadequate to compensate for immediate and temporal loss of riparian area functions. Additionally, longer-term risk remains because riparian trees take considerable and variable time to mature and related riparian functions develop across various time horizons. These risks are likely magnified with climate change because future conditions are expected to be less suitable for fully functioning riparian areas, climate change may impact riparian vegetation health, and newly established smaller vegetation may be less resilient to extreme environmental changes.

Risk will likely be at a site-by-site scale based on where mitigation is needed, the suitability of mitigation sites, and the extent of mitigation planning, construction, and monitoring. Off-site mitigation may have greater risk than on-site because conditions and habitats may be too dissimilar to support equivalent functions. However, off-site mitigation in appropriate and well-functioning mitigation banks, reserves, and conservation areas can increase certainty of successful mitigation. Supplemental actions may reduce risk because riparian and aquatic functions can be realized in the near term. Additionally, supplemental actions may help provide functions that are equivalent or greater than those being impacted.

5.3.5 Nonregulatory Programs

King County recognizes the importance of protecting critical areas through both regulatory and nonregulatory approaches. Such approaches reduce and mitigate the various risks discussed above in Section 5.3.4. King County coordinates with communities and other partners to guide investment in nonregulatory programs that protect natural resources, including critical areas. Nonregulatory programs that offer protections to riparian areas and aquatic areas are discussed at a summary level below.

Stream Mapping

See Section 5.1.4 for discussion of updates to King County stream mapping and Section 5.1.6 for a discussion of land conservation and habitat restoration as key nonregulatory programs that work in tandem with Riparian Area Compensatory Mitigation to address risks of departures and to ensure no net loss of critical areas functions and values.

5.4 Summary and Assessment of Updates

A summary assessment of regulatory updates discussed in Section 5 is discussed below. The assessment includes review of increased protections for riparian areas, summary of risks to critical areas functions and values, and the County's demonstration of compliance with no net loss and special consideration for anadromous fisheries mandates.

5.4.1 Primary Improvements to Riparian Area Protections with Updated Riparian Area Widths in the King County Code

Updated riparian area widths in the K.C.C. provide improved protections of riparian area functions and values that better align with BAS. Aligning Type S and F aquatic areas with appropriate SPTHs provides additional protections compared to prior riparian area widths, with benefits realized both inside and outside the UGA. While the riparian area width for Type S and F aquatic areas is smaller inside the UGA than outside the UGA, the increase from prior widths is relatively greater inside the UGA. Type N aquatic areas have a modest increase in additional protection because they align with the minimum widths for water quality functions, specifically pollution removal, but will have lesser benefits for other riparian functions because the updated width is only half the SPTH. Protections for Type O aquatic areas will have the least improvement. While Type N and O aquatic areas will have smaller riparian area widths, these areas are generally much less frequent across the landscape. The greatest overall increase in riparian area protections will be in rural Type S and F aquatic areas because the riparian widths more closely align with BAS and because these are the most common aquatic area types in UKC. In addition, the riparian areas of Type S aquatic areas with mapped CMHAs will see additional increases in width of protected area by measuring the riparian area from the outer edge of the severe CMHA. Updated grazing area buffer widths in the K.C.C. related to livestock properties (i.e., LMO), while in some cases increased, still depart from BAS as they will provide minimal additional protections that will only apply in limited circumstances, are half of or less than the minimum recommended water quality riparian area width and are only a quarter of the SPTH. In sum, updated riparian area widths in the K.C.C. more closely align with BAS than the previous widths and provide improved protection for riparian area functions.

The updated riparian area compensatory mitigation requirements will more effectively offset unavoidable adverse impacts from development in riparian areas. Previous riparian area mitigation ratios in K.C.C. were insufficient to ensure the County meets GMA requirement for no net loss of riparian area functions and values. Increasing both on-site and off-site compensatory mitigation ratios will provide certainty that mitigation will address impacts and achieve equivalent or greater functions. Maintaining greater ratios for off-site mitigation will continue to account for greater uncertainty in outcomes associated with these areas. Including alternative on-site mitigation ratios with required supplemental actions will improve mitigation success because supplemental actions provide functions that can be realized in the near term and are equivalent to or greater than those being impacted. Increased mitigation requirements align with BAS and will help King County meet the GMA no net loss requirement for ecological functions.

5.4.2 Summary of Riparian Area Updates in the King County Code

Updating riparian area widths in the K.C.C. improves protections for riparian areas; however, as described in the previous subsections, some components of the updated riparian area protections do not fully align with BAS and create risks for the long-term protection of riparian area functions and values (see Sections 5.1.4, 5.2.4, and 5.3.4).

The WAC notes that protecting some critical areas may require using both regulatory measures and nonregulatory programs, and that conservation and protection measures may address land uses on any lands within a jurisdiction and not only lands with designated critical areas. Additionally, local government may develop and implement alternative means of protecting critical areas from some activities using BMPs or a combination of regulatory measures and nonregulatory programs.

Regulatory updates, risks, comprehensive plan considerations, and nonregulatory actions that mitigate risk are summarized in the Riparian Areas Summary Table in Section 5.5.

5.4.3 Updating the King County Code and the GMA No Net Loss Requirement (WAC 365-196-830)

As noted in Section 1.2.1, King County can meet the GMA no net loss requirement in WAC 365-196-830 through a combination of regulatory measures and nonregulatory programs and actions. The WAC highlights the importance of using a regional approach when giving special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries. Conservation and protection measures may address land uses on any lands within a jurisdiction, and not only lands with designated critical areas. Further, local governments may develop and implement alternative means of protecting critical areas from some activities using BMPs or a combination of regulatory measures and nonregulatory programs. The WAC underscores that, while avoidance is the most effective way to protect critical areas, development regulations may impact critical areas if compensatory mitigation is required or other corresponding mitigation efforts occur.

An evaluation of no net loss for critical areas is not defined or described in the WAC, but Ecology (Ecology 2017) provides useful guidance on how to evaluate no net loss for shoreline master programs, which can be adapted to evaluate no net loss for critical areas.

The primary purpose of the no let loss evaluation is to verify that the required mitigation for any new development fully offsets the impacts of the proposed development. The updated compensatory mitigation requirements in the K.C.C. minimize the chance of new development activities that result in a net loss of riparian functions. In addition to compensatory mitigation, additional losses of function can occur through regulatory protections being set below what BAS recommends and through unmitigated violations of critical areas codes. To meet no net loss, these additional losses of ecological function need to be offset by nonregulatory actions that create ecological gains, such as voluntary restoration of salmonid habitat. The lower the regulatory protections, the more nonregulatory actions King County will need to undertake to offset allowed impacts.

Habitat protection and restoration and other nonregulatory programs are necessary for achieving both no net loss and functioning riparian areas because development regulations only apply to new development and redevelopment and are focused on

addressing the impacts of that particular development, and because, in limited circumstances, King County's regulatory protections depart from BAS. However, the GMA only requires protection of critical areas from further harm and does not impose a corresponding requirement for enhancement or restoration (Commerce 2023). While critical areas restoration cannot be mandated, King County supports and promotes habitat restoration and enhancement through its Comprehensive Plan, large capital improvement projects (habitat restoration, fish passage, and stormwater), Strategic Climate Action Plan, and with coordination and implementation of Watershed Resource Inventory Area (WRIA) salmon recovery plans and projects. In addition, King County implements a variety of initiatives supporting riparian protection and restoration, including the 3 Million Trees Initiative, Clean Water Healthy Habitat, and the LCI. King County also provides technical assistance through Watershed Stewards and provides restoration programs such as the Small Habitat Restoration Program and the Fish Passage Restoration Program. Finally, King County has tax reduction programs and a few additional incentives for landowners aimed at protecting and restoring critical areas.

With information from existing critical areas monitoring efforts, the updated riparian area widths and ongoing nonregulatory actions indicate that King County is likely achieving no net loss at the watershed scale. King County has a monitoring and adaptive management program, and with some targeted enhancements and better integration of existing permit monitoring with ecological monitoring, the County's ability to evaluate net changes in critical areas will be strengthened. Opportunities to strengthen the County's M&AM efforts are outlined in Section 3.5.

5.4.4 Updating the King County Code and Special Considerations for Anadromous Fisheries

Updated riparian area widths in the K.C.C. for Type S and F aquatic areas are aligned with BAS and correspond to areas that directly support salmonids and salmonid habitat. While riparian area widths inside the UGA are smaller than widths outside the UGA, they are now within the range of SPTHs supported by BAS. Type S and F aquatic areas are the most abundant aquatic area types in UKC and are mostly found outside the UGA where the larger riparian area width applies. Because these aquatic areas are the most frequent across UKC, increased protections through greater riparian area widths should result in widespread improvement in protections of riparian and aquatic areas that directly benefit salmonids and anadromous fisheries. The updated riparian area width for Type N aquatic areas aligns with the minimum water quality widths suggested by BAS. The updated Type O riparian area and LMO grazing area buffer widths represent minor improvements in conditions for salmonids. In sum, the combined updates in the K.C.C. as well as all the nonregulatory actions and programs the County undertakes to preserve and restore salmonid habitat (see Section 5.4.3) demonstrates that King County has provided special consideration for anadromous fisheries.

5.5 Riparian Areas Summary Table

Critical Area Topic	2024 Best Available Science (BAS) Review	Previous King County Code	Updated King County Code	Qualitative Risk Assessment of Regulatory Updates	Comprehensive Plan Considerations and Nonregulatory Programs
Riparian Area Width	The width of riparian areas should be based on site potential tree height (SPTH) of tallest dominant 200-year-old riparian trees. Tallest dominant riparian trees in King County include Douglas fir, western hemlock, and black cottonwood. The SPTH of these trees range from 128 to 243 feet. Two thirds of stream miles in King County have SPTH greater than 195 feet and 84% of stream miles have a SPTH between 180 and 215 feet. A riparian area width of 200 feet is the average SPTH for riparian trees in unincorporated King County. No BAS evidence that riparian functions are less important in non-fish-bearing streams or that riparian area widths should differ between urban and rural areas. Riparian areas should have a minimum width of 100 feet to protect water quality functions.	<u>Outside the Urban Growth Area</u> Shoreline (S)[1] – 165’ Fish-bearing (F)[1] – 165’ Non-fish-bearing (N)[1] – 65’ Other (O)[1] – 25’ <u>Inside the Urban Growth Area</u> Shoreline (S) – 115’-165’* Fish-bearing (F) – 115’-165’* Non-fish-bearing (N) – 65’ Other (O) – 25’ <u>Livestock Management Ordinance Grazing Area Buffer</u> [with/without an FMP] Shoreline (S)/Fish (F) – 0-25’/50’ Non-fish-bearing (N) – 0’ Other (O) – 0’ *”High” condition basins.	<u>Outside the Urban Growth Area</u> Shoreline (S)[1] – 200’ Fish-bearing (F)[1] – 200’ Non-fish-bearing (N)[1] – 100’ Other (O)[1] – 50’ <u>Inside the Urban Growth Area</u> Shoreline (S) – 180’ Fish-bearing (F) – 180’ Non-fish-bearing (N) – 100’ Other (O) – 50’ <u>Livestock Management Ordinance Grazing Area Buffer</u> [with/without an FMP] Shoreline (S)/ Fish (S) – 40’/50’ Non-fish-bearing (N) – 35’/50’ Other (O) – 0’ *(updated grazing area buffer widths will be required for properties not in compliance with previous code when updated code is adopted, when properties convert uses from crops to livestock)*	Low risk to riparian area functions for Type S and F aquatic areas because updated riparian area widths align with BAS. Moderate risk remains for Types S and F in the Urban Growth Area (UGA) because riparian area widths align with the lower end of SPTHs; however, there are only a small number of stream miles inside the UGA. Moderate to high risk to riparian area functions for Type N aquatic areas because, aside from pollution removal (achieved at a 100-foot width), riparian area widths do not align with BAS for full protection of all functions. Moderate-to-high and long-term risk for microclimate and wildlife across all riparian area widths because full protection would require a riparian area width equivalent to multiple SPTHs. High risk to riparian area functions for all aquatic areas associated with livestock properties because they are a large source of pollutants, grazing area buffer widths have the largest departures from BAS, and updated widths apply in limited circumstances.	Increasing riparian area widths heightens environmental protections; however, these also decrease the amount of land available for housing development and livestock agricultural operations. King County continues to align riparian area widths with adjacent aquatic-area types [1] to reduce complexity of implementation, correspond to shoreline regulation, and provide higher protections for fish-bearing aquatic areas. Taking into account multiple GMA goals and comprehensive planning considerations, King County is strengthening riparian area protection while retaining some differentiation of levels of protection for riparian areas inside and outside the UGA, for non-fish-bearing aquatic areas (Types N and O), and for properties with livestock activities. Nonregulatory programs, including stream mapping, best management practices, technical assistance, livestock fencing, King County’s land open space conservation and habitat restoration programs, landowner incentive programs, and critical areas monitoring and adaptive management, reduce and mitigate risks and improve outcomes of critical areas protections.
Riparian Area Boundaries	Riparian areas should be measured from the outside edge of mapped channel migration zones (CMZs) to allow for migrating channels to have functional riparian areas. Where CMZs are not mapped, riparian areas should be measured from the edge of the active channel (ordinary high-water mark). King County subdivides the CMZ into two channel migration hazard areas (CMHAs)—either severe (25 to 50 years of migration) or moderate (50 additional years). For a list of rivers and streams with mapped CMZs, see Section 5.2.4.	Riparian areas start at the edge of ordinary high-water mark. If a CMZ is mapped, the riparian area protections apply to the area within the severe CMHA portion of the CMZ when that area is wider than the riparian area width.	Riparian areas start at the edge of ordinary high-water mark. If a CMZ is mapped, the protected riparian area will include the area within the severe CMHA and will extend outside the severe CMHA to include the riparian area width associated with the adjacent aquatic area, as measured from the outer edge of the severe CMHA.	Updated riparian area protections do not fully align with BAS because the entire CMZ is not protected. Low near-term risk to riparian area functions because most CMZs have wide severe CMHA (protected with updates), and moderate long-term risk because protections are limited to the outer edge of severe CMHA areas rather than the outer edge of the full CMZ. A channel could migrate past protected areas before maps are updated. High certainty that riparian areas are under-protected where CMZs are not mapped or have not been recently updated. For a list of rivers and streams with mapped CMZs, see Section 5.2.4.	Expanding riparian area protections associated with CMZs heightens environmental protections and reduces risks to public health and safety; however, this expansion also decreases the amount of land available for housing and agriculture development. Floodplain development regulations and nonregulatory programs, including land conservation and habitat restoration, CMZ mapping, and stream mapping, help reduce and mitigate risks and improve outcomes of critical areas protections.

Riparian Area Compensatory Mitigation	Compensatory mitigation requires an appropriate ratio of area of impact to area of mitigation. Ratios should, at a minimum, account for replacement of impacted area, risk of failure, and time lags between project impacts and mitigation maturity. Compensatory mitigation occurring at an off-site location should be greater than mitigation occurring on site. Pairing mitigation with additional actions provides near-term compensation for lost functions and greater confidence in mitigation success.	<u>Compensatory Mitigation Ratios</u> [area of mitigation to area of alteration] On site (all aquatic areas) – 1:1 Off site (S, F) – 3:1 Off site (N, O) – 2:1	<u>Compensatory Mitigation Ratios</u> [area of mitigation to area of alteration] On site (S, F, N) – 3:1 On site (O) – 2:1 Off site (S, F, N) – 4:1 Off site (O) – 3:1 Alternative on-site compensatory mitigation includes smaller ratios combined with a choice of required supplemental actions, based on aquatic-area type and existing vegetation.	Increased on-site and off-site compensatory mitigation ratios help account for replacement of lost or impacted areas, temporal loss, and uncertainty in mitigation success; all which reduce risk and improve success. Updated ratios have moderate, longer-term risk, because potential future functions may be less than expected and riparian trees take time to mature. Off-site mitigation may have greater risk than on-site mitigation because conditions and habitats may be too dissimilar to support equivalent functions. Allowable alterations and permit exempt activities increase risk, compared to if they were not allowed.	Increasing riparian area mitigation ratios helps ensure that unavoidable adverse impacts to riparian areas are appropriately offset. Heightened regulatory requirements expand environmental protections and ensure no net loss of riparian functions and values. Increasing mitigation requirements may increase the costs of select development and land use practices on private properties encumbered by riparian areas. Nonregulatory programs, including stream mapping, help reduce and mitigate risks and improve outcomes of critical areas protections.

[1] Aquatic Area Types: Shoreline (S) – Shorelines of the state; Fish (F) – Not S type, contain fish or fish habitat, fish present, or a defined channel 2 feet or greater in width with a gradient less than 20%, or a channel in the 100-year floodplain of a type S or F; Non-fish-bearing (N) – Not S or F type and connected by surface water to type S or F; Other (O) – Not S, F, or N type and not connected to Type S, F, or N by surface water.

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6 Wildlife Habitat (A Type of Fish and Wildlife Habitat Conservation Area)

Fish and Wildlife Habitat Conservation Areas (FWHCAs) contribute to wildlife and plant biodiversity and occur on both publicly and privately owned lands. Designating FWHCAs is an important part of land use planning, ensuring that species maintain sufficient habitat to support viable populations over the long term. In addition to protecting habitats and species of local importance, designating FWHCAs in development regulations found in the King County Code (K.C.C.) ensures protection of areas where endangered, threatened, and sensitive species have a primary association (WAC 365-190-130).

King County protects wildlife by designating and protecting species and habitats of local importance, designating and protecting wildlife corridors, conserving land and habitat through nonregulatory programs, and by prioritizing development in the County's Urban Growth Area (UGA). Wildlife and wildlife habitat in King County are also protected, in part, through development regulations and nonregulatory programs related to the management of wetlands and wetland buffers (see Section 4) and riparian areas (see Section 5).

Development impacts and climate change are two of the greatest threats facing wildlife habitat and biodiversity (Bellard et al. 2022; Weiskopf et al. 2020; Bateman et al. 2020; Mantyka-Pringle et al. 2015; Staudinger et al. 2013; Jetz et al. 2007). Development results in direct loss of habitat and further impacts wildlife by fragmenting habitat at the landscape scale (Haddad et al. 2015; Newbold et al. 2015; Bennett and Saunders 2010). Climate change is already impacting wildlife populations (Roman-Palacios and Wiens 2020; Schloss et al. 2012). In Washington State, climate change is shifting the amount, extent, and quality of habitat available to species, resulting in shifts in species composition, distribution, and biodiversity (WDFW 2015).

This section discusses best available science (BAS), comprehensive planning considerations, development regulations, and King County programs related to the protection of local wildlife and wildlife habitat.

6.1 Wildlife Habitat Protections

King County's Comprehensive Plan includes policies listing Species of Local Importance (SOLI) and Habitats of Local Importance (HOLI). These policies, E-435 and E-437, respectively, are included in Chapter 5 of the Comprehensive Plan. Development regulations in K.C.C. 21A.24.382 require protection of an active breeding site of any federal- or state-listed endangered, threatened, sensitive, and candidate species, and any SOLI. HOLI listed in the Comprehensive Plan are not explicitly protected in code, though some instances of HOLI are offered varying levels of protection through wetland, riparian area, and geologically hazardous area (GHA) development regulations.

King County offers additional protections to wildlife and wildlife habitat by protecting a designated wildlife habitat network (WHN). The WHN, defined in K.C.C. 21A.06.1424, was created and codified in 1994. It maps and protects a network of wildlife habitat, critical areas, trails, parks, open space, and other areas. This mapped network is intended to allow for wildlife migration and alleviate habitat fragmentation. Development regulations for the WHN are listed in K.C.C. 21A.24.386.

6.1.1 BAS Review

BAS addresses conservation of populations and species through the lens of protecting large areas of land, including corridors and unique and rare habitat types, such as old-growth forest, snag, and talus. Climate change must also be considered when designing protection measures for biodiversity. This section first summarizes how climate change is expected to affect biodiversity, then examines species of local importance and the protection of unique and rare habitat types. Finally, the science on corridor protection is summarized.

Climate Change Impacts to Species and Habitats

Washington's State Wildlife Action Plan (WDFW 2015) summarizes some of the primary ways that climate change will affect habitats and species:

- Shifts in habitat amount, extent, and quality
- Shifts in species composition, distribution, and biodiversity as well as shifts in species interactions
- Impaired biological, ecological, and biogeochemical processes
- Declines in certain vegetation types and expansions in others as suitable habitat ranges shift
- Shifts in phenology, affecting plant reproduction and/or productivity and animal life histories, survival, reproduction, and growth
- Increases in forest disease susceptibility due to moisture stress
- Altered aquatic organism behavior, health, growth, reproductive success, and survival
- Increased sensitivity to pollutants and contaminants
- Increased risk of invasive species spread and/or establishment

The impacts on individual species will vary and it is impossible to fully anticipate the cascading effects that will unfold as one change leads to more changes in the coming years and decades. Species interactions are complex and are often not well understood until something happens that causes an obvious change, such as a population crash or a pest invasion. Species interactions occur at many levels and include both animal-to-animal and animal-to-plant interactions. These relationships sustain functioning ecosystems. Examples of important relationships include predator-prey relationships (Bretagnolle and Gillis 2010; Beschta and Ripple 2009; Abrams 2000); pollination (Torezan-Silingardi et al. 2021); seed dispersal (McConkey et al. 2012); herbivore effects on plants (e.g., Brodie et al. 2011); and parasitism (Frainer et al. 2018). While it

is relatively easy to identify which species are at highest risk of extinction in the short term (e.g., American pike, white-tailed ptarmigan, Olympia oyster), it is far less obvious how changing phenologies (the timing of natural events, such as flowering in plants) (Piao et al. 2019; Tang et al. 2016) combined with global climate change (Tylianakis et al. 2008) will have long-term, cascading effects on wildlife populations.

Species and Habitats of Local Importance

King County reviewed the following resources when considering updates to SOLI and HOLI lists:

- Washington State Priority Habitats and Species (PHS) List (WDFW 2023)
- Washington's State Wildlife Action Plan (WDFW 2015)
- Survival by Degrees—389 bird species on the brink (Wilsey et al. 2019)
- Washington Department of Natural Resources (DNR) Natural Heritage Program Vascular Plant Species of Concern list (Fertig 2021)

Using these resources, King County created a table to determine which animals should be considered for inclusion in the County's SOLI list. The table, found in Appendix A of this report, groups species by animal type and provides state and federal status, habitat use in the State of Washington, vulnerability to climate change, and reason for inclusion in the County's SOLI list.

In addition to assessing which animals may be included in the SOLI list, King County reviewed DNR's Natural Heritage Program Vascular Plant Species of Concern list (Fertig 2021) and identified plants (Table 6.1) to be considered for inclusion in King County's SOLI list.

Table 6.1 Plants considered for inclusion in King County's Species of Local Importance (SOLI) list.

Common Name	Species	Federal Status	State Status
Alaska harebell	*Campanula lasiocarpa*	None	SS
Branched montia	*Montia diffusa*	None	SS
Brewer's cliffbrake	*Pellaea breweri*	None	SS
Choriso's bog-orchid	*Platanthera chorisiana*	None	SS
Few-flowered sedge	*Carex pauciflora*	None	SS
Flat-leaved bladderwort	*Utricularia intermedia*	None	SS
Golden paintbrush	*Castilleja levisecta*	Threatened (proposed for delisting)	ST
Harvest brodiaea	*Brodiaea rosea ssp. rosea*	None	SS
Kamchatka fritillary	*Fritillaria camschatcensis*	None	SS
Long-styled sedge	*Carex stylosa*	None	SS
Northern bog clubmoss	*Lycopodiella inundata*	None	SS

Common Name	Species	Federal Status	State Status
Old field blue toadflax	*Nuttallanthus canadensis*	None	SS
One-cone clubmoss	*Lycopodium lagopus*	None	SS
Pacific peavine	*Lathyrus vestitus var. ochropetalus*	None	SE
Spleenwort-leaved goldthread	*Coptis asplenifolia*	None	SS
Spotted Joe-pye weed	*Eutrochium maculatum var. bruneri*	None	SS
Stalked moonwort	*Botrychium pedunculosum*	None	ST
Swamp gentian	*Gentiana douglasiana*	None	SS
Tall bugbane	*Actaea elata var. elata*	None	SS
Tree clubmoss	*Dendrolycopodium dendroideum*	None	SS
Triangular-lobed moonwort	*Botrychium ascendens*	None	ST
Water lobelia	*Lobelia dortmanna*	None	SS
Weak thistle	*Cirsium remotifolium var. remotifolium*	None	SE
Western moonwort	*Botrychium hesperium*	None	SS
White meconella	*Meconella oregana*	None	SE
Whitebark pine	*Pinus albicaulis*	Proposed Threatened	SS

King County's review of PHS guidance indicates that westside (Camas) prairie, Oregon white-oak woodlands, and herbaceous balds should be considered for inclusion in King County's HOLI list (WDFW 2023). Each of these habitat types contain species with narrow habitat requirements not found elsewhere.

Connectivity and Conservation

There are two primary components to creating a system of protected and connected fish and wildlife habitat: larger blocks of habitats/open spaces, sometimes called "reserves," and "corridors" that connect reserves to one another with fish and wildlife habitat. Designating and protecting these areas are important for local and ecoregional biodiversity. This subsection includes a short discussion on the size of reserves, then examines the science of identifying habitat corridors to be protected.

Important habitat blocks may be large or small. Not all high-value reserves must be large blocks of habitat (Riva and Fahrig 2023). Island biogeography theory (MacArthur and Wilson 1967), which has been embraced in conservation science for five decades, contends, among other things, that species richness increases with the size of the habitat patch. Many conservation practitioners have thus prioritized the protection of larger habitat areas over relatively smaller ones (Pickett and Thompson 1978). However, recent studies illuminate the importance small habitat patches have for

conservation (Yan et al. 2021; Wintle et al 2019; Hunter 2017). Riva and Fahrig (2022) contend that “acknowledging the conservation value of small patches, even very small patches, will be a necessary step for stemming biodiversity loss in the Anthropocene.”

King County’s 2004 BAS review defined habitat corridors as “contiguous, vegetated, dispersal conduits of variable length and width that connect isolated habitat patches to other patches or larger landscape habitat components” (King County 2004). The concept focused heavily on corridors for the movement of species, and it secondarily acknowledged the habitat value of the corridors themselves.

In conservation science, connectivity was first conceptualized to facilitate wildlife movement and gene flow (Harris and Scheck 1991; Rosenberg et al. 1997). Connectivity is now considered a primary climate adaptation strategy for biodiversity conservation (Beier 2012) that must be retained across the landscape not only for short-term movement needs, such as dispersal and seasonal range shifts, but also for long-term range shifts as species evolve (Schloss et al. 2022).

Regardless of uncertainties of the fate of any particular species, it can be assumed that some species will adapt without moving to new locations (Román-Palacios and Wiens 2020; Virkkala et al. 2020). Some species’ ranges may expand such that they remain where they currently are and expand into additional places (Tape et al. 2018, 2022), whereas other species will go extinct (Román-Palacios and Wiens 2020). Extinctions may be local or global, as “the combination of the pace of climatic changes, dispersal limitations, and habitat fragmentation patterns will make movement an infeasible adaptation strategy” (Schloss et al. 2022, 2012). Further, it should not be assumed that all species whose ranges overlap under current conditions will continue to overlap in the future (Costanza 2020). “As species’ niches shift individualistically, species whose distribution coincidentally overlaps under current climate may diverge in distribution under future climates” (Carroll et al. 2010).

Schloss et al. (2022) summarize why planning for habitat connectivity for climate adaptation is different from present-day connectivity planning in several ways. First, “connectivity for climate adaptation will need to facilitate movement outside a species’ present range…to future suitable habitats” (Keeley et al. 2018; Groves 2012; Schmitz 2015). Second, “connectivity for climate change-driven movement needs to facilitate movement over many generations and will therefore need to incorporate habitats that support feeding, cover, and reproduction over longer periods of time.” And third, “geophysical features are likely to play an important role in facilitating connectivity in a changing climate, because terrain and soil features remain relatively constant as climate changes and a diversity of these features creates conditions that support a diversity of microclimates and habitats” (Dobrowski et al. 2009; Anderson and Ferree 2010; Brost and Beier 2012).

Early work connected the current distributions of focal species to their projected future distributions (Williams et al. 2005; Phillips et al. 2008). Beier (2012) argued that accommodating species’ range shifts to future climate space can be achieved by a

combination of conservation of large, topographically, and climatically diverse natural landscape blocks and coarse-filter corridors between those blocks. This approach would result in a system of connected biodiversity areas. Beier (2012) proposed three non-mutually exclusive ways to design the coarse-filter corridors: 1) climate gradient corridors, 2) linkages defined by landscape units of relatively uniform topography and soils, and 3) river riparian areas as climate corridors. Each of these ways to design corridors are briefly addressed in the following subsections.

Climate Gradient Corridors

Earlier work in connectivity mapping commonly used a cost-distance corridor approach that drew the shortest connection between two habitat patches (WHCWG 2010). Nuñez et al. (2013) mapped climate gradient corridors, a new approach that provides the most unidirectional change in the temperature gradient. Instead of the shortest line between habitat patches, a climate gradient is often a longer route with fewer temperature extremes. This approach combines temperature gradients with land use patterns and mapped corridors with the potential to facilitate climate-driven movements of biota in the Pacific Northwest. First, they identified habitat patches with a low degree of human modification relative to the surrounding landscape. Next, they identified pairs of these patches that, if connected, would allow species to move from warmer to cooler areas. Finally, they mapped corridors between linked patches using a cost-distance model that delineated routes that a) had the most unidirectional changes in present-day temperature between the patches, b) avoided extreme deviations in temperature, and c) remained within areas of lowest human influence. Nuñez et al. (2013) contended that the network of patches and corridors in their resulting maps “are likely to be robust to uncertainty in the magnitude and direction of future climate change because they are derived from gradients and land-use patterns.”

Littlefield et al. (2017) found it imperative to incorporate future climate projections into connectivity modeling to facilitate species movement and population persistence in a changing climate. They used historical climate data sets and future climate projections to map “potential species’ movement routes that link current climate conditions to analogous climate conditions in the future (i.e., future climate analogs).” They did this by using a novel moving-window analysis based on electrical circuit theory. By including future climate projections into their models, they found that priority areas both shifted and were more limited, and that movement routes that connect present-day landscapes may differ from those needed to track changing climatic conditions.

Most recently, Schloss et al. (2022) explicitly incorporate land use, topographic complexity, and climate projections into their modeling approach to attempt to provide “enduring ecological benefits in the face of environmental change.” They found that, in places that are already highly fragmented, the remaining connections are critical to conserve. Additionally, including land use, topography, and climate projections is important for identifying priority corridors in landscapes that are not yet highly fragmented. Finally, their work reinforces the importance of conserving aquatic areas

and riparian areas for connectivity in the long term. Regulatory and nonregulatory protections for these critical areas are discussed in Section 5 of this report.

Uncertainty is inherent in modeling connectivity, even without addressing climate change (Lawler and Michalak 2017). Uncertainty increases further when trying to incorporate climate change because of a significant lack of information about species' responses to climate change (Urban et al. 2016). Second, climate change happens continuously, but the models used to understand how species respond to it usually aren't continuous. Most studies that address species' movements or future ranges either treat climate change as a single event at some point in the future or average changes over time. However, in reality, climate change is unpredictable and comes with extreme events and fluctuations (Littlefield et al. 2019, citing Garcia et al. 2014). And third, long-term model effectiveness is nearly impossible to test: "At present, few large-scale connectivity models—and to staff's knowledge, no connectivity models explicitly designed to account for climate change—have been directly evaluated for long-term effectiveness" (Littlefield et al. (2019), citing Gilbert-Norton et al. 2010; Gregory and Beier 2014).

Landscape Units

Brost and Beier (2012) advocate using landscape units of relatively uniform topography and soils as a part of designing linkages to "conserve the arenas of biological activity rather than the temporary occupants of those arenas." Anderson and Ferree (2010) asked what factors ultimately control total diversity, thinking that if they could define those factors, the major drivers of total species richness could be protected in the long term. They hypothesized that if geophysical diversity drives regional diversity, "then conserving geophysical settings may offer an approach to conservation that protects diversity under both current and future climates." Their results indicate that four geophysical factors (the number of geological classes, latitude, elevation range, and the amount of calcareous bedrock) predicted species diversity with certainty (Anderson and Ferree 2010). They next ran an independent test to confirm the species-geology relationships for 885 rare species and found that 40 percent of the species were restricted to a single geology. Additionally, each geology class supported from five to 95 endemic species, and calcareous bedrock and extreme elevations had significantly more rare species than expected by chance (Anderson and Ferree 2010). Their results provide a strong argument for protecting geophysical settings to "conserve the stage for current and future biodiversity and may be a robust alternative to species-level predictions" (Anderson and Ferree 2010). Because of the important role that geophysical features are likely to play in facilitating connectivity in a changing climate, Schloss et al. (2022) also include them in their "no regrets" approach to connectivity planning.

Riparian Areas

The science supporting the protection of riparian areas for the benefit of water quality and fish habitat, especially in the face of climate change, is reviewed in Section 5.

Riparian habitat is also well documented to disproportionately contribute to species richness and provide habitat for many upland species as well as riparian specialists (for example, Olson et al. 2007; Sabo et al. 2005; Naiman et al. 1993). Graziano et al. (2022) provides a review of the nexus of riparian areas and biodiversity, ecological function of riparian areas, threats and conservation challenges, and conservation efforts, including an examination of the fixed buffer width approach to protection. They write, “The synergism of intermediate flood-induced disturbances, moist microclimates, constant nutrient influx, high productivity, and resource heterogeneity make riparian zones disproportionately rich in biodiversity” (Graziano et al. 2022). The protection of riparian habitat is a fundamental requirement for the conservation of biodiversity.

Seavy et al. (2009) succinctly summarize the importance of riparian area corridors to climate adaptation: “Riparian ecosystems are naturally resilient, provide linear habitat connectivity, link aquatic and terrestrial ecosystems, and create thermal refugia for wildlife: all characteristics that can contribute to ecological adaptation to climate change.” Additionally, “they span climatic gradients and have cool, moist microclimates relative to surrounding areas” (Krosby et al. 2018). A riparian climate-corridor index developed by Krosby et al. (2018) to quantify the degree to which riparian areas may promote species range shifts and provide climate refugia reached conclusions highly relevant to King County: “high-value riparian climate-corridors are least protected in flat, lowland areas, suggesting that such corridors should be high priorities for future conservation effort.”

Because of their linear nature and the level of protection already afforded them to varying degrees via regulations, the inclusion of riparian corridors into a connectivity network makes logical sense. For their “no regrets” approach to corridor mapping, Schloss et al. (2022) did not explicitly model movement from, to, or along riparian corridors, but the climate linkages they identified still tended to follow riparian valleys. Fremier et al. (2015) explored the use of riverine corridors as a potential contributor to a more resilient network of protected areas. They argue that scientific evidence supports the conservation value of a riparian connectivity network to help mitigate the impacts of climate change and upland habitat fragmentation. They also argue that conservation is better served if riparian connectivity is part of a larger landscape connectivity strategy.

6.1.2 Comprehensive Planning Considerations

Through Comprehensive Plan and Critical Areas Ordinance (CAO) updates as well as commitments to companion nonregulatory actions, the County seeks to simultaneously address the many GMA goals (see Section 1.1), some of which can be in conflict. This includes meeting state requirements to plan for and accommodate a range of housing types and affordability levels within the urban area, focusing new development in the urban area, recognizing property rights, and enhancing and supporting agriculture while ensuring no net loss of critical areas functions and values at an ecosystem scale (see Section 1.2). To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs to reduce risk of impacts to critical areas functions and values.

Codifying additional protections for specific habitats and species heightens environmental protections by limiting development in areas where species or habitats of primary association are present. Identifying SOLI or HOLI typically requires professional technical assistance. Depending on the circumstances and the species or habitats identified, protections may apply temporarily or indefinitely. Protecting HOLI and SOLI at the scale of individual properties or parcels is inherently challenging given the number of listed species and habitats, the technical assistance required to identify those species and habitats, and the migratory nature of wildlife.

WAC 365-190-130 Fish and Wildlife Habitat Conservation Areas

WAC 365-190-130 outlines requirements and guidance related to the management of FWHCA in the State of Washington. It emphasizes the importance of maintaining suitable habitats for species to support viable populations over the long term while acknowledging that it does not mean maintaining all individuals of all species at all times.

This WAC directs counties to consider classifying and protecting FWHCAs, including areas where endangered, threatened, and sensitive species have a primary association. Counties are also directed to consider protections for HOLI and SOLI, as determined locally. Counties must consult BAS and information provided by state and federal agencies as species and habitats are classified and designated.

In addition to classifying species and habitats, counties are instructed to consider creating interconnected systems of FWHCAs to offer further protections to wildlife and wildlife habitat at the landscape scale. These protections can be achieved through regulatory or nonregulatory approaches.

6.1.3 Regulatory Updates

Based on BAS review and comprehensive planning considerations, King County is updating SOLI and HOLI lists found in the King County Comprehensive Plan.

Table 6.2 identifies animal species that are newly included in the County's SOLI list (Comprehensive Plan policy E-435). Appendix A of this report includes a table with additional information about these species. Species with a state or federal listing status as well as candidate species were already protected by previous King County policy and code but have been included in the SOLI list to improve consistency and accessibility.

Table 6.2 Animals considered for inclusion in King County's Species of Local Importance (SOLI) list.

Common Name	Scientific Name	Federal Status	State Status	New SOLI in 2024
Birds				
Common Loon	*Gavia immer*	None	SS	Yes
Marbled Murrelet*	*Brachyramphus marmoratus*	FT	SE	Yes
Western Grebe	*Aechmophorus occidentalis*	None	SC	No
Black Scoter	*Melanitta nigra*	None	none	No
Surf Scoter	*Melanitta perspicillata*	None	none	No
White-winged Scoter	*Melanitta fusca*	None	none	No
Western High Arctic Brant	*Branta bernicla*	None	none	Yes
Harlequin Duck	*Histrionicus histrionicus*	None	none	No
Cinnamon Teal	*Anas cyanoptera*	None	none	No
Bufflehead	*Bucephala albeola*	None	none	Yes
Barrow's Goldeneye	*Bucephala islandica*	None	none	No
Common Goldeneye	*Bucephala clangula*	None	none	No
Wood Duck	*Aix sponsa*	None	none	No
Hooded merganser	*Lophodytes cucullatus*	None	none	No
Trumpeter Swan	*Cygnus buccinator*	None	none	No
Tundra Swan	*Cygnus columbianus*	None	none	No
Pelagic Cormorant	*Phalacrocorax pelagicus*	None	none	Yes
Pigeon Guillemot	*Cepphus columba*	None	none	Yes
Caspian Tern	*Hydroprogne caspia*	None	none	Yes
Waterfowl Concentrations (Anatidae excluding Canada Geese in urban areas)	Varies	NA	NA	Yes
Western Washington nonbreeding concentrations of plovers (Charadriidae) and sandpipers (Scolopacidae)	Varies	NA	NA	Yes
Northern Spotted Owl*	*Strix occidentalis*	FT	SE	Yes
Western Screech Owl	*Otus kennicotii macfarlanei*	None	none	Yes
Bald Eagle*	*Haliaeetus leucocephalus*	None	none	Yes
Golden Eagle	*Aquila chrysaetos*	None	SC	Yes
Osprey*	*Pandion haliaetus*	None	none	No

Common Name	Scientific Name	Federal Status	State Status	New SOLI in 2024
Northern Goshawk*	*Accipiter gentilis*	None	SC	Yes
Peregrine Falcon*	*Falco peregrinus*	None	none	Yes
American Bittern	*Botaurus lentiginosus*	None	none	No
Great Blue Heron*	*Ardea herodias*	None	none	No
Hairy Woodpecker	*Picoides villosus*	None	none	No
Pileated Woodpecker	*Dryocopus pileatus*	None	none	Yes
Black-Backed Woodpecker	*Picoides arcticus*	None	SC	Yes
American Three-toed Woodpecker	*Picoides tridactylus*	None	none	Yes
Belted Kingfisher	*Ceryle alcyon*	None	none	No
Pacific Coast Band-tailed Pigeon	*Columba fasciata*	None	none	No
Oregon Vesper Sparrow	*Pooecetes gramineus affinis*	Petitioned for listing	SE	Yes
Yellow-Billed Cuckoo	*Coccyzus americanus*	FT	SE	Yes
Vaux's Swift*	*Chaetura vauxi*	None	none	Yes
Western Meadowlark	*Sturnella neglecta*	None	none	No
Olive-sided Flycatcher	*Contopus cooperi*	None	none	No
Red-eyed Vireo	*Vireo olivaceus*	None	none	Yes
Purple Finch	*Carpodacus purpureus*	None	none	No
Purple Martin	*Progne subis*	None	none	Yes
Sooty grouse	*Dendragapus fuliginosus*	None	none	No
Fish				
Chinook Salmon (Puget Sound)	*Oncorhynchus tshawytscha*	FT	none	Yes
Steelhead (Puget Sound)	*Oncorhynchus mykiss*	FT	SC	Yes
Rainbow Trout	*Oncorhynchus mykiss*	None	none	No
Bull Trout	*Salvelinus confluentus*	FT	SC	Yes
Dolly Varden	*Salvelinus malma*	None	none	No
Chum Salmon	*Oncorhynchus keta*	None	none	No
Coastal Resident/Searun Cutthroat	*Oncorhynchus clarki clarki*	None	none	No
Coho/Silver Salmon	*Oncorhynchus kisutch*	None	none	No
Pink Salmon	*Oncorhynchus gorbuscha*	None	none	No
Sockeye/Red Salmon	*Onchorhynchus nerka*	None	none	No
Kokanee Salmon	*Onchorhynchus nerka*	None	none	No
Bocaccio Rockfish	*Sebastes paucispinis*	FE	none	Yes

Common Name	Scientific Name	Federal Status	State Status	New SOLI in 2024
Brown Rockfish	*Sebastes auriculatus*	None	none	Yes
Canary Rockfish	*Sebastes pinniger*	FT	none	Yes
Copper Rockfish	*Sebastes caurinus*	None	none	Yes
Quillback Rockfish	*Sebastes maliger*	None	none	Yes
Yelloweye Rockfish	*Sebastes ruberrimus*	FT	none	Yes
English Sole	*Parophrys vetulus*	None	none	No
Southern Rock Sole	*Pleuronectes bilineatus*	None	none	No
Pacific Cod	*Gadus macrocephalus*	None	none	Yes
Lingcod	*Ophiodon elongatus*	None	none	No
Pacific Herring	*Clupea pallasi*	None	none	No
Pacific Sand Lance	*Ammodytes hexapterus*	None	none	No
Surf Smelt	*Hypomesus pretiosus*	None	none	No
Longfin Smelt	*Spirinchus thaleichthys*	None	none	No
White Sturgeon	*Acipenser transmontanus*	None	none	No
Pacific Lamprey	*Entosphenus tridentatus*	None	none	No
Western River Lamprey	*Lampetra ayresii*	None	SC	Yes
Pygmy Whitefish	*Prosopium coulteri*	None	SS	Yes
Mammals				
Fisher	*Martes pennanti*	None	SE	Yes
Pacific Marten	*Martes caurina*	None	none	Yes
Gray Wolf	*Canis lupus*	FE	SE	Yes
Wolverine	*Gulo gulo*	FT	SC	Yes
Cascade Red Fox	*Vulpes vulpes cascadensis*	None	SE	Yes
Townsend's Big-Eared Bat*	*Corynorhinus townsendii*	None	SC	Yes
Myotis bats	*Myotis* spp.	None	none	Yes
Pallid Bat	*Antrozous pallidus*	None	none	Yes
Big Brown Bat (roosting concentrations)	*Eptesicus fuscus*	None	none	Yes
Douglas Squirrel	*Tamiasciurus douglasii*	None	none	Yes
Roosevelt Elk	*Cervus canadensis roosevelti*	None	none	No
Mountain Goat	*Oreamnos americanus*	None	none	No
Pika	*Ochotona princeps*	None	none	No
Northern Flying Squirrel	*Glaucomys sabrinus*	None	none	Yes

Common Name	Scientific Name	Federal Status	State Status	New SOLI in 2024
Hoary marmot	*Marmota caligata*	None	none	Yes
Townsend's Chipmunk	*Tamias townsendii*	None	none	Yes
Killer (Orca) Whale	*Orcinus orca*	FE	SE	Yes
Gray Whale	*Eschrichtius robustus*	FE	SS	Yes
Harbor Porpoise	*Phocoena phocoena*	None	SC	Yes
Dall's Porpoise	*Phocoenoides dalli*	None	none	Yes
Harbor Seal	*Phoca vitulina*	None	none	Yes
California sea lion (haul-outs)	*Zalophus californianus*	None	none	Yes
Steller Sea Lion	*Eumetopias jubatus*	None	none	Yes
Amphibians				
Larch Mountain Salamander	*Plethodon larselli*	None	SS	Yes
Oregon Spotted Frog	*Rana pretiosa*	FT	SE	Yes
Northern Red-legged Frog	*Rana aurora*	None	none	No
Western Toad	*Bufo boreas*	None	SC	Yes
Reptiles				
Northwestern Pond Turtle	*Actinemys marmorata*	Petitioned for listing	SE	Yes
Western fence Lizard	*Sceloporus occidentalis*	None	none	No
Invertebrates				
Western Pearlshell Mussel	*Margaritifera falcata*	None	none	No
Western Ridged Mussel	*Gonidea angulata*	None	none	No
Oregon Floater	*Anodonta oregonensis*	None	none	No
Blue-gray Taildropper	*Prophysaon coeruleum*	None	SC	Yes
Olympia Oyster	*Ostrea lurida*	None	none	Yes
Butter Clam	*Saxidomus giganteus*	None	none	Yes
Native Littleneck Clam	*Leukoma staminea*	None	none	Yes
Dungeness Crab	*Cancer magister*	None	none	No
Pandalid Shrimp	*Pandalus* species	None	none	No
Beller's Ground Beetle	*Agonum belleri*	None	SC	Yes
Hatch's Click Beetle	*Eanus hatchii*	None	SC	Yes
Pacific Clubtail	*Phanogomphus kurilis*	None	SC	Yes
Western Bumble Bee	*Bombus occidentalis*	Under review	SC	Yes

Common Name	Scientific Name	Federal Status	State Status	New SOLI in 2024
Johnson's Hairstreak	*Mitoura johnsoni*	None	SC	Yes
Valley Silverspot	*Speyeria zerene bremnerii*	None	SC	Yes

*Development regulations specified in K.C.C. 21A.24.382.

In addition to animal species, plant species in Table 6.3 are newly included in the County's SOLI list (Comprehensive Plan policy E-435). In alignment with WAC 365-190-130 (see Section 6.1.2), King County reviewed DNR's Natural Heritage Program Vascular Plant Species of Concern list (Fertig 2021) to inform these additions.

Table 6.3 Plants newly included in King County's Species of Local Importance (SOLI) list.

Common Name	Species	Federal Status	State Status	new SOLI in 2024
Alaska harebell	*Campanula lasiocarpa*	None	SS	Yes
Branched montia	*Montia diffusa*	None	SS	Yes
Brewer's cliffbrake	*Pellaea breweri*	None	SS	Yes
Choriso's bog-orchid	*Platanthera chorisiana*	None	SS	Yes
Clubmoss mountain-heather	*Cassiope lycopodioides*	None	SS	No
Columbia white-topped aster	*Sericocarpus rigidus*	None	SS	No
Few-flowered sedge	*Carex pauciflora*	None	SS	Yes
Flat-leaved bladderwort	*Utricularia intermedia*	None	SS	Yes
Golden paintbrush	*Castilleja levisecta*	Threatened (proposed for delisting)	ST	Yes
Harvest brodiaea	*Brodiaea rosea ssp. rosea*	None	SS	Yes
Kamchatka fritillary	*Fritillaria camschatcensis*	None	SS	Yes
Large St. Johns'-wort	*Hypericum majus*	None	SS	No
Long-styled sedge	*Carex stylosa*	None	SS	Yes
Northern bog clubmoss	*Lycopodiella inundata*	None	SS	Yes
Old field blue toadflax	*Nuttallanthus canadensis*	None	SS	Yes
One-cone clubmoss	*Lycopodium lagopus*	None	SS	Yes
Oregon goldenweed	*Heterotheca oregona*	None	SS	No
Pacific peavine	*Lathyrus vestitus var. ochropetalus*	None	SE	Yes
Spleenwort-leaved goldthread	*Coptis asplenifolia*	None	SS	Yes
Spotted Joe-pye weed	*Eutrochium maculatum var. bruneri*	None	SS	Yes
Stalked moonwort	*Botrychium pedunculosum*	None	ST	Yes

Common Name	Species	Federal Status	State Status	new SOLI in 2024
Swamp gentian	*Gentiana douglasiana*	None	SS	Yes
Tall bugbane	*Actaea elata var. elata*	None	SS	Yes
Tree clubmoss	*Dendrolycopodium dendroideum*	None	SS	Yes
Triangular-lobed moonwort	*Botrychium ascendens*	None	ST	Yes
Water lobelia	*Lobelia dortmanna*	None	SS	Yes
Weak thistle	*Cirsium remotifolium var. remotifolium*	None	SE	Yes
Western moonwort	*Botrychium hesperium*	None	SS	Yes
White meconella	*Meconella oregana*	None	SE	Yes
Whitebark pine	*Pinus albicaulis*	Proposed Threatened	SS	Yes

Based on review of the State of Washington's PHS list, the habitat types in Table 6.4 are included in the County's HOLI list (Comprehensive Plan policy E-437).

Table 6.4 Habitat types included in King County's Habitats of Local Importance (HOLI) list.

Habitat of Local Importance	New to list in 2024
Old-growth forest	No
Sphagnum-dominated peat bogs	No
Westside prairie	Yes
Oregon white oak woodlands	Yes
Herbaceous balds	Yes
Caves	No
Cliffs	No
Talus	No
Snag-rich areas	No

6.1.4 Risk Assessment of Regulatory Updates

King County protects wildlife by designating and protecting SOLI and HOLI, designating and protecting wildlife corridors, conserving land and habitat through nonregulatory programs, and by prioritizing development in the County's UGA. Wildlife and wildlife habitat in King County are also protected, in part, through development regulations and nonregulatory programs related to the management of wetlands and wetland buffers (see Section 4) and riparian areas (see Section 5).

This approach is informed by BAS and aligns with WAC 365-190-130, which states that FWHCA protections must maintain "populations of species in suitable habitats within

their natural geographic distribution so that the habitat available is sufficient to support viable populations over the long term and isolated subpopulations are not created… This does not mean maintaining all individuals of all species at all times, but it does mean not degrading or reducing populations or habitats so that they are no longer viable over the long term" (see Section 6.1.2).

King County is adding animal and plant species as SOLI in Comprehensive Plan policy E-435. In addition to expanding the list of SOLI, King County is adding three habitat types as HOLI in Comprehensive Plan policy E-437. These additions are informed by BAS and state guidance. Updating SOLI and HOLI lists aligns Comprehensive Plan policies with BAS and allows the County to better implement nonregulatory land conservation programs (see Section 6.1.5) that consider the full variety of locally important species and habitats.

6.1.5 Nonregulatory Programs

King County recognizes the importance of protecting critical areas through both regulatory and nonregulatory approaches. King County coordinates with communities and other partners to guide investment in nonregulatory programs that protect natural resources, including critical areas. Nonregulatory programs that offer protections to wildlife and wildlife habitat are discussed at a summary level below. Readers can learn more by visiting linked web pages.

Land Conservation in King County and Wildlife Habitat Climate Gradient Analysis

King County operates nonregulatory open space acquisition programs, such as the Land Conservation Initiative (LCI), using funding from King County's Conservation Futures program and other sources. The LCI is a regional collaboration between King County, cities, business associations, agricultural communities, environmental partners, and other groups aimed at preserving the County's last, most important natural lands and urban green spaces over the next 30 years. King County has mapped and prioritized 65,000 acres of land for protection in six categories: urban green space, trails, natural lands, rivers, farmlands, and forestlands. In particular, adding land and removing infrastructure from upland and riparian natural lands and river corridors helps to create and maintain habitat corridors of ecologically intact land where natural processes can unfold.

To inform conservation efforts moving forward, if grant funding can be secured, King County plans to conduct a climate gradient analysis for wildlife habitat in the County. This mapping exercise would build upon state-led analysis and use climate-informed wildlife migration models and updated stream and wetland mapping resources (see Section 3.2.5) to identify and map areas and corridors critical to the protection of local wildlife biodiversity as the climate changes over time. Completing this mapping using climate-informed models will help King County, local jurisdictions, and community members understand the relative habitat value of different habitat areas and wildlife corridors in the County. The outcomes of this analysis will inform King County's efforts

to protect critical wildlife biodiversity areas and corridors and preserve connectivity through land conservation efforts.

Additionally, policies in the 2024 Comprehensive Plan direct the County to identify and implement recommended strategies to establish and protect corridors of forest with old-growth characteristics, particularly in upper watershed areas and along major river corridors in support of habitat for salmon and other wildlife. Establishing such corridors would likely occur, in part, through future LCI acquisitions.

This nonregulatory program will improve outcomes for wildlife and wildlife habitat, advancing King County's progress in satisfying GMA goals for urban growth, reducing sprawl, environmental protection, shoreline management, climate resiliency, open space and recreation, natural resource industries, public facilities and services, and community coordination.

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7 Critical Aquifer Recharge Areas (CARA)

Critical aquifer recharge areas (CARA) are the geographic areas that have a "critical recharging effect on aquifers used for potable water" (RCW 36.70A.030). King County is reviewing and updating its Comprehensive Plan policies and associated development regulations in the King County Code (K.C.C.) for the protection of CARAs, which were first enacted in 1994 (King County 2004a). Protecting groundwater is an important regional issue because groundwater provides approximately 30 percent of the water used in King County and is the primary source of water in unincorporated King County (UKC) outside of the Urban Growth Area (UGA). On Vashon-Maury Island and in other sole-source aquifer areas, it is the only source of drinking water (King County 2016).

Many land use activities can potentially affect the quality or quantity of groundwater recharge. All groundwater is vulnerable, but some areas where strategic public groundwater resources are located are more vulnerable than other areas (Ecology 2005). Any potential land use activity that stores, uses, or produces known contaminants of concern (constituents found to be a risk to human health and capable of groundwater transport) and has a sufficient likelihood of releasing such contaminants to the environment at detrimental levels is considered a threat. Any land use that can reduce the quantity of recharge to the aquifer to a significant degree is also considered to be a threat. If these activities occur above aquifer recharge areas critical to groundwater quality and quantity, it is prudent to implement groundwater protection measures in those areas to protect the groundwater resources of the County (King County 2004b).

Mapping CARA provides the general framework for groundwater quality and quantity protection policy. CARA identification methods have evolved substantially in the resource management and land use planning literature since the 1980s. The most recent advancement in prioritizing aquifer recharge areas requires two major tasks. The first task is to map the aquifer susceptibility and the second task is to map the areas where the value of the groundwater resource is high. The most common areas mapped for this second step are water supply protection areas (commonly called wellhead protection areas and sole-source aquifers). The final overlay of these two maps delineates CARA (King County 2004a).

Climate change has the potential to impact future groundwater availability. Warmer temperatures in the Pacific Northwest are projected to lead to greater demand for water in the summer and fall, while reduced snowpack and associated stream flows could reduce seasonal groundwater recharge. Understanding the potential effects of climate variability and change on groundwater is more complex than with surface water (Holman 2006). Groundwater residence times can range from days to hundreds of years or more, which delays and disperses the effects of climate and challenges efforts to detect responses in the groundwater to climate variability and change (Gurdak 2009). Climate variability affects subsurface water resources both directly by altering surface water flux and indirectly via changes in groundwater extraction patterns (Gupta 2021). Assessment of climate change effects on groundwater recharge and water supplies is

needed to understand and mitigate for potential impacts. King County has ongoing monitoring of groundwater resources to assess changes in groundwater resources.

This section discusses CARA regulations in King County and associated Growth Management Act (GMA) CARA classification requirements. Relevant best available science (BAS) and comprehensive planning considerations are discussed along with updates to the K.C.C.

7.1 CARA Classification

King County's Comprehensive Plan has a *Groundwater Resources* section in the Environment chapter. These policies (E-493 – E-498) are important components of the County's responsibility to protect groundwater resources.

King County defines CARA as areas of recharge potential (susceptibility) and areas of critical importance for potability (wellhead protection areas and sole-source areas), which are classified into three categories (K.C.C. 21A.24.313):

- Category I CARA are mapped areas that are designated as highly susceptible to groundwater contamination and are located within a sole-source aquifer or a wellhead protection area.
- Category II CARA are mapped areas that are designated as having medium susceptibility to ground water contamination and are located within a sole-source aquifer or a wellhead protection area.
- Category III CARA are mapped areas that are designated as having low susceptibility to groundwater contamination and are located over an aquifer underlying an island that is surrounded by salt water.

The County also classifies areas of high recharge potential (without wellhead protection or sole-sources areas) as equally important to protect for effects on streams, lakes, and wetlands that provide critical fish and wildlife habitat. These areas are also classified as Category II CARA.

King County codified an additional method for determining Category I CARA for protecting drinking water sources in 2008. This Category I CARA is defined as an area where hydrogeologic mapping or a numerical flow transport model in a Washington Department of Health-approved wellhead protection plan demonstrate that the area is within the 1-year time of travel to a wellhead for a Group A water system independent of the mapped susceptibility.

7.1.1 BAS Review

Various methods of vulnerability assessment of groundwater have been developed using different approaches. The following methods, GOD, AVI, DRASTIC, SINTACS, and SI, have a variety of parameters that are based on overlay and indexing

techniques, depending on the type of aquifer, the type of pollutant, and the availability of data (Maria 2018):

- DRASTIC considers seven parameters: depth to water (D), net recharge (R), aquifer media (A), soil media (S), topography (T), impact of the vadose zone (I), and hydraulic conductivity (C).
- SINTACS involves seven parameters: static level depth (S), net recharge (I), nonsaturated zone (N), soil type (T), aquifer type (A), hydraulic conductivity (C), and topographic slope (S).
- AVI bases groundwater vulnerability on two physical parameters: 1) thickness (d) of each sedimentary layer above the uppermost, saturated aquifer surface, and 2) estimated hydraulic conductivity (K) of each of these sedimentary layers.
- GOD utilizes three main parameters: the groundwater occurrence, the lithology of the overlying layers, and the depth to groundwater.
- SI involves five layers: Depth to water, net recharge, aquifer media, topography, and land use (LU).

Current literature review reveals that subsets or variations of the parameters of the DRASTIC methodology are commonly used for defining areas of aquifer susceptibility and vulnerability. DRASTIC is one of the most widely known and used methods for the assessment of aquifer vulnerability (Fannakh 2022).

Each of these methodologies has advantages and limitations in assessing vulnerability. A sensitivity analysis of DRASTIC suggests that depth to water table (D) is the key factor determining vulnerability, followed by impact to the vadose zone (I) and soil type (S) (Maria 2018). King County's current susceptibility mapping uses parameters D, S, and I of the DRASTIC method. CARA classification methodology is detailed in King County 2004a and 2004b. No changes to the County's methodology for delineating CARA were proposed based on the recent literature review of aquifer susceptibility and vulnerability. With no changes in the methodology, no update to the existing CARA map was necessary as part of the BAS review.

King County reviewed existing guidance documents from Ecology and Commerce. The guidelines from Ecology help jurisdictions designate CARA (Ecology 2005; update 2021). King County's existing methodology of delineating CARA follows the state guidance from Ecology. The Critical Areas Handbook from Washington Department of Commerce (Commerce 2023) provides guidance and resources for drafting critical areas ordinances including CARA. King County designates CARA based on important considerations outlined in the Handbook. The Handbook references Washington Administrative Code (WAC) 365-190-100, which states:

> "Counties and cities must classify recharge areas for aquifers according to the aquifer vulnerability."

As noted in Section 7.1.3, King County will be updating the CARA classifications to include aquifer vulnerability designations.

7.1.2 Comprehensive Planning Considerations

Through the update of the Comprehensive Plan and Critical Areas Ordinance (CAO) as well as commitments to companion nonregulatory actions, the County seeks to simultaneously address the many GMA goals (see Section 1.1), some of which can be in conflict. This includes meeting state requirements to plan and accommodate a range of housing types and affordability levels within the urban area, focusing new development in the urban area, recognizing property rights, and enhancing and supporting agriculture while ensuring no net loss of critical areas functions and values at an ecosystem scale (see Section 1.2). To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs to reduce risk of impacts to critical areas functions and values.

CARA Mapping

King County updates its Comprehensive Plan and development regulations every 10 years as required by the GMA. Environment policy E-445 states in part, “The county shall periodically update [the CARA] map with new information from adopted groundwater and wellhead protection studies and other relevant sources.” King County plans to update its CARA map before the next 10-year Comprehensive Plan update in 2034. The King County Council last adopted the CARA map in 2012 (K.C.C. 21A.24.311).

State Agency Guidance

King County values preserving aquifer functions and values for providing drinking water, reflected in current code and policy. Ecology’s CARA guidance document (2021 update) includes identifying the following as important steps to protect groundwater resources:

- Where drinking water aquifers are located
- What the underground characteristics are that transmit recharge and any associated contaminants, to the extent that is practical and available
- Where groundwater is currently used for drinking water
- Where groundwater will be needed for drinking water in the future
- What contamination threats to drinking water already exist
- What measures need to be in place to protect recharge availability
- What measures need to be in place to prevent contamination of recharge
- For special consideration for anadromous fisheries, how surface water depends on groundwater

7.1.3 Regulatory Updates

King County will be making future updates to the K.C.C. to clarify that CARA is classified according to aquifer vulnerability and these areas will be mapped at a later date.

The Commerce Critical Areas Handbook (2023) outlines high and low vulnerability. King County is planning to update the existing CARA categories I and II (see Section 7.1) as "high vulnerability areas" due to their potential impact on drinking water sources if degraded by contamination and hydrogeologic conditions that facilitate degradation. King County will be adding "medium vulnerability areas" to the existing CARA category III. This special area refers only to Vashon-Maury Island as an island surrounded by salt water. The potential impact on drinking water, if degraded by contamination, is due to the sole-source nature of the Island's drinking water. The lower hydrogeologic susceptibility infers a lower and slower pathway of degradation, but the physical nature of being an island surrounded by saltwater means the impact would be greater. At this time, King County will not be mapping "low vulnerability areas" that have a lower risk of impact from contaminants that will degrade groundwater and by hydrogeologic conditions that do not facilitate degradation.

King County will be adding relevant definitions within the K.C.C. updates to improve clarity include references to other relevant K.C.C. sections, including K.C.C. 21A.24.314.

7.1.4 Risk Assessment of Regulatory Updates

As King County updates its development regulations in the K.C.C., it seeks to simultaneously address the many GMA goals (see Section 1.1), some of which can be in conflict. King County's approach to managing risks to critical areas functions and values is discussed in Section 3.2.

CARA Classification

King County's BAS review for CARA was informed by Washington State guidance (see Section 2.1) and included review of published resources and peer-reviewed literature. Findings from the BAS review process continue to support King County's methodology for delineating CARA. The development standards and the classification methodology are not changing with these updates. Because there was no change in the methodology, the CARA map is not being updated as part of the BAS process (see Section 7.1.2, CARA Mapping).

King County will be making minor changes to the K.C.C. to clarify that CARA is classified according to aquifer vulnerability as required by the state. Updates to the K.C.C. are not expected to meaningfully change critical areas protections for CARA or effect County permit processing. Updates clarify that CARA will be classified according to aquifer vulnerability, bringing the K.C.C. up to date with state requirements. The BAS review continues to support the County's methodology for delineating CARA.

7.1.5 Nonregulatory Programs

King County recognizes the importance of protecting critical areas through both regulatory measures and nonregulatory programs. King County coordinates with communities and other partners to guide investment in nonregulatory programs that protect natural resources, including critical areas. Nonregulatory programs that augment protections for CARAs are discussed at a summary level below.

King County Groundwater Monitoring and Community Engagement

King County has ongoing monitoring of groundwater resources in critical areas that provide understanding of functions and values of County aquifers. In addition to groundwater resource protections in K.C.C. Chapter 21A.24, groundwater resources are protected by K.C.C. Chapters 9.04 (Stormwater Runoff and Surface Water and Erosion Control), 9.12 (Water Quality), and 9.14 (Groundwater Protection).

Since 2001, King County has monitored groundwater resources in critical areas, providing understanding of functions and values of this ecosystem. Monitoring provides a long-term data set for assessing functions and values of County aquifers as well as assessing the effects of climate change on groundwater resources.

King County also utilizes education and outreach to enhance groundwater protection. An ongoing example of this effort is the County partnership with the Vashon-Maury Island Groundwater Protection Committee to assist residents with being good stewards of their island aquifer system.

Public Benefit Rating System

The County's Public Benefit Rating System (PBRS) (see Section 3.3) is a voluntary incentive program that provides property tax reductions for participating landowners who choose to leave open spaces in a natural condition. Groundwater recharge areas are one type of open space resource that can be protected through enrollment in the program. Enrollment of land in PBRS results in avoidance of impacts to groundwater recharge areas, protecting critical areas functions and values and limiting the likelihood of future impacts.

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8 Frequently Flooded Areas

Flooding can damage infrastructure, homes, and businesses. At the same time, flooding and floodplains contribute to the functioning and integrity of many critical areas. Fish and wildlife depend on the habitat created when a river is allowed to migrate and overflow its banks. Floodplains themselves provide critical salmon habitat, and floodplain processes help to create and maintain complex habitat that salmon rely on through different life stages. For example, floodplains and related off-channel habitats (e.g., side channels, backwaters, ponds) provide areas of slower-moving water and abundant food resources, which provide opportunities for salmonid rearing and high growth as well as refuge during flood events. Groundwater connections and hyporheic exchange between floodplains, wetlands, and other aquatic areas can help to keep water temperatures cool through recharge (Figure 2.1). King County's policies, the 2024 Flood Management Plan, and regulations are intended to both reduce risk to infrastructure, people, and property while protecting the habitat and water quality functions and values of floodplains.

King County updated the King County Code (K.C.C.) in 2020 to comply with regulatory guidance and standards from the Federal Emergency Management Agency (FEMA) and the Department of Ecology (Ecology). King County participates in the National Flood Insurance Program (NFIP) and is subject to compliance with the FEMA Biological Opinion (BiOp) for Puget Sound. The current Critical Areas Ordinance (CAO) update includes very limited technical updates to clarify the relationship between the 2024 Flood Management Plan and the County's Shoreline Master Program.

The 2024 Flood Management Plan emphasizes planning and implementing multi-benefit flood risk reduction projects. The Plan also affirms the County's commitment to exceeding National Flood Insurance Program requirements. King County has scoped and secured grant funding to support a stand-alone update to the County's codes regulating development in frequently flooded areas. That work will occur in 2026 and 2027. This BAS review for frequently flooded areas is focused on identifying revisions to the CAO to accelerate project delivery, streamline regulatory review, reduce costs, and improve the effectiveness of habitat restoration and fish passage projects. These identified revisions are intended to better support vital salmon recovery projects and to advance the County's goals of providing special consideration to anadromous fisheries, reconnecting functioning floodplains and removing barriers to fish passage while maintaining compliance with the BiOp provisions, FEMA NFIP standards, Ecology floodplain management requirements, and local regulatory standards.

King County's floodplain regulations, which exceed NFIP minimum standards, provide enhanced protection from flooding for people and property, especially through compensatory storage and zero-rise floodway provisions. These measures also reduce development impacts that would lead to loss of floodplain functions that support salmon habitat. However, the County's strict development limits in flood hazard areas have unintentionally hindered salmon recovery projects, such as floodplain reconnection and fish passage projects. Salmon habitat restoration and fish passage projects are

important nonregulatory actions that are part of the County's strategy for ensuring no net loss of critical areas functions and values, making special consideration for anadromous fisheries and for advancing commitments for salmon recovery.

Concurrent with the initial BAS review conducted in 2023 and 2024, King County updated its Flood Management Plan. The adopted 2024 King County Flood Management Plan describes in detail County policies affecting frequently flooded areas. As part of developing this plan, King County reviewed Ecology's *Comprehensive Flood Hazard Management Planning: A Guidebook*, which promotes integrated floodplain management, non-structural alternatives, and ecological restoration (Ecology 2021). King County also reviewed Watershed Resource Inventory Area (WRIA) salmon recovery plan floodplain habitat and connectivity findings and goals (WRIA 8 Salmon Recovery Council 2017; WRIA 9 2021; Snohomish Basin Salmon Recovery Forum 2005), climate change data for projected changes in river flows and sea level rise (Lee et al. 2018; Mauger et al. 2015; Mauger and Won 2020; Miller et al. 2018), and academic research on the functions and values of floodplains (Booth et al. 2003; Collins and Sheikh 2005; Gendaszek et al. 2012; King County 2018; King County 2019, 2022).

According to WAC 365-190-110, frequently flooded areas "perform important hydrologic functions and may present a risk to persons and property." The WAC specifies that areas classified as frequently flooded areas should include the designated 100-year FEMA floodplain (also referred to as the 1 percent-annual-chance floodplain), at a minimum.

The FEMA-designated floodplain is specified on Flood Insurance Rate Maps (FIRM). King County's floodplain development regulations and FIRMs were first adopted and enacted in 1978 when the County officially joined FEMA's NFIP. King County's frequently flooded or flood hazard area regulations for unincorporated areas are in King County's CAO, which is codified in K.C.C. Chapter 21A.24. The County's flood code was most recently updated in 2020. King County's flood-related land use regulations describe the types of activities that are allowed in flood hazard areas, channel migration zones, coastal high-hazard areas, and sea level rise risk areas.

Allowable uses and standards under King County's regulations vary by location within the flood hazard area, but all standards are intended to reduce safety risks to people, infrastructure, property, and to promote salmon recovery. King County has adopted several regulations that exceed the minimum NFIP standards and effectively reduce future flood losses. Additionally, in July 2020, King County adopted a Sea Level Rise Risk Area and associated changes to local land use codes for Vashon-Maury Island to reduce the risks of sea level rise on new shoreline development.

Frequently flooded areas and climate change are inextricably linked. The Pacific Northwest is expected to see changes in weather patterns that will make flooding more frequent and severe in winter, and water temperatures higher and stream flows lower in summer. Sea level rise is already occurring, and the rate of change is forecast to increase, with impacts in terms of both risk to homes, businesses, and infrastructure as well as critical salmon habitat and habitat forming processes on our coastal shorelines.

8.1 BAS Review

As noted above, King County has scoped and secured grant funding to support a stand-alone update to the County's codes regulating development in frequently flooded areas. This work will occur in 2026 and 2027. The current BAS review for frequently flooded areas is focused on identifying revisions to the CAO to accelerate project delivery, streamline regulatory review, reduce costs, and improve the effectiveness of habitat restoration and fish passage projects. These identified revisions are intended to better support vital salmon recovery projects and to advance the County's goals of providing special consideration to anadromous fisheries, reconnecting functioning floodplain, and removing barriers to fish passage while maintaining compliance with the BiOp provisions, FEMA NFIP standards, Ecology floodplain management requirements, and local regulatory standards. King County reviewed Commerce BAS guidance documents, the FEMA BiOp checklist, and Ecology guidance for flood hazard management planning and integrated floodplain management.

Concurrently with BAS review and development of this report, King County updated its Flood Management Plan. The 2024 King County Flood Management Plan describes in detail County policies affecting frequently flooded areas. As part of developing this update, King County reviewed 2021 state guidance for comprehensive flood hazard management planning, which promotes integrated floodplain management, nonstructural alternatives, and ecological restoration. King County also reviewed WRIA salmon recovery plan floodplain habitat and connectivity findings and goals, climate change data for projected changes in river flows, and academic research on the functions and values of floodplains, sediment dynamics, and the role and function of large wood on aquatic habitats. These resources informed the development of the goals, objectives, guiding principles, and policies in the 2024 Flood Management Plan as well as the BAS review for frequently flooded areas focused on strengthening support for salmon recovery projects.

8.2 Comprehensive Planning Considerations

As King County updates its Comprehensive Plan policies and associated development regulations found in the K.C.C., it seeks to simultaneously address GMA goals (see Section 1.1), King County Comprehensive Plan policies (see Section 3.1.1.), and state requirements for ensuring no net loss of ecosystem functions and values (see Section 1.3). To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs to reduce risk of impacts to critical areas functions and values.

King County's Comprehensive Plan Environment and Shorelines chapters include high-level policies guiding land use and floodplain management activities in flood hazard areas. These policies direct that the County implement a comprehensive floodplain management program consistent with the King County Flood Management Plan or its successor that minimizes damages and preserves and restores natural floodplain

functions. The Comprehensive Plan notes that “provisions implementing [frequently flooded area] policies are included in the critical areas regulations.”

Updates in the 2024 Comprehensive Plan add direction for integrated approaches to floodplain management that provide multiple benefits, strengthen climate change resilience, and support front-line communities. Policies also call for the County to continue to exceed minimum standards of NFIP and to carry out policies, including guidance for land use and floodplain management activities in accordance with King County’s Flood Hazard Management Plan or successor plan. The Shoreline Management Chapter includes policies that call for protection of frequently flooded areas and channel migration areas within shoreline jurisdiction, with implementing codes found in critical areas regulations. Policies direct continued mapping of channel migration zones.

The 2024 King County Flood Management Plan, adopted as a functional plan of the King County Comprehensive Plan, provides stronger policy and programmatic support for integrated floodplain management, multi-benefit flood risk reduction (including salmon recovery benefits), incorporation of climate change considerations into decision-making, and ensuring equitable access to flood risk reduction services and benefits. It includes policies that call for preserving and enhancing the natural functions of flood hazard areas, evaluating opportunities to relocate existing flood protection facilities farther from the water’s edge to accommodate increased buffers, and implementing multi-benefit flood risk reduction projects that will protect and restore fish and wildlife habitat. The plan’s guiding principles, which are intended to help provide direction to the County’s work, reference actively seeking opportunities to achieve net ecological gain in addressing flooding and channel migration.

The Washington State Shoreline Management Act (SMA) requires local governments to identify and limit development within channel migration zones in Shorelines of the State, a jurisdictional area defined as those streams with a mean annual flow equal to or greater than 20 cubic feet per second (termed SMA streams). Specifically, the WAC states, “Applicable shoreline master programs should include provisions to limit development and shoreline modifications that would result in interference with the process of channel migration that may cause significant adverse impacts to property or public improvements and/or result in a net loss of ecological functions associated with the rivers and streams” (WAC 173-26-221 (2)(iv)(B). See Section 5.2 for a detailed description of additional state requirements for designation of channel migration zones, King County’s approach to mapping and regulating channel migration hazard areas, BAS review, and how riparian area widths are measured in areas with mapped channel migration hazard areas.

8.3 Regulatory Updates

The current CAO update includes very limited technical updates to clarify the relationship between the adopted 2024 Flood Management Plan and the County’s Shoreline Master Program.

King County has scoped and secured grant funding to support a stand-alone update to the County's codes regulating development in frequently flooded areas, which will occur in 2026 and 2027.The current BAS review for frequently flooded areas is focused on identifying revisions to the CAO to accelerate project delivery, streamline regulatory review, reduce costs, and improve the effectiveness of habitat restoration and fish passage projects.

The potential additional regulatory updates identified in this BAS review are focused on identifying regulatory updates to better support salmon recovery projects, including floodplain reconnection and fish passage projects, which are an essential part of King County's efforts to protect and restore the functions and values of frequently flooded areas that support salmonids at different life stages. These identified revisions are intended to better support vital salmon recovery projects and to advance the County's goals of providing special consideration to anadromous fisheries, reconnecting functioning floodplain, and removing barriers to fish passage while maintaining compliance with the BiOp provisions, FEMA NFIP standards, Ecology floodplain management requirements, and local regulatory standards.

The County's long-standing regulations for frequently flooded areas (including "zero rise floodway" regulations that effectively apply to the entire 100-year floodplain) are intended to prevent new residential and commercial development that would negatively impact floodplain functions and habitat values or be at risk of damage during flood events. However, these regulations have also unintentionally created barriers to salmon recovery projects aimed at restoring degraded habitat, including floodplain reconnection and fish-passage projects that restore critical habitat and habitat-forming processes for salmonids protected by the Endangered Species Act (ESA). Salmon recovery projects, which often involve removal of channel constrictions or reconnection of historical habitat, almost by definition impact water surface elevation. Absolute no-rise standards can limit the extent of restoration of historical functions and values and are not well suited in application to projects that are intended to restore dynamic habitat forming processes.

To address this, this BAS review supports updating the K.C.C. for frequently flooded areas with the following goals:

- Clearly define salmon recovery projects
- Establish conditions under which salmon recovery projects may cause a rise in water surface elevations
- Identify requirements for flood impacts analysis and notification

To ensure that regulations continue to give special consideration to anadromous salmonids (GMA requirement) and meet the intent of the FEMA BiOp to prevent harm to ESA-listed salmon, a salmon recovery project could be defined as a project whose primary purpose is to promote recovery of salmonids and associated habitats by restoring riparian areas, degraded fish habitat, fish passage, or the physical, chemical,

or biological processes that create and sustain fish habitat. The regulations could require that salmon recovery projects meet at least one of the following criteria:

1. Qualify for streamlined hydraulic project approval from Washington Department of Fish and Wildlife due to restoration or enhancement of fish habitat.
2. Qualify for nationwide or regional Clean Water Act Section 404 permitting from the U.S. Army Corps of Engineers for fish passage, aquatic habitat restoration, enhancement, or establishment.
3. Qualify for streamlined ESA consultation using Limit 8 or a National Marine Fisheries Service or U.S. Fish and Wildlife Service programmatic consultation for fish passage and habitat restoration actions.
4. Be funded, in whole or in part, by the King County mitigation reserve program.
5. Be identified in the Puget Sound salmon recovery plan or the Four-Year Work Plan of a Water Resource Inventory Area that has been approved by the Puget Sound Partnership.

8.4 Risk Assessment of Regulatory Updates

King County's existing CAO underwent a FEMA BiOp compliance review, including the completion of a BiOp checklist, in 2010 and the submission of a Programmatic Habitat Assessment in 2012. The County received a BiOp approval letter in July 2012.

Current proposed updates to flood codes are technical in nature and clarify the relationship between the 2024 Flood Management Plan and the County's Shoreline Master Program. They do not have a substantive impact on salmon or salmon habitat.

The additional identified code updates, which will inform the comprehensive update to County regulations for frequently flooded areas planned for 2026 and 2027, emphasize supporting salmon recovery projects, particularly floodplain reconnection and fish-passage projects. These updates are designed to facilitate and accelerate the permitting process for salmon recovery projects that restore historical spawning and rearing habitats, habitat-forming processes, or access to those habitats.

By clearly defining which salmon recovery projects qualify for conditional approval of changes in water surface elevation, including tying the definition to existing federal and state regulatory streamlining and salmon recovery programming, these amendments would simplify the process for salmon recovery and fish passage projects. This would result in faster, more predictable outcomes for restoration efforts, ultimately improving the ecological functions and values of frequently flooded and riparian areas with special consideration for the needs of anadromous salmon. By facilitating clearly defined salmon recovery projects, these updates should create gains in the habitat functions and values of frequently flooded areas and reduce risks to anadromous salmon.

8.5 Nonregulatory Programs

King County recognizes the importance of protecting critical areas through both regulatory measures and nonregulatory programs. King County coordinates with communities and other partners to guide investment in nonregulatory programs that protect natural resources, including critical areas. Nonregulatory programs that offer protections to frequently flooded areas functions and values are discussed at a summary level below.

8.5.1 Acquisition of Homes in Flood Hazard Areas

King County initiated an acquisition program in the early 1990s following a Presidentially declared disaster and the establishment of federal programs to provide grant funding for home buyouts. As part of the 1993 Flood Hazard Management Plan, the County began to identify areas of high hazard (deep and fast-flowing water) and repetitive flood damage, where acquisition could eliminate future risks to life and property. In the intervening decades, the County has completed acquisitions of repetitively flooded areas, including along the Cedar, White, Snoqualmie, Tolt, and Raging rivers. From 2013 to 2023, King County acquired 1,984 acres in mapped 1 percent-annual-chance floodplains and an additional 83.5 acres in 0.2 percent-annual-chance floodplains. Acquisition in these flood-prone areas permanently addresses the hazard, protects functions and values of frequently flooded areas, and increasingly has provided opportunities to remove or set back roads and levees, which provides opportunities to increase flood and sediment storage and conveyance and to restore salmon habitat.

8.5.2 Flood Mapping

Flood hazard area maps are tools to inform the public of potential flood hazards and form the basis for land use regulations focused on reducing existing risks and preventing future risks. King County continues to emphasize regularly updating flood hazard data and mapping for the County's major rivers and some tributaries. Maps are also being developed for other tributaries as resources become available, with much of this work currently funded by the King County Flood Control District. In addition to riverine flood maps, King County also updates mapping for coastal high-hazard areas and sea level rise risk areas, subject to funding (e.g., grant funding).

FEMA reviews the County's flood studies and hazard maps and produces the effective FIRMs. These effective FIRMs represent the official implementation of flood hazard mapping. Once finalized, King County and local jurisdictions adopt the effective FIRMs and use them for regulatory purposes, such as zoning, permitting, and floodplain management. While FIRMs help determine flood insurance rates and Flood Insurance Study (FIS) requirements under NFIP, other factors also influence rates, including how effectively the County implements its Flood Risk Reduction (FRR) programs. FIRMs are also made available on King County's website on the interactive King County iMap online mapping tool, and at King County libraries in hard copy.

8.5.3 Channel Migration Zone Mapping

As noted earlier in this document, the County currently strives to remap channel migration zones approximately every 20 years. In 2014, King County amended its critical areas code (K.C.C. Chapter 21A-24) to establish criteria for the designation, classification, and mapping of moderate and severe channel migration hazard areas (CMHA) within the CMZ. Updates to these maps inform community members and King County permitting staff of safety risks as well as where flood and channel migration regulations may apply to a given property. In turn, these updated maps improve King County's ability to effectively implement and enforce development regulations that work in conjunction with flood hazard mapping and regulation to protect frequently flooded areas, particularly in areas where the river channel is prone to migration over time. They also support King County's ability to issue development permits in a fair and timely manner.

The County's CMZ mapping focuses on larger tributaries in developed areas where channel migration both creates hazards to people and property and supports formation of complex habitat. King County has mapped CMZs for priority reaches of the Greenwater, Green, White, Tolt, Raging, South Fork Skykomish, Upper Snoqualmie (above Snoqualmie Falls), and Cedar rivers. Mapping was completed in 2024 for the Lower Snoqualmie River and initiated for Issaquah Creek. Code updates related to the application of riparian area widths in areas with mapped CMHAs are described in Section 5.2.

King County mapping resources are available online through King County's interactive mapping tool, King County iMap. This nonregulatory investment improves outcomes for species and critical areas, advancing King County's progress in satisfying GMA goals for safety, environmental protection, shoreline management, climate resiliency, community coordination, and permitting.

8.5.4 Floodplain Reconnection Projects

The historical construction of roads, flood control levees, and revetments in frequently flooded areas has, in many instances, cut off the connection of rivers and their natural floodplains, reducing the functions and values of floodplains to store and slowly release floodwater, provide refuge and rearing habitat for salmonids, deposit sediment that forms agricultural soils, and support groundwater recharge. The County has set a goal through the Clean Water Healthy Habitat Strategic Plan of reconnecting 3,000 acres of floodplain over 30 years. Since 2020, the County has completed four major multi-benefit flood risk reduction projects that reconnect more than 250 acres of floodplain.

8.5.5 Land Conservation in King County

King County operates nonregulatory open space acquisition programs, such as the Land Conservation Initiative (LCI), using funding from King County's Conservation Futures grant program and other sources. The LCI is a regional collaboration between

King County, cities, business associations, agricultural communities, environmental partners, and other groups aimed at preserving the County's last, most important natural lands and urban green spaces over the next 30 years. King County has mapped and prioritized 65,000 acres of land for protection in six categories, including urban green space, trails, natural lands, rivers, farmlands, and forestlands.

By conserving land in the rivers and natural lands categories, the County augments the role of development regulations in preventing new development in floodplains and secures lands that can be used for large-scale floodplain reconnection projects. Purchase of development rights that protect farmland, often located in frequently flooded areas, helps to support permanent, low-density land use in frequently flooded areas.

While not every parcel of land protected under LCI has critical areas, permanent protection of ecological functions and values is often a key reason for seeking permanent protection. For example, of the more than 850 parcels protected under LCI since 2016, more than 65 percent have some portion of the parcel within 200 feet of a river or stream.

8.5.6 Habitat Restoration

Since the 1999 federal Endangered Species Act listings of Chinook salmon and bull trout, King County has supported the development and implementation of federally approved watershed-based salmon conservation plans in each of its major watersheds. Over the last 25 years, King County and salmon recovery partners—such as cities, Tribes, and nongovernmental organizations—have implemented a significant number of salmon habitat restoration projects called for in these plans. These plans recommend long-term salmon habitat restoration efforts, such as floodplain restoration, riparian restoration, fish passage barrier removals, and wetland restoration along salmon-bearing streams and rivers. To date, hundreds of acres of river floodplains have been reconnected through the removal of levees and revetments, more than 1,000 acres of riparian restoration have taken place through the collective actions of many partners, the marine shorelines of King County on Vashon-Maury Island are being restored through the removal of bulkheads to enhance habitat for forage fish that salmon feed on as they migrate, and the County has undertaken a strategic approach to prioritizing and implementing fish passage barrier removals associated with County properties and facilities.

By implementing salmon habitat restoration projects, King County has improved riparian, floodplain, and wetland habitat conditions and critical areas along salmon-bearing streams and rivers. At the same time, these projects support human needs and human health by reducing flood risk to communities, reducing the effects of climate change through reforestation, and making our waters clean and swimmable.

Two recent examples of projects that stemmed from WRIA planning efforts are the Riverbend Floodplain Restoration Project on the Cedar River and the Fall City Floodplain Restoration Project on the Snoqualmie River. Collectively, these projects

created or enhanced over 200 acres of floodplain habitat in important reaches for salmon, including instream rearing and refuge, spawning, and off-channel habitat for Chinook, coho, and sockeye salmon, steelhead, and cutthroat trout.

In addition to benefits to salmon, these projects also reduced flood risk by restoring natural floodplain storage and reconnecting river channels, and enhanced water quality and sediment transport, supporting broader ecosystem functions and resilience

In the next 5 years, King County has several floodplain and nearshore restoration projects planned and will restore an estimated 100 acres of floodplain and approximately 400 feet of marine shoreline on Vashon-Maury Island. These efforts reflect coordinated investments in salmon recovery, flood risk reduction, and climate resilience across WRIA priority areas.

8.6 References

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9 Geologically Hazardous Areas

Geologically Hazardous Areas (GHAs) are “areas that because of their susceptibility to erosion, sliding, earthquake, or other geological events, are not suited to the siting of commercial, residential, or industrial development consistent with public health or safety concerns” (RCW 36.70A.030). Landslide Hazard Areas (LHAs) are a type of GHA that includes “areas subject to landslides based on a combination of geologic, topographic, and hydrologic factors,” including “areas located in a canyon or on an active alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding” (WAC 365-190-120).

King County reviewed Department of Commerce (Commerce) guidance documents (2022 and 2023) and the scope of King County’s 2004 best available science (BAS) literature to inform the current BAS review for GHAs. The County previously identified the need for clearer development standards for alluvial fan hazard areas based on reports to Council, a pilot multi-benefit flood risk reduction project on Griffin Creek, and questions from permit applicants arising through the code enforcement process. The County identified that BAS review was necessary to inform standards for the management of alluvial fans, which are designated by the state as a type of landslide hazard area within the state-defined GHA critical area. King County reviewed BAS and alluvial fan critical areas protections in place at other regional jurisdictions. This review found that regulatory updates are necessary to establish development standards for alluvial fans.

Alluvial fans naturally occur along stream channels at the base of a slope. Hazardous geologic processes occur on alluvial fans, creating risks to infrastructure and public health and safety. Debris flows and floods transport sediment and rocks at fast rates that can damage property or harm community members. Debris flows, debris floods, and flash flooding can occur on both public and private property, depositing sediment in areas such as residential and commercial properties, farmlands, floodplains, or stream channels. These events can damage or destroy homes and decrease farmland productivity. In addition, these events can have lasting negative and positive effects on wildlife habitat.

9.1 Alluvial Fan Hazard Management

Prior to the 2024 Comprehensive Plan update, King County’s Comprehensive Plan and the King County Code (K.C.C.) included limited policies and development regulations for the management of alluvial fans. King County previously regulated alluvial fans using LHA critical areas regulations (K.C.C. 21A.06.680), limiting King County’s ability to reduce public health and safety risks associated with alluvial fans, such as flooding or debris flow. Given this, the BAS review for GHAs focused on alluvial fan hazard areas.

9.1.1 BAS Review

King County's 2004 BAS review included limited review of scientific literature associated with alluvial fans and debris flows (King County 2004a, 2004b) and instead focused on assessing other GHAs, including seismic, erosion, landslide, volcanic, and coal mine hazard areas. King County's current BAS review included review of scientific literature related to the identification, protection, and management of alluvial fans and Alluvial Fan Hazard Areas (AFHA).

To inform the creation of development standards for alluvial fans, King County also reviewed alluvial fan development standards in place at other jurisdictions, many located in the Pacific Northwest. Whatcom County, WA, San Diego County, CA, and the City of Mt. Vernon, WA, are examples of jurisdictions implementing AFHA development standards and structural management alternatives to manage risks from these hazards. Some jurisdictions have updated mapping to identify where alluvial fans exist and where hazards related to an alluvial fan may occur.

King County's BAS review findings for alluvial fans are summarized below.

General Information About Alluvial Fans

Alluvial fans are broad, gently sloping, cone-shaped landforms made up of sediment and debris caused by a buildup of deposits immediately below a significant change in the stream channel slope or valley confinement (WALERT 2023a; Mickelson et al. 2022). An alluvial fan typically occurs where a stream emerges from a steeper slope channel onto a low gradient area such as a floodplain (Mickelson et al. 2022). Fan hazards are triggered by short, intense periods of rainfall or an outburst flood (WALERT 2023c). Hazards associated with alluvial fans include flash floods, debris flows, debris floods, mudflows, and outburst floods.

An outburst flood is a quick burst of water released into a stream channel, which can be triggered by the failure of a blocked stream channel or a beaver dam. Flash floods are a rapid increase in flow along a stream channel that may allow water to overflow channel banks and cause a flood. If a flood contains rocks, trees, and other debris, it is termed a debris flow (Mickelson et al. 2023). Debris flow deposits can recruit gravel, cobbles, boulders, and large woody debris while flowing downslope and damaging trees next to the channel from rock or debris impact and scarring. Mud and gravel may be splashed onto trees and other channel-adjacent objects (Mickelson et al. 2022). Because of the ability of a debris flow to carry these materials to the front of the flowing mass, debris flows are extremely dangerous to public safety and infrastructure (Mickelson et al. 2022).

Debris flows range in size from a few square yards to hundreds of acres in area and from a few inches to 50 feet thick. Even smaller debris flows can be locally dangerous (WALERT 2023c). Debris flows can travel a considerable distance from the upland areas to the valley floor, where they can disrupt roadways and other infrastructure

lifelines, destroy property, and cause flooding. Typically, there is little time between a rainfall event upstream and the arrival of the flood downstream in the lowlands, often under an hour (WALERT 2023b). Due to their speed and destructive capability, debris flows pose an immediate and critical threat to public safety (Mickelson et al.2023) and can be catastrophic, sweeping away everything in their path, including huge boulders, homes, and cars (WGS 2023).

Alluvial fans are continually evolving over time and often have several active and inactive stream channels. Stream channels on alluvial fans can experience avulsion, where the active stream channel can quickly move by the process of erosion into a new pathway. The active stream channel that is currently filled with water may not be the same active channel after a flood or debris flow event. A structure previously considered safe from harm could quickly become inundated or in the path of a surging wall of mud and debris or high-bedload flooding (WGS 2023).

Some conditions that contribute to debris flows include steep slopes, heavy rainfall, seismic events, weak or loose rock and soil, changes in runoff patterns, improper grading or construction of roads, and wildfire (WALERT 2023c).

Functions and Values of Alluvial Fan Hazard Areas (AFHAs)

Alluvial fans can function to transport sediment and wood to larger, downstream fish-bearing channels. The processes that deliver sediment downstream may affect salmonids in a variety of ways, from benefiting salmon habitat to overloading streams with sediment in the short term (Commerce 2023). Debris flows are a source of recruitment for large wood and branches that contribute to habitat in forest and riparian ecosystems (Quinn et al. 2020).

Climate Change and Alluvial Fan Hazard Areas (AFHAs)

Climate change projections of warmer summer and winter weather and increasing winter rainfall (Mass et al. 2022) influence AFHAs and increase public health and safety risks on alluvial fans. Wetter and more frequent wet weather increase the number of hazards on alluvial fans and areas that may have debris flows. Though streams feeding alluvial fans may have no or low flow for most of the year, they can quickly become flooded with fast-moving water after or during a small rainstorm.

Warmer and drier weather increases risks to wildfire hazards, which, in turn, increase risk of post-wildfire debris flows. Wildfires dramatically change landscape and ground conditions so that even small rainstorms can produce dangerous flash floods and debris flows (WGS 2023; WALERT 2023b; Mickelson et al. 2022). The burning of vegetation can cause soils to become temporarily water-repellent after the fire. This change in soil infiltration capacity and the loss of vegetated cover can lead to high runoff, which can trigger flash floods and debris flows during rain events.

The risk of these hazards may remain elevated for several years after a wildfire has been extinguished (Mickelson et al. 2023). The lowlands may still be at risk even if the immediate upland area has not been burned. A burned area far up on a hillside could trigger debris flows that would flow into the lowlands below (Figure 9.1) (WALERT 2023b). Figure 9.1 shows a typical scenario of alluvial fans at the base of steep drainages and creeks (Figure 9.1a). After a wildfire (Figure 9.1b), the burned upland areas (Figure 9.1c) are highly susceptible to the initiation of debris flows and floods that then travel downslope to the lowlands and alluvial fans, where homes or property may be in the path of the destructive hazard (Figure 9.1c). It is increasingly important to consider post-wildfire flooding as the frequency, intensity, and distribution of wildfires increase because of the changing climate.

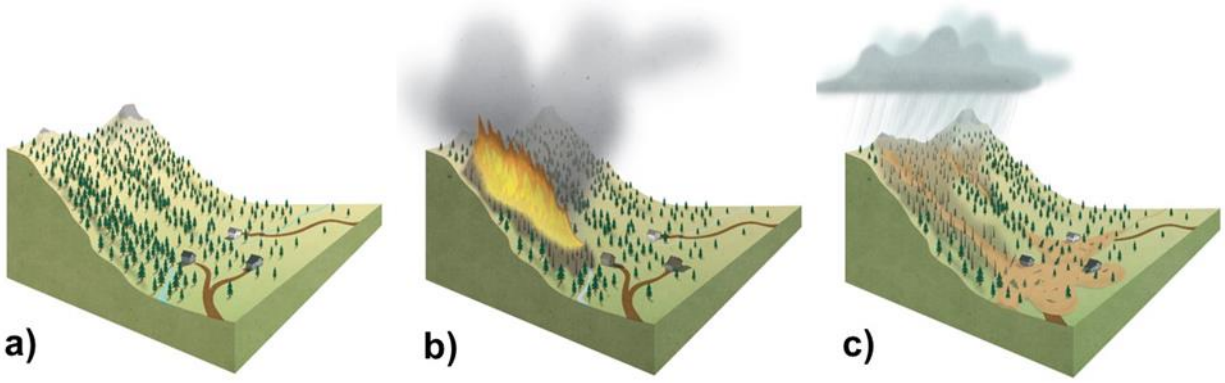


Figure 9.1 Debris flows after wildfire (WALERT 2023b).

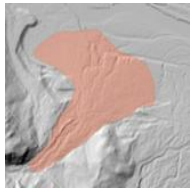
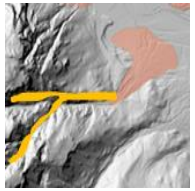
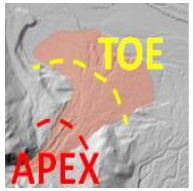
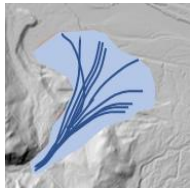
As an example, King County experienced a large wildfire in September 2022, burning 60 square kilometers in the area north of Baring and Skykomish, WA (Mickelson et al. 2022), causing property loss, power outages, traffic delays on a state highway, interrupted access to homes and businesses, and significant poor air quality throughout the Pacific Northwest (Breda et al. 2022). After the fire, the Washington State Department of Transportation (WSDOT) identified potential debris flow and high-risk areas (WSDOT 2022) and recommended remedial mitigation options to limit future highway closures (WSDOT 2023).

Mapping Alluvial Fans

GHA maps, including maps for AFHAs, are essential to effective management, protection, and restoration efforts and are used for many purposes, including comprehensive resource management planning, environmental impact assessment, capital project design, land use permitting, and landslide geohazard assessment. Mapping can include classifying hazards and identification of risks to public health and safety. In some cases, mapping can include risk assessments and detailed path analysis of flows.

Table 9.1 compares common mapping approaches for alluvial fan hazards and identifies key features of different approaches.

Table 9.1 Comparison of mapping approaches.

	(a) Maps outline	(b) Maps drainage path and outline	(c) Model's likelihood of debris flows on alpine fans	(d) Maps and identifies if active	(e) Maps general level of hazards	(f) Flood and sediment models	(g) Risk-based models
Identifies or Informs on							
Boundary	✓	✓	✓	✓	✓	✓	✓
Potential Hazard	✓	✓	✓	✓	✓	✓	✓
Level of hazard of fans			✓	-	-	✓	-
Location of hazards					-	✓	✓
Types of hazards					-		-
Runout or flow path						✓	✓
Source drainage path		✓					✓
Climate impacts							✓
Rank or classify risk			✓	✓	✓	✓	✓
Management strategies			✓	✓	✓	✓	✓

Note:
Images are artistic depictions of mapping approaches.
✓ implies items on left side are addressed with above mapping approach.
- implies items indirectly addressed with mapping approach.

The mapping of alluvial fans generally includes the more traditional and commonly used method of mapping the physical outline of an alluvial fan on a map using Light Detection and Ranging (LiDAR, a remote sensing method used to examine the surface of the Earth), aerial imagery, other mapping tools, and field observation to identify the footprint of an alluvial fan, indicating where alluvial fan hazards have occurred in the past (column (a) in Table 9.1; Figure 9.2; Mickelson et al. 2023). This method is often the first step to identifying AFHAs. The Washington Geological Survey (WGS) follows a version of this approach when mapping alluvial fans (Mickelson et al. 2023) and is publishing reports that include updated alluvial fan hazard maps in the state's counties (Mickelson et al. 2023).

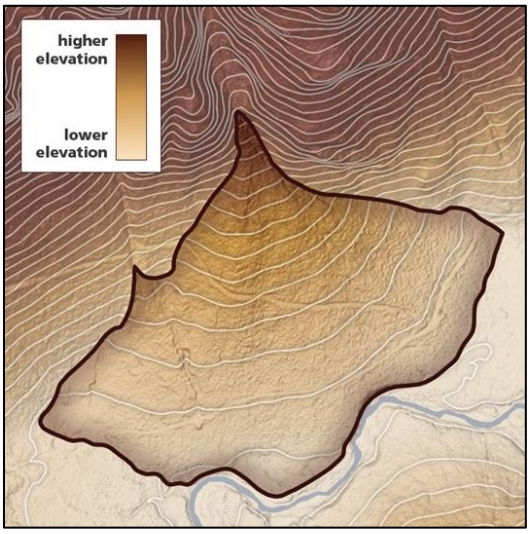


Figure 9.2 Mapping of an alluvial fan outline showing a 40-foot contour interval (Mickelson et al. 2023).

A similar method includes also mapping the contributing watershed or evidence where a debris flow already was initiated above a mapped fan (column (b) in Table 9.1; Bornaetxea et al. 2023). This is commonly seen in watershed analyses and more sophisticated predictive modeling approaches. The pathway of a debris flow is often visible as bare scars along dry or flowing creeks, hillslopes, and drainages.

Mapping approaches that can classify hazards or rank associated risks consist of methods shown in columns (c) through (g) of Table 9.1. Column (c) shows a method that identifies which alluvial fans are more likely to be subjected to debris flows or floods using maps and a computational mapping analysis (e.g., Melton's ratio or the relative relief ratio) (Davies et al. 2023; Wilford et al 2009). Maps showing active areas of fans (column (d)) are created using digital datasets and informed by field observations to determine the boundaries of the alluvial fan and whether the alluvial fan is currently active. Active areas of alluvial fans pose higher risks of damage to structures and property and increase risks to public safety and health.

Mapping often also includes identifying and classifying hazards based on their location in a drainage area or the alluvial fan. This is based on field observation, aerial imagery, and expert knowledge of fan processes (column (e)). This can consist of mapping boundaries of the apex (the top of the alluvial fan) where larger impacts occur. Impacts in the distal area (or toe) of the alluvial fan experience lower impacts but can pose a significant risk to public health and safety.

Modelling approaches (columns (f) and (g) of Table 9.1) can be used to map flooding depth and location and sediment deposition, predict flow paths, and calculate impact forces on structures resulting from alluvial fan hazards, such as debris floods, debris flows, mudflows, and flash floods. These more time-consuming but useful methods can be costly for applicants wanting to make alterations within an AFHA and are best used in combination with field observations. Modeling channelized debris and using risk-based models (Figure 9.1 column (g); Burns et al. 2022; Sturzenegger et al. 2021; EGBC 2023) is a more current and sophisticated method that models the level of hazards and locations where alluvial fan hazards are likely to start, travel, and end. Some drainages do not have alluvial fans at their base and the potential for debris flows may not be realized (Davies et al. 2023). The Oregon Department of Geology and Mineral Industries (DOGAMI) has also mapped landslide hazards and has recently developed a standardized protocol to identify areas prone to channelized debris flow (CDF) (Burns et al. 2022). The protocol creates an inventory where CDFs have occurred, may start, and travel, and identifies watersheds where CDFs are likely to occur. The results are presented in a report and summarized in a map that categorizes hazard areas according to a CDF potential ranking: none-very low, low, moderate, and high (Burns et al. 2022).

King County developed an Environmentally Sensitive Areas Landslide Hazards Map in the 1990s, using it as the basis for applying development regulations and prioritizing capital investments. In 2004, this map was renamed the Critical Areas Landslide Hazards Map (King County 2016) and was updated with new hazards if observed as part of the permitting process. These maps were not produced using modern mapping technology and don't identify different types of landslide hazards. Landslide mapping updates were initiated in 2014 by both the County and Washington State. The current mapping inventory of alluvial fans provides incomplete geographical coverage and consists of four sources:

- 2016 King County Landslide Mapping Update Along Major River Corridors
- 2016 King County Critical Areas Potential Landslide Hazard Areas and Potential Steep Slope Hazard Areas mapping update in areas of permitting interests
- 2017 Washington Geological Survey Protocol for Landslide Inventory Mapping from Lidar Data in Washington
- 2019 Washington Geological Survey Landslide Mapping of Western Washington

Collectively, these data sets do not provide complete alluvial fan mapping coverage for King County. Not all alluvial fans are mapped, and existing maps do not depict the location or severity of hazards on a fan. As a result, potential hazards and subsequent

risks to public health and safety are not accounted for in all planning and permitting decisions, capital projects, and habitat restoration efforts. Decisions based on poor or limited data can undermine planning efforts and investment in capital projects.

Management Practices on Alluvial Fans

Issues associated with alluvial fans and debris flows in the Puget Lowland areas of King County can be different than other places, such as British Columbia, Canada, and Whatcom County, WA, where development at the base of creeks on alluvial fans is more common. While there are some differences between King County geography, vegetative cover, and climate with other places dealing with alluvial fans, management practices can be similar. Within King County, the Puget Lowland also has geologic processes that differ to the western slope of the Cascades in eastern King County.

The complexity of any given alluvial fan is a function of many factors, including surrounding land use, stratigraphy, soils or geology, topography or landforms, clearing and grading activities, surcharge loading, total rainfall over a sustained period, and presence of a geologic contact on top of which the groundwater or subsurface flow regime may run or, in some cases, may even liquefy the underlying soils (Iverson et al. 2015; Snohomish County, WA 2015a).

As a result of population pressures and urbanization along the King County coastline due to rail and roads infrastructure and development along the shoreline, it is expected that there will be an increased risk of urban landslides (Hampton et al. 2004). To mitigate that risk, various strategies can be employed to reduce risk to public health and safety and to minimize environmental impacts. Some jurisdictions implement development regulations and best management practices to reduce risks from these types of hazards. In addition, regulatory interpretation and guidance to applicants and developers on management practices are provided at some jurisdictions. As wildfire awareness increases, jurisdictions can look to Washington State for guidance on mapping and managing risks of debris flows and floods caused post-wildfire debris flows.

Some examples of management practices in the industry and at jurisdictions are:

- Establish monitoring and adaptive management programs (KWL 2010)
- Public education (Hofmeister et al. 2002; Whatcom County, WA 2012)
- Warning systems that include traffic alerts and road closures (KWL 2010; Hofmeister et al. 2002)
- Planned retreat (land acquisition where hazards are deemed too high) (KWL 2003, 2010; Commerce 2023; Davies et al. 2023)
- Watershed-scale consideration and management (KWL 2010; Commerce 2023)
- Debris basins, barriers, and deflection berms; debris flow and flood impact walls; levees; enhanced channels; debris fences; grade control structures; and sediment storage basins and traps (Utah Silver Jackets Team 2022; Girard 2005; KWL 2010; Whatcom County, WA 2012; Hofmeister et al. 2002)

- Raised structures (San Diego County, CA 2023)

Limitations of some management practices include short- and long-term environmental effects, the requirement for ongoing maintenance, difficulties in developing appropriate design parameters, and the possibility that structures may relocate the hazard and shift the impact to adjacent properties (Hofmeister et al. 2002).

9.1.2 Comprehensive Planning Considerations

In addition to BAS review, King County considered nonscientific information during the development of alluvial fan development standards. Through the update of the Comprehensive Plan and Critical Areas Ordinance (CAO), as well as commitments to companion nonregulatory actions, the County seeks to simultaneously address the many GMA goals (see Section 1.1), some of which can be in conflict. This includes protecting the environment, supporting fair and timely permitting process, recognizing property rights, and enhancing and supporting agriculture while ensuring no net loss of critical areas functions and values at an ecosystem scale (see Section 1.2). To advance multiple GMA goals, the County relies on a mix of regulatory measures and nonregulatory programs to reduce risk of impacts to critical areas functions and values.

Establishing development standards for alluvial fans heightens environmental protections and public safety by limiting development and permitted land use activities in designated hazard areas. At the same time, alluvial fans are an important habitat-forming process that regulations should take into consideration while giving special consideration to salmonids.

Regulatory Guidance and Regional Approaches to Alluvial Fan Management

While there are some differences in alluvial fans, the geologic processes that build alluvial fans and create hazard areas are similar. King County shares geology, topography, and climate with relevant regional governing bodies in the Pacific Northwest, including jurisdictions in both the United States and Canada. These areas share similar challenges in managing alluvial fans and AFHAs while meeting goals associated with housing development, agriculture, forestry, and critical areas protections.

The Washington State Department of Ecology (Ecology) recommends limiting development in channel migration zones (CMZs), alluvial fans, and other areas that are likely to see unpredictable floodwater and debris flow events (Commerce 2023). Provincial guidelines published by the British Columbia Ministry of Water Land and Air Protection include discouraging development where local knowledge, experience, or studies indicate a concern that there may be a debris flow hazard (BC MWLAP 2004).

To inform development of alluvial fan development standards, King County completed a review of alluvial fan development standards and regulations in place in the western United States and Canada, with a focus on cities, counties, states, and provinces in the

Pacific Northwest, including Whatcom County. References to alluvial fans and debris flows are present in code and policy language at jurisdictions reviewed as part of this BAS. However, these references are commonly incorporated into the LHA code and policy. This means that development standards are the same as those for all other types of landslides that fall within the LHA, regardless of the differences of the hazards, mapping technologies, and circumstances for proposed development or land use action.

Some jurisdictions have language that defines alluvial fans as a separate hazard area type within the GHA, having definitions specific to geomorphic features on alluvial fans (Whatcom County, WA). Code and policies should reflect the geomorphic differences and types of impacts that occur on AFHAs other than GHAs, including LHAs, to mitigate hazards. Some jurisdictions that address alluvial fans and related hazards also include definitions on various types of hazards (mudflows, debris flows, debris floods, and flash floods).

The following are examples of code definitions, development standards, or AFHA management concepts that were identified during the BAS review process:

- AFHA as a separate type of LHA with different code and policy
- AFHA management plans
- Mapping requirements
- Setbacks and buffers
- Notice on title or property covenants
- Requirements on factor of safety for hazard occurrences
- Consideration of debris flow or flow runout
- Management strategies to mitigate hazards
- Considerations of long-term impacts of hazard mitigation
- Requirements that minimize risks to public safety
- Minimize impacts to other critical areas
- Avoiding the use of dredging or other activities that can potentially harm habitat functions
- Qualifications for professionals who can prepare reports
- Technical requirements for a critical areas report specifically prepared for GHAs, LHAs, and AFHAs.

Some jurisdictions (e.g., cities of Anacortes and Edmonds, WA, and Whatcom County, WA) have adopted language in code on additional technical requirements for critical areas reports addressing GHAs and who is qualified to prepare these technical reports. Geological critical areas reports generally provide criteria for the review and reporting of the AFHA.

A review by the City of Anacortes in 2017 revealed that property covenants are included in regulations when developments occur in landslide hazard areas in the City of Everett, City of Seattle, and Island County (Geoengineers 2017). In 2015, Snohomish County followed suit and amended its code to include additional notice, disclosure, and covenant requirements where the covenant runs with the land and states that the

property is in an LHA, the owner accepts the responsibility for the risks, describes the risks, and informs future purchasers and provides indemnification (Snohomish County, WA 2015b).

The Washington State Department of Natural Resources (DNR) and DOGAMI released a guide (WGS and DOGAMI 2023) that provides general guidance that homeowners should consider regarding their home and property, including landslide warning signs and who to contact if they suspect active landslides on their property. DOGAMI's 2019 "Preparing for Landslide Hazards: A Land Use Guide for Oregon Communities" is published as a quick-reference guide (DOGAMI 2019b) and a more extended document (DOGAMI 2019a). These guides bring together strategies and examples from a variety of sources to help communities make good decisions to become more resilient to landslide hazards through community land use options and strategies.

9.1.3 Regulatory Updates

Based on the 2024 review of BAS and comprehensive planning considerations, King County is updating its Comprehensive Plan and the K.C.C. to improve the management of alluvial fans and AFHAs. Updates are intended to:

- define the County's role in alluvial fan and AFHA management.
- implement development standards for AFHAs that reduce public health and safety risks, including establishing limits and conditions for replacement and expansion of structures.
- limit clearing and grading and prohibit most new development in AFHAs.
- allow select emergency actions to be permitted to reduce alluvial fan hazard risks to existing development and land uses.

Updates satisfy the GMA requirement that the County regulate GHAs and LHAs to reduce risk to public health and safety. The majority of policy updates defining AFHAs as a new type of GHA can be found in Chapter 5 of the Comprehensive Plan and in K.C.C. Chapters 21A.06 and 21A.24. Alluvial fan development standards, which, in part, define allowed, conditionally allowed, and nonallowed activities in AFHAs, can be found in K.C.C. 21A.24.045. Additional development regulations pertaining to alluvial fans can be found in a new section of the K.C.C. specific to alluvial fan management. Having updated, clear, and comprehensive development standards for AFHAs in the K.C.C. is intended to reduce risks to public health and safety associated with alluvial fans.

9.1.4 Nonregulatory Programs

King County recognizes the importance of protecting critical areas through both regulatory measures and nonregulatory programs. King County coordinates with communities and other partners to guide investment in nonregulatory programs that protect natural resources, including critical areas. Nonregulatory programs that offer protections to alluvial fans are discussed at a summary level below. Readers can learn more by visiting linked webpages.

Alluvial Fan Mapping

King County permitting staff currently use landslide hazard mapping resources updated in 2016 (see Section 9.1.1) to inform critical areas permitting processes. King County plans to develop its own alluvial fan mapping resources to ensure consistency with County definitions of "alluvial fan" and "alluvial fan hazard areas" and to support implementation of alluvial fan policies and development regulations. Updated alluvial fan mapping from the County will be developed at a resolution high enough to inform members of the public, permitting staff, and County project managers about the location and types of alluvial fan hazards present on specific parcels. King County mapping resources are available online through King County's interactive mapping tool, King County iMap.

This nonregulatory investment will improve outcomes for species and critical areas, advancing King County's progress in satisfying GMA goals for environmental protection, shoreline management, climate resiliency, community coordination, and permitting.

Land Conservation in King County

King County operates nonregulatory open space acquisition programs, such as the Land Conservation Initiative (LCI), using funding from King County's Conservation Futures grant program and other sources. The LCI is a regional collaboration between King County, cities, business associations, agricultural communities, environmental partners, and other groups aimed at preserving the County's last, most important natural lands and urban green spaces over the next 30 years. King County has mapped and prioritized 65,000 acres of land for protection in six categories: urban green space, trails, natural lands, rivers, farmlands, and forestlands.

Updating King County Comprehensive Plan policies and establishing alluvial fan development regulations will reduce risk to public health and safety while preserving natural lands and wildlife habitat. To complement regulatory protection of these areas, King County intends to use updated alluvial fan mapping to inform the voluntary acquisition of areas with high habitat value or that pose a significant risk to public health and safety.

9.1.5 Risk Assessment of Regulatory Updates

Prior to the 2024 Comprehensive Plan update, King County's Comprehensive Plan and the K.C.C. included limited policies and development regulations for the management of alluvial fans. King County previously regulated alluvial fans using LHA critical areas regulations, limiting King County's ability to reduce public health and safety risks associated with alluvial fans, such as flooding or debris flow.

Designating and managing AFHAs is an important part of land use planning. Ensuring alluvial fan hazards are identified and that policies and development regulations

address alluvial fan hazards reduces risk to public health and safety and improves protection of the ecological functions and values of alluvial fans. The GMA requires that cities and counties regulate GHAs to reduce risk to public health and safety (Section 1.2.1).

Regulatory updates and nonregulatory commitments discussed in this section generally align with BAS and are informed by review of alluvial fan management practices and standards in other Puget Sound cities and counties. Collectively, these updates and nonregulatory commitments represent a moderate improvement in managing the public health and safety risks and ecological functions and values of alluvial fans and AFHAs.

Nonregulatory commitments, including alluvial fan mapping and voluntary acquisition of high-risk properties, enables King County to better manage public health and safety risks. Identifying and managing GHAs, including alluvial fans and AFHAs is essential as King County's population continues to grow, and climate change increases the risk of alluvial fan hazards, such as debris flow and catastrophic flooding.

Alluvial fan management practices continue to evolve. Reviewing BAS and revising or expanding alluvial development standards in future Comprehensive Plan updates will allow King County to better manage alluvial fan hazards. Future updates to alluvial fan regulations and nonregulatory programs should also consider updated mapping resources and King County's Flood Hazard Management Plan.

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Appendix A: Animal Species of Local Importance (SOLI)

King County uses the following resources to identify animal species of local importance (SOLI):

- Washington State Priority Habitats and Species List (WDFW 2023)
- Washington's State Wildlife Action Plan (WDFW 2015)
- Survival by Degrees—389 bird species on the brink (Wilsey et al. 2019)

Animal species are listed in the table below, grouped by animal type. The table provides state and federal status, habitat use in the State of Washington, vulnerability to climate change, and reason for inclusion in the list. Plant species of local importance are discussed in Section 6.1 (see Species and Habitats of Local Importance).

Acronyms for the table below are listed here.

Federal Status (United States 1983):

- FT – Federally listed Threatened Species under the Endangered Species Act
- FE – Federally listed Endangered Species under the Endangered Species Act

State Status, with state definitions (WDFW 2023a):

- SE – Endangered. Seriously threatened with extinction throughout all or a significant portion of its range
- ST – Threatened. Likely to become endangered within the foreseeable future without cooperative removal of threats
- SS – Sensitive. Vulnerable or declining and likely to become endangered or threatened in a significant portion of its range without cooperative management or removal of threats
- SC – Species identified as a Candidate for listing under Washington Administrative Code 220-610-110

Special Designations:

- PHS – Priority Habitats and Species (WDFW 2023b)
- SGCN – Species of Greatest Conservation Need (WDFW 2015; list updated 2018)

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Common and Scientific Name	Animal Type	Marine or Terrestrial Use in King Co.	Federal Status	State Status	Special Designations	Habitat	Risk from Climate Change	Justification and/or Limiting Factors
Common Loon, *Gavia immer*	Bird	Both	none	SS	PHS; SGCN	Breeds in mountain lakes; winters in marine nearshore.	Moderate	This species has a small breeding population in Washington. Its overall range has contracted northward. Due to life history and a small population in Washington, it is highly vulnerable to impacts if not monitored and managed where appropriate.
Marbled Murrelet*, *Brachyramphus marmoratus*	Bird	Both	FT	SE	PHS; SGCN	Breeds in old-growth forest; feeds in marine nearshore.	Moderate-high	Because of its breeding association with old forests, Marbled Murrelet populations have been severely affected by loss of mature and old forest habitat. Food resources in the marine environment may also influence population status. Audubon Washington bird of "immediate concern."
Western Grebe, *Aechmophorus occidentalis*	Bird	Marine	none	SC	PHS; SGCN	Large freshwater lakes, reservoirs, and marshes during the summer breeding season; primarily coastal marine areas with relatively sheltered waters are used in winter.	High	Fluctuating water levels at breeding sites, disruption of nesting activities, and reductions of prey at overwintering areas in the Salish Sea. Audubon Washington bird of "high concern."
Black Scoter, *Melanitta nigra*	Bird	Marine	none	none	SGCN	Winter in marine waters/shorelines.	Moderate-high	This species has undergone significant population declines in Puget Sound. Sources of impacts have not been clearly identified. Increasing development in the Puget Sound region has led to more disturbance, pollution, and degradation of foraging areas used by sea ducks.
Surf Scoter, *Melanitta perspicillata*	Bird	Marine	none	none	SGCN	Winter in marine waters/shorelines.	Moderate-high	This species has undergone significant population declines in Puget Sound. Sources of impacts have not been clearly identified. Increasing development in the Puget Sound region has led to more disturbance, pollution, and degradation of foraging areas used by sea ducks. Reduction of marine forage (primarily herring spawn) may be reducing populations in some areas.
White-winged Scoter, *Melanitta fusca*	Bird	Marine	none	none	SGCN	Winter in marine waters/shorelines.	Moderate-high	This species has undergone significant population declines in Puget Sound. Sources of impacts have not been clearly identified. Increasing development in the Puget Sound region has led to more disturbance, pollution, and degradation of foraging areas used by sea ducks. Reduction of marine forage (primarily herring spawn) may be reducing populations in some areas.
Western High Arctic Brant, *Branta bernicla*	Bird	Marine	none	none	PHS; SGCN	Winter in marine waters/shorelines; rely on eelgrass beds for foraging.	Moderate-high	Western High Arctic Brant include a small population that has experienced a long-term decline in numbers. Factors affecting population status and distribution are currently unknown.
Harlequin Duck, *Histrionicus histrionicus*	Bird	Both	none	none	PHS; SGCN	Breeding habitat is along fast moving, mountain streams, and wintering habitat is along rocky marine shorelines.	Moderate-high	Declines in wintering numbers of Harlequin Ducks have occurred on Puget Sound. Sources of impacts have not been clearly identified.
Cinnamon teal, *Anas cyanoptera*	Bird	Terrestrial	none	none	SGCN	Breeding areas typically contain dense upland vegetation near freshwater ponds and lakes, usually with dense aquatic vegetation.	Moderate	A once fairly common breeding species in Washington that has declined significantly in the past 40 years.

Common and Scientific Name	Animal Type	Marine or Terrestrial Use in King Co.	Federal Status	State Status	Special Designations	Habitat	Risk from Climate Change	Justification and/or Limiting Factors
Bufflehead, *Bucephala albeola*	Bird	Both	none	none	PHS	In the winter, most often found in coastal areas in shallow bays and inlets.	High	Non-breeding concentrations.
Barrow's Goldeneye, *Bucephala islandica*	Bird	Both	none	none	PHS; SGCN	This species is a cavity nester, the female placing its nest in mature and late successional forests and riparian areas adjacent to low-gradient rivers, sloughs, lakes, and beaver ponds.	High	Cavity nesting habitat; non-breeding concentrations.
Common Goldeneye, *Bucephala clangula*	Bird	Marine	none	none	PHS	Winter primarily in marine areas, in shallow protected bays, estuaries, and large lakes with a sandy, gravel, or rocky substrate.	High	Non-breeding concentrations.
Wood Duck, *Aix sponsa*	Bird	Terrestrial	none	none	PHS	Wooded wetlands and slow-moving, tree-lined rivers, with a preference for deciduous-tree habitats. Requires either a natural cavity or nest box to raise its young.	Low	Loss of cavity nesting habitat.
Hooded merganser, *Lophodytes cucullatus*	Bird	Terrestrial	none	none	PHS	Small, forested, freshwater wetlands with emergent vegetation.	Low	Loss of cavity nesting habitat.
Trumpeter Swan, *Cygnus buccinator*	Bird	Both	none	none	PHS	Inhabit lakes, ponds, large rivers, and coastal bays. Their most important habitat requirements are open water, access to food, and protection from disturbance.	Moderate	Habitat loss and lead poisoning from ingestion of lead shot.
Tundra Swan, *Cygnus columbianus*	Bird	Both	none	none	PHS	During migration and through the winter, inhabit shallow lakes, slow-moving rivers, flooded fields, and coastal estuaries.	Unknown	Vulnerable aggregations.
Pelagic Cormorant, *Phalacrocorax pelagicus*	Bird	Marine	none	none	PHS	Exclusively marine, can be found in bays and sounds.	Unknown	Vulnerable aggregations.
Pigeon Guillemot, *Cepphus columba*	Bird	Marine	none	none	PHS	Exclusively marine, along rocky shores and inshore waters.	Unknown	Vulnerable aggregations. Conservation status is not well understood.
Caspian Tern, *Hydroprogne caspia*	Bird	Both	none	none	PHS	Fresh- and saltwater wetlands, especially estuaries, coastal bays, and beaches. Nesting sites are often human made.	Unknown	Vulnerable aggregations: highly susceptible to disturbance at nesting sites. Audubon Washington bird of "high concern."
Waterfowl Concentrations (Anatidae, excluding Canada Geese in urban areas)	Bird	Both	none	none	PHS	Varies, but includes significant breeding areas during breeding season and regular concentrations in winter.	Unknown	Vulnerable aggregations.

Common and Scientific Name	Animal Type	Marine or Terrestrial Use in King Co.	Federal Status	State Status	Special Designations	Habitat	Risk from Climate Change	Justification and/or Limiting Factors
Western Washington nonbreeding concentrations of plovers (Charadriidae) and sandpipers (Scolopacidae)	Bird	Both	none	none	PHS	Varies, but includes any concentrations during migration periods and winter.	Unknown	Vulnerable aggregations.
Northern Spotted Owl*, *Strix occidentalis*	Bird	Terrestrial	FT	SE	PHS; SGCN	Old-growth forest.	High	Impacts from habitat loss are now exacerbated by effects of competition with Barred Owls for prey and habitat. Audubon Washington bird of "Immediate Concern."
Western Screech Owl, *Otus kennicotii macfarlanei*	Bird	Terrestrial	none	none	SGCN	Found in many forest types, from urban to rural and including riparian zones and forests dominated by Douglas-fir, western hemlock, Sitka spruce, and grand fir.	Moderate	This species appears to have been impacted by the presence of Barred Owls in western Washington.
Bald Eagle*, *Haliaeetus leucocephalus*	Bird	Both	none	none	SGCN	Shorelines (marine and freshwater) and riparian areas.	Low-Moderate	Population is currently robust.
Golden Eagle, *Aquila chrysaetos*	Bird	Terrestrial	none	SC	PHS; SGCN	Open areas with large, rocky cliffs or large trees. Often found in alpine parkland and mid-elevation clear-cuts, as well as in shrub-steppe areas and open forests.	Moderate-High	Harassment by humans; loss of prey base. Audubon Washington bird of "High Concern."
Osprey*, *Pandion haliaetus*	Bird	Both	none	none	none	Nest near rivers, estuaries, salt marshes, lakes, reservoirs, and other large bodies of water.	Stable	Stable and potentially growing population.
Northern Goshawk*, *Accipiter gentilis*	Bird	Terrestrial	none	SC	PHS	Nest almost exclusively in coniferous forest, mostly late-seral stage.	High	Availability of nesting habitat and suitable prey, especially post-fledging. Although the effects of timber harvesting on goshawks are not fully understood, evidence suggests that harvest impacts nest site selection and potentially impacts nesting rates. Audubon Washington bird of "Immediate Concern."
Peregrine Falcon*, *Falco peregrinus*	Bird	Terrestrial	none	none	SGCN	Nest on cliffs near water.	Low-Moderate	Stable and growing population.
American bittern, *Botaurus lentiginosus*	Bird	Terrestrial	none	none	none	Found in dense freshwater marshes and extensive wet meadows. They prefer wetlands with thick cattail and bulrush, mixed with areas of open water. In the winter, can be found in a wider range of habitats, including flooded willow and salt marshes.	Low	Audubon Washington bird of "Immediate Concern."
Great Blue Heron*, *Ardea herodias*	Bird	Both	none	none	PHS	Typically feeds in slow-moving or calm salt, fresh, or brackish water. Inhabit sheltered, shallow bays and inlets, sloughs, marshes, wet meadows, shores of lakes, and rivers. Nesting colonies are typically found in mature forests, on islands, or near mudflats.	Stable	Bald Eagle predation on nests; loud noise near nests.

Common and Scientific Name	Animal Type	Marine or Terrestrial Use in King Co.	Federal Status	State Status	Special Designations	Habitat	Risk from Climate Change	Justification and/or Limiting Factors
Hairy Woodpecker, *Picoides villosus*	Bird	Terrestrial	none	none	none	Mature coniferous forest.	Low	They require areas with heavier, more mature tree cover than Downy Woodpeckers and are more dependent on the presence of large trees.
Pileated Woodpecker, *Dryocopus pileatus*	Bird	Terrestrial	none	none	none	Inhabit mature and old-growth forests, and second-growth forests with snags and fallen trees. They need big nesting trees, which are the limiting factor.	Stable	The removal of large snags, large decaying live trees, and large downed wood of the appropriate species, size, and decay class eliminates nest and roost sites and foraging habitat.
Black-Backed Woodpecker, *Picoides arcticus*	Bird	Terrestrial	none	SC	PHS	Suitable mature, old-growth, and recently dead lodgepole pine, ponderosa pine, and pine-dominated mixed coniferous forest stands that have experienced recent pine beetle infestation, large blowdowns, or fire.	High	Forest management policies that reduce occurrence of large, high-intensity wildfires that create woodpecker habitat.
American three-toed woodpecker, *Picoides tridactylus*	Bird	Terrestrial	none	none	none	Nest in mature or old-growth boreal conifer forests, especially spruce, larch, fir, and pine. They can be found at elevations from about 4,000 feet up to the tree line. Will come down lower to burned and flooded areas with standing dead trees and to other areas undergoing heavy infestations of wood-boring beetles.	High	Quantity and distribution of mature and old-growth forests probably limit their numbers. Past timber management and current megafires have not left the diseased and dying timber that hosts their main food source.
Belted kingfisher, *Ceryle alcyon*	Bird	Both	none	none	none	Nest along marine and freshwater shorelines. They require sandy vertical banks for nest burrows and clear water so they can see their aquatic prey.	Stable	Availability of suitable banks for nesting is a limiting factor in distribution and abundance.
Pacific coast band-tailed pigeon, *Columba fasciata*	Bird	Terrestrial	none	none	PHS; SGCN	Relies on upland forests with mineral sources.	Low-Moderate	Timber harvest and management of clearcuts that reduce food resources. Audubon Washington bird of "High Concern."
Oregon Vesper Sparrow, *Pooecetes gramineus affinis*	Bird	Terrestrial	Petitioned for listing	SE	PHS	Open habitats (grassland, shrub-steppe, and agriculture).	Moderate	Loss and degradation of habitat; this subspecies is now in danger of extirpation in Washington. Audubon Washington bird of "Immediate Concern."
Yellow-Billed Cuckoo, *Coccyzus americanus*	Bird	Terrestrial	FT	SE	PHS; SGCN	Large, continuous riparian zones with cottonwoods and willows. Cottonwoods and willows that form open woodlands with dense, low vegetation are particularly preferred.	Low-Moderate	Reasons for decline are not well understood but include habitat loss.

Common and Scientific Name	Animal Type	Marine or Terrestrial Use in King Co.	Federal Status	State Status	Special Designations	Habitat	Risk from Climate Change	Justification and/or Limiting Factors
Vaux's Swift*, *Chaetura vauxi*	Bird	Terrestrial	none	none	PHS	Nesting habitat is forest, either coniferous or mixed, but primarily old growth with snags for nesting and roosting. Nests are in natural cavities with vertical entranceways, such as hollow trees.	High	Old-growth snags.
Western Meadowlark, *Sturnella neglecta*	Bird	Terrestrial	none	none	none	In King County, inhabit grasslands/prairie areas and agricultural areas.	Low	Conversion of grassland/prairie habitat. Also, Western Meadowlarks are extremely sensitive to human disturbance during the breeding season and will abort nesting attempts if they are flushed while incubating eggs.
Olive-sided Flycatcher, *Contopus cooperi*	Bird	Terrestrial	none	none	none	Used burned areas and logged areas.	High	Audubon Washington bird of "Immediate Concern."
Red-eyed Vireo, *Vireo olivaceus*	Bird	Terrestrial	none	none	none	In Washington, confined to stream and lakeside woodlands and cottonwood stands.	Unknown	Decline in population most likely resulting from Brown-headed Cowbird parasitism and the degradation and loss of streamside habitat.
Purple Finch, *Carpodacus purpureus*	Bird	Terrestrial	none	none	none	Moist coniferous and mixed-forest lowlands, especially those with many openings and edges, and an abundant understory. They are often found in revegetating clear-cuts, on farmland, and in rural residential areas.	Moderate	House Finches have replaced Purple Finches in many developed areas of Washington.
Purple Martin, *Progne subis*	Bird	Terrestrial	none	none	SGCN	Natural and manmade cavities in marine and freshwater nearshore habitats.	Low-Moderate	The population of Purple Martins in Washington is small and largely dependent on humans to provide nest structures. Consequently, persistence of the population likely requires ongoing human intervention of erecting and maintaining nest structures. Audubon Washington bird of "High Concern."
Sooty Grouse, *Dendragapus fuliginosus*	Bird	Terrestrial	none	none	PHS	Wet conifer forest from sea level to the subalpine and alpine zones at openings and edges that provide a well-developed understory vegetation of grasses, herbs, and shrubs. Winter in dense conifer stands, often at a higher elevation than their breeding habitat.	Unknown	Sooty Grouse are more productive in old-growth forest than even-aged forest. Deforestation for development and agriculture has eliminated habitat for Sooty Grouse in this area.
Chinook Salmon (Puget Sound), *Oncorhynchus tshawytscha*	Fish	Both	FT	none	PHS; SGCN	Spawners use pool and riffle areas in channels that have adequate depth, velocity, gravel substrate, and temperature. Young juveniles use lower-velocity and shallower areas, including stream margins and non-mainstem channels such as those found in natural floodplains. Suitable or optimal freshwater temperatures vary by life stage but generally range between 41 and 59°F. Estuaries serve as important rearing habitats, and juveniles use shallow nearshore areas as they migrate through Puget Sound. Sub-adults use deeper, more offshore Puget Sound areas for foraging.	Moderate-High	Riverine, riparian, floodplain, estuarine, and nearshore-marine habitats lost, modified, or heavily degraded by agricultural, urban, and residential development. Habitat loss and degradation due to dams, transportation crossings, culverts, water diversions, and shoreline industrial uses. Dam operations that modify natural hydrological cycle and flows and restrict or eliminate fish passage. River scour and excessive sedimentation from high flows and bank/hillside erosion.

Common and Scientific Name	Animal Type	Marine or Terrestrial Use in King Co.	Federal Status	State Status	Special Designations	Habitat	Risk from Climate Change	Justification and/or Limiting Factors
Steelhead (Puget Sound), *Oncorhynchus mykiss*	Fish	Both	FT	SC	PHS; SGCN	Spawn in river mainstems and large and small tributaries, some relatively far upstream compared to other salmonids. Redds constructed in riffles and downstream margins of pools in streambeds where gravel sizes are optimal. Instream woody debris, boulders, and stream bank structure provide important cover. Newly emerged juveniles use shallow gravel bed areas in riffles, among boulders, or near stream banks. As juveniles grow, they move to higher-water-velocity areas.	Moderate-High	Riverine, riparian, floodplain, estuarine, and nearshore-marine habitats lost, modified, or heavily degraded by agricultural, urban, and residential development. Habitat loss and degradation due to dams, transportation crossings, culverts, water diversions, and shoreline industrial uses. Dam operations that modify natural hydrological cycle and flows and restrict or eliminate fish passage. River scour and excessive sedimentation are threats from high flows and bank/hillside erosion.
Rainbow Trout, *Oncorhynchus mykiss*	Fish	Terrestrial	none	none	PHS	Generally prefer fast water in small to large mainstem rivers, and medium to large tributaries.	Unknown	Species of Recreational, Commercial, and/or Tribal Importance.
Bull Trout, *Salvelinus confluentus*	Fish	Terrestrial	FT	SC	PHS; SGCN	Deep pools in cold rivers and large tributary streams, often in moderate to fast currents, and large, cold lakes and reservoirs.	Moderate-High	Spawning and resident habitat has been destroyed or is threatened by urbanization, fisheries management activities, agriculture practices, mining, residential development, livestock grazing, dams, and logging practices. Increased water temperatures, which may have negative temporal and spatial impacts.
Dolly Varden, *Salvelinus malma*	Fish	Both	none	none	PHS	Streams and lakes.	Unknown	Species of Recreational, Commercial, and/or Tribal Importance.
Chum Salmon, *Oncorhynchus keta*	Fish	Both	none	none	PHS	Small coastal streams and the lower reaches of larger rivers. Fry do not rear in freshwater for more than a few days. Shortly after they emerge, chum fry move downstream to the estuary and rear there for several months before heading out to the open ocean.	Unknown	Species of Recreational, Commercial, and/or Tribal Importance.
Coastal Resident/Sea-run Cutthroat Trout, *Oncorhynchus clarki clarki*	Fish	Both	none	none	PHS	Small to moderately large, clear, well-oxygenated, shallow rivers with gravel bottoms. Marine nearshore.	Unknown	Species of Recreational, Commercial, and/or Tribal Importance.
Coho/Silver Salmon, *Oncorhynchus kisutch*	Fish	Both	none	none	PHS	Spawn in small coastal streams and the tributaries of larger rivers. They prefer areas of mid-velocity water with small- to medium-sized gravels. Because they use small streams with limited space, they must use many such streams to successfully reproduce, which is why coho can be found in virtually every small coastal stream with a year-round flow.	Unknown	Species of Recreational, Commercial, and/or Tribal Importance.
Pink Salmon, *Oncorhynchus gorbuscha*	Fish	Both	none	none	PHS	Mainstems of large rivers and some tributaries, often very close to salt water.	Unknown	Species of Recreational, Commercial, and/or Tribal Importance.
Sockeye/Red Salmon, *Oncorhynchus nerka*	Fish	Both	none	none	PHS	Streams and rivers connected to lakes.	Unknown	Species of Recreational, Commercial, and/or Tribal Importance.

Common and Scientific Name	Animal Type	Marine or Terrestrial Use in King Co.	Federal Status	State Status	Special Designations	Habitat	Risk from Climate Change	Justification and/or Limiting Factors
Kokanee Salmon, *Oncorhynchus nerka*	Fish	Terrestrial	none	none	PHS	Lake and their tributaries.	Unknown	Altered stormwater flows, past hatchery practices, predation, fishing, passage barriers, lake temperature, and dissolved oxygen levels.
Bocaccio Rockfish, *Sebastes paucispinis*	Fish	Marine	FE	none	PHS	Deep marine water.	Moderate-High	By-catch in other fisheries, injuries from barotrauma can be fatal. Anglers can't identify species.
Brown Rockfish, *Sebastes auriculatus*	Fish	Marine	none	none	PHS	Marine nearshore to depths of approximately 400 feet.	Moderate-High	Habitat loss or degradation; toxins in water.
Canary Rockfish, *Sebastes pinniger*	Fish	Marine	FT	none	PHS	High current areas and deeper water.	Moderate-High	By-catch in other fisheries, injuries from barotrauma can be fatal. Anglers can't identify species.
Copper Rockfish, *Sebastes caurinus*	Fish	Marine	none	none	PHS	Depths less than 200 feet and associated with high-relief rocky habitats throughout Puget Sound.	Moderate-High	By-catch in other fisheries, injuries from barotrauma can be fatal. Anglers can't identify species.
Quillback Rockfish, *Sebastes maliger*	Fish	Marine	none	none	PHS	Nearshore and deep waters to 700 feet in Puget Sound. Prefer high-relief rocky habitat; however, can also be found on mud/sand bottoms near rock outcrops or at the base of drop-offs.	Moderate-High	By-catch in other fisheries, injuries from barotrauma can be fatal. Anglers can't identify species.
Yelloweye Rockfish, *Sebastes ruberrimus*	Fish	Marine	FT	none	PHS	Deep waters of Puget Sound. High-relief rocky habitats and often near steep slopes.	Moderate-High	By-catch in other fisheries, injuries from barotrauma can be fatal. Anglers can't identify species.
Southern Rock Sole, *Pleuronectes bilineatus*	Fish	Marine	none	none	PHS	The only flatfish in Puget Sound that are known to spawn in very shallow water, even intertidally, and their eggs have been found on exposed beaches in some locations.	Unknown	Species of Recreational, Commercial, and/or Tribal Importance.
Pacific Cod, *Gadus macrocephalus*	Fish	Marine	none	none	PHS	Found at most depths, most commonly associated with soft bottom and low-relief habitats, including mud, sand, and gravel, but larger individuals may occasionally inhabit rock and boulder habitats.	High	Increases in sea surface temperature. By-catch in other fisheries, injuries from barotrauma can be fatal. Anglers can't identify species.
Lingcod, *Ophiodon elongatus*	Fish	Marine	none	none	PHS	Found on the bottom, with most individuals occupying rocky areas at depths of 10 to 100 meters (32 to 328 feet).	Unknown	Highly susceptible to overfishing.
Pacific Herring, *Clupea pallasi*	Fish	Marine	none	none	PHS; SGCN	Marine nearshore and estuarine. Juveniles congregate in bays, inlets, and channels in summer, and typically spend at least their first year in Puget Sound/Strait of Georgia.	Moderate-High	Maintaining viable spawning grounds and water quality in Puget Sound is a challenge to herring management in Washington. Water temperature, salinity changes, and vegetation under climate change are a risk.
Pacific Sand Lance, *Ammodytes hexapterus*	Fish	Marine	none	none	PHS; SGCN	Upper intertidal sand and sand/gravel spawning sites on Puget Sound beaches are documented as important breeding areas throughout Puget Sound.	Moderate-High	Lack of erosional sediment inputs due to shoreline armoring. Water temperature, oxygen availability, and prey species availability under climate change are a risk.

Common and Scientific Name	Animal Type	Marine or Terrestrial Use in King Co.	Federal Status	State Status	Special Designations	Habitat	Risk from Climate Change	Justification and/or Limiting Factors
Surf Smelt, *Hypomesus pretiosus*	Fish	Marine	none	none	PHS	Spawning occurs around high tides on mixed sand-gravel substrates in the upper intertidal zone in a wide variety of wave-exposure regimes, from very sheltered beaches to fully exposed pebble beaches.	Moderate-High	Widespread shoreline armoring practices on Surf Smelt spawning beaches.
Longfin Smelt, *Spirinchus thaleichthys*	Fish	Both	none	none	PHS	Wide range of temperature and salinity conditions in coastal waters near shore, bays, estuaries, and rivers. Some populations are landlocked in lakes, including Lake Washington.	Unknown	Potential threats include pesticide runoff from agricultural areas and invasions by exotic species, both plant and animal, that may displace or predate on adult or larval Longfin Smelt.
White Sturgeon, *Acipenser transmontanus*	Fish	Both	none	none	PHS; SGCN	Marine nearshore estuarine; rivers.	Moderate	Species of Recreational, Commercial, and/or Tribal Importance.
Pacific Lamprey, *Entosphenus tridentatus*	Fish	Both	none	none	PHS; SGCN	Medium- and large-sized, low-gradient rivers and streams.	Moderate-High	Species of Recreational, Commercial, and/or Tribal Importance. Adults spawn in gravel nests in stream riffles and then die. Eggs hatch into larvae (ammocoetes) and drift downstream to slow velocity areas. Ammocoetes live in silt/sand substrates and filter feed for three to seven years. They no longer exist above dams and other impassable barriers in west coast streams.
Western River Lamprey, *Lampetra ayresii*	Fish	Both	none	SC	PHS; SGCN	Larval lamprey burrow into soft sediment of slow-moving freshwater streams and rivers that lead to the ocean.	Moderate-High	Habitat above artificial barriers.
Pygmy Whitefish, *Prosopium coulteri*	Fish	Terrestrial	none	SS	PHS; SGCN	Deep, unproductive lakes where the water temperatures are 50°F or lower.	Low to Moderate	Decline in numbers possibly from non-native fish.
Fisher, *Pekania pennanti*	Mammal	Terrestrial	none	SE	PHS; SGCN	Inhabit coniferous and mixed coniferous-deciduous forests and tend to avoid areas with significant human activity and developed areas. Forests that provide moderate to high canopy closure and the presence of large woody structures such as cavity trees, snags, and logs.	Moderate-High	Fisher was extinct in Washington. There are now reintroduction efforts. Incidental trapping capture, highway mortality, and other mortality sources pose a risk for the reintroduced population.
Pacific Marten, *Martes caurina*	Mammal	Terrestrial	none	none	PHS; SGCN	Older coniferous forests and riparian forest habitats.	Moderate-High	Risk of loss to trapping, and the loss and fragmentation of habitat from road building and logging.
Gray Wolf, *Canis lupus*	Mammal	Terrestrial	FE	SE	PHS elsewhere in WA, not KC; SGCN	Habitat generalists. Generally found in forests and nearby open habitats characterized by lower elevations and gentle terrain, especially during winter.	Low-Moderate	Illegal killing and persecution. Human-wolf conflict resulting from livestock depredations.
Wolverine, *Gulo gulo*	Mammal	Terrestrial	FT	SC	PHS; SGCN	Alpine and subalpine forest habitats.	Moderate-High	Loss of denning habitat and foraging habitat due to climate change. Barriers or impediments to movement across Interstate 90.

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Cascade Red Fox, *Vulpes vulpes cascadensis*	Mammal	Terrestrial	none	SE	PHS; SGCN	A subspecies of Red Fox that occurs only in the montane environments of the Cascade Range in Washington. Subalpine meadows, parklands, and open forests.	High	Climate change may represent a threat from loss of higher elevation meadows and parklands.
Townsend's Big-Eared Bat*, *Corynorhinus townsendii*	Mammal	Terrestrial	none	SC	PHS; SGCN	In western Washington, inhabits lowland conifer and deciduous forests, montane conifer forest, riparian forest, and open fields. Use caves, mines, hollow trees, and built structures for roosting. Snags and large trees may be important roosts for this species.	Moderate-High	Human disturbance of roosts during breeding and wintering periods. Reclamation or vandalism of mines. Loss of snag habitat. Pesticides in agricultural areas.
Big Brown Bat, *Eptesicus fuscus*	Mammal	Terrestrial	none	none	PHS	Trees, snags, caves, mines, crevices in cliffs, bridges, and buildings (e.g., inside attics and walls).	Unknown	Protection of maternity roosts and sizeable hibernacula is a priority for conservation.
Pallid Bat, *Antrozous pallidus*	Mammal	Terrestrial	none	none	PHS	Rock crevices, holes in rock overhangs, large snags and decadent trees, caves, mines, bridges, and other open human-made structures.	Unknown	Known hibernacula and maternity roosts should be protected from human activity.
Myotis spp., *Myotis* spp.	Mammal	Terrestrial	none	none	PHS	Varies by species; many rely on large snags.	Unknown	Varies by species but loss of large decadent trees and snags is likely an important threat. White-nose syndrome.
Douglas Squirrel, *Tamiasciurus douglasii*	Mammal	Terrestrial	none	none	Protected under WAC 220-200-100	Stands of fir, pine, cedar, and other conifers.	Unknown	Locally impacted by loss of forest.
Roosevelt Elk, *Cervus canadensis roosevelti*	Mammal	Terrestrial	none	none	PHS	Productive grasslands, meadows, or clearcuts, interspersed with closed-canopy forests.	Unknown	Species of Recreational, Commercial, and/or Tribal Importance.
Mountain Goat, *Oreamnos americanus*	Mammal	Terrestrial	none	none	PHS	Alpine and subalpine environments.	High	Population in decline.
Pika, *Ochotona princeps*	Mammal	Terrestrial	none	none	Protected under WAC 220-200-100; SGCN	Live year-round in talus fields that are surrounded by meadows or forests, usually located above 8,200 feet.	High	Sensitive to temperatures above 78°F and relies on winter snowpack to insulate them from extreme cold conditions.
Northern Flying Squirrel, *Glaucomys sabrinus*	Mammal	Terrestrial	none	none	Protected under WAC 220-200-100	Deciduous and coniferous forests. Make their homes in snags, woodpecker holes, nest boxes, and abandoned nests of birds and other squirrels.	Unknown	Loss of snags.
Hoary Marmot, *Marmota caligata*	Mammal	Terrestrial	none	none	Protected under WAC 220-200-100	High elevations above timberline in the sub-alpine and alpine zones where rockslides or loose boulder piles occur next to moist meadows or other lush herbaceous vegetation.	High	Reduced snow cover (snow droughts). Extreme heat events.

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Townsend's Chipmunk, *Tamias townsendii*	Mammal	Terrestrial	none	none	Protected under WAC 220-200-100	Inhabit dense forests and brush thickets and live in underground burrows.	Unknown	Old-growth stands appear to provide better habitat than young (30–60 year old) second-growth stands. Population trend unknown.
Killer (Orca) Whale, *Orcinus orca*	Mammal	Marine	FE	SE	PHS; SGCN	All marine waters.	Southern residents: Moderate-High Transient/ offshore: Low-Moderate	Declining populations linked to a variety of factors, including depleted populations of Chinook salmon, noise and disturbance from marine vessels, and chemical contaminants in water and food supply.
Gray Whale, *Eschrichtius robustus*	Mammal	Marine	FE	SS	PHS; SGCN	Marine nearshore and deeper water during migration.	Low-Moderate	Oil spills.
Harbor Porpoise, *Phocoena phocoena*	Mammal	Marine	none	SC	PHS	Marine waters throughout Puget Sound.	Low-Moderate	Entanglement in fisheries gear (netting, pots, and traps).
Dall's Porpoise, *Phocoenoides dalli*	Mammal	Marine	none	none	PHS	Marine, including nearshore.	Unknown	Vulnerable aggregations.
Harbor Seal, *Phoca vitulina*	Mammal	Marine	none	none	PHS	Marine, including nearshore.	Unknown	Vulnerable aggregations.
California Sea Lion (haul-outs), *Zalophus californianus*	Mammal	Marine	none	none	PHS	Marine, including nearshore.	Unknown	Vulnerable aggregations.
Steller Sea Lion, *Eumetopias jubatus*	Mammal	Marine	none	none	PHS	Marine, including nearshore.	Moderate	Alteration of marine food webs through changes in coastal upwelling patterns, warmer water temperatures, ocean acidification, changes in prey availability (including species range shifts), and changes in other ecological processes.
Larch Mountain Salamander, *Plethodon larselli*	Amphibian	Terrestrial	none	SS	PHS; SGCN	Associated with talus, scree, gravelly soils, and other areas of accumulated rock where spaces exist between the rock and soil. Steep slopes are also an important habitat feature. Occupied rocky substrates in non-forested areas are usually north facing and nonvascular plants, especially mosses, dominate the ground cover. In some areas of the Cascade Mountains, inhabit old-growth coniferous forests without significant exposed rocky areas. In all of these habitats, important microhabitats include woody debris, leaf litter, and rocks.	High	Status is based on the small global range, narrow environmental specificity, and concern that there is not adequate protection for this species' specialized habitat of rocky accumulations and talus. Any ground-disturbing activity or land use that changes the moisture regimes and permeability of inhabited rocky substrates, such as overstory tree removal and gravel removal, may threaten populations. In addition, sedentary habits and specific habitat requirements likely hinder dispersal and colonization to new areas as well as limiting gene flow between populations.
Oregon Spotted Frog, *Rana pretiosa*	Amphibian	Terrestrial	FT	SE	PHS; SGCN	This species is highly aquatic and rarely found away from water. Extant populations occur in large, shallow wetland systems associated with a stream or stream network. Breeding habitat is in seasonally flooded margins of wetlands and areas of extensive shallows (approximately six to eight inches deep). Egg masses are	Moderate-High	Human-caused stressors include wetland loss and alteration, loss of disturbance processes that set back succession, introduction of non-native/invasive flora and fauna, and alteration of creek and river channels. Only six watersheds are currently known to be occupied in Washington. Within a watershed, most breeding populations are small and many are isolated from other breeding populations. Require breeding sites in shallow water with short

Common and Scientific Name	Animal Type	Marine or Terrestrial Use in King Co.	Federal Status	State Status	Special Designations	Habitat	Risk from Climate Change	Justification and/or Limiting Factors
						placed in areas where they receive little or no shading from vegetation. Beaver-impounded systems appear to provide many of the habitat requirements of this species.		vegetation and full sun exposure. This habitat type is rapidly lost to invasive grasses without management or restoration to native flora.
Northern Red-legged Frog, *Rana aurora*	Amphibian	Terrestrial	none	none	none	Found in lowland (mostly below 3000 feet in Washington) moist forested habitats with access to suitable breeding sites, which include still-water bodies that persist until at least July at low elevations, later at high elevations.	Unknown	Although widespread throughout its historical habitat in western Washington, declines in British Columbia, Oregon, and California cause concern.
Western Toad, *Bufo boreas*	Amphibian	Terrestrial	none	SC	PHS; SGCN	Occurs in a variety of terrestrial habitats, including forests. Breeding waters are usually permanent and include wetlands, ponds, lakes, reservoir coves, and the still-water off-channel habitats of rivers as well as river edges.	Moderate	Road mortality. Loss of upland habitat through the development on shorelines and around waterbodies used for breeding. Habitat alteration and degradation.
Northwestern Pond Turtle, *Actinemys marmorata*	Reptile	Terrestrial	Petitioned for listing	SE	PHS; SGCN	Ponds and lakes. Nest in grasslands and open woodland around ponds.	Moderate	American Bullfrogs and introduced warm-water fish. Habitat loss, degradation, and fragmentation. Lack of suitable habitat for reintroduction sites. Invasive tall vegetation overgrowing nesting habitats and uplands.
Western Fence Lizard, *Sceloporus occidentalis*	Reptile	Terrestrial	none	none	none	Habitats include grassland, woodland, coniferous forest, upper beach driftwood along Puget Sound, and farmland. Tend to avoid dense moist forests.	Unknown	Beach driftwood at risk from bulkheading.
Western Pearlshell Mussel, *Margaritifera falcata*	Mollusk: freshwater mussel	Terrestrial	none	none	SGCN	Inhabits cold creeks and rivers with clear, cold water with low velocities and stable substrates, and are frequently found in eddies and with sea-run salmon or native trout. Tend to congregate in areas with boulders and gravel substrate with some sand, silt, and clay. This species appears to be intolerant of sedimentation.	Moderate	Degraded water quality resulting from development and unsustainable agriculture. Many historical sites no longer support mussels, and many local populations no longer successfully reproduce.
Western Ridged Mussel, *Gonidea angulata*	Mollusk: freshwater mussel	Terrestrial	none	none	SGCN	Inhabits cold creeks, rivers, and lakes from low to mid-elevations with substrates that vary from gravel to firm mud, and include at least some sand, silt, or clay. Generally associated with constant flow, shallow water (less than 10 feet in depth), and well-oxygenated substrates.	Moderate	Degraded water quality resulting from development and unsustainable agriculture. Many historical sites no longer support mussels, and many local populations no longer successfully reproduce.
Oregon Floater, *Anodonta oregonensis*	Mollusk: freshwater mussel	Terrestrial	none	none	none	Found more commonly in ponds, lakes, and reservoirs but can also occur in low gradient reaches of streams. They can be found in silty substrates and sandbars at stream confluences.	Unknown	The Oregon Floater is likely affected by the same factors that affect other western Anodonta, including water diversion, dams, pollution, and invasive species.

Common and Scientific Name	Animal Type	Marine or Terrestrial Use in King Co.	Federal Status	State Status	Special Designations	Habitat	Risk from Climate Change	Justification and/or Limiting Factors
Blue-gray taildropper, *Prophysaon coeruleum*	Mollusk: slug	Terrestrial	none	SC	PHS; SGCN	Moist, coniferous or mixed-wood forests of varying age classes. Associated with moist forest floor conditions and abundant coarse woody debris, particularly of bigleaf maple.	Unknown	Often associated with older forests and required microhabitat features, including abundant coarse woody debris or other cover, a deep forest litter layer, and shaded, moist forest floor conditions.
Olympia Oyster, *Ostrea lurida*	Mollusk: clams, mussels, and oysters	Marine	none	none	PHS; SGCN	Marine: water depths up to 230 feet and water temperature range of 43 to 68°F.	High	Likely sensitive to a number of climate factors, including declines in salinity, oxygen, and pH. Species of Recreational, Commercial, and/or Tribal Importance.
Butter Clam, *Saxidomus giganteus*	Mollusk: clams, mussels, and oysters	Marine	none	none	PHS	Marine shorelines: sand, gravel, or cobble. Occur from the mid-intertidal to subtidal zones.	Unknown	Vulnerable aggregations. Species of Recreational, Commercial, and/or Tribal Importance.
Native Littleneck Clam, *Leukoma staminea*	Mollusk: clams, mussels, and oysters	Marine	none	none	PHS	Marine shorelines: buried four to six inches deep in cobble, gravel, sand, or mud substrate. Normally occur in the mid-intertidal zone.	Unknown	Vulnerable aggregations. Species of Recreational, Commercial, and/or Tribal Importance.
Dungeness Crab, *Cancer magister*	Shellfish	Marine	none	none	PHS	Marine shorelines: eelgrass beds and prefers sandy or muddy substrates.	Unknown	Vulnerable aggregations. Species of Recreational, Commercial, and/or Tribal Importance.
Pandalid Shrimp, *Pandalus* species	Shellfish	Marine	none	none	PHS	Marine: varied.	Unknown	Vulnerable aggregations. Species of Recreational, Commercial, and/or Tribal Importance.
Beller's Ground Beetle, *Agonum belleri*	Arthropod: beetle	Terrestrial	none	SC	PHS; SGCN	Occurs only in low- to mid-elevation (less than 3,280 feet) Puget Lowland Sphagnum bogs.	Moderate-High	Occurs only in low to mid-elevation (less than 3,280 feet) Puget Lowlands Sphagnum bogs. Small number of isolated populations, highly limited distribution and range, and dependence on specialized, restricted, and threatened habitats.
Hatch's Click Beetle, *Eanus hatchii*	Arthropod: beetle	Terrestrial	none	SC	PHS; SGCN	Sphagnum bogs between 0 and 1640 feet in elevation.	Moderate-High	Sphagnum bogs between 0 and 1,640 feet in elevation. Small number of isolated populations, highly limited distribution and range, and use of specialized, highly restricted, and threatened Sphagnum moss bog habitat.
Pacific Clubtail, *Phanogomphus kurilis*	Arthropod: dragonfly	Terrestrial	none	SC	PHS; SGCN	Large ponds and lakes in western Washington.	Moderate-High	Riparian vegetation; cool water temperatures. Small number of isolated populations and continued threats to aquatic habitats.
Western Bumble Bee, *Bombus occidentalis*	Arthropod: bee	Terrestrial	Under review	SC	PHS; SGCN	Depend on habitats with rich floral resources throughout the nesting season. Bumble bees require above- and below-ground micro-sites for overwintering and nesting, including logs, stumps, and abandoned rodent and ground-nesting bird nests.	Moderate-High	Facing high or extremely high risk of extinction. Requires habitat free of pathogens and insecticides.
Johnson's Hairstreak, *Mitoura johnsoni*	Arthropod: butterfly/moth	Terrestrial	none	SC	PHS; SGCN	Old-growth forests from 100 to 2,500 feet in elevation that contain western hemlock and western dwarf mistletoe.	Moderate-High	Western dwarf mistletoe (*Arceuthobium campylopodum*), a plant that parasitizes old-growth western hemlock trees.
Valley Silverspot, *Speyeria zerene bremnerii*	Arthropod: butterfly/moth	Terrestrial	none	SC	PHS; SGCN	Westside prairie: native grasslands.	Low-Moderate	In the south Puget Sound region: low-elevation, short-stature grasslands.

Appendix B: Critical Areas Screening Trends and Housing Development

King County's Department of Local Services (DLS) processes housing development permit applications and enforces King County Code (K.C.C.) in unincorporated King County (UKC). The Growth Management Act (GMA) requires that King County protect critical areas. The GMA also requires that the County plan for and accommodate a variety of housing types and that permit applications be processed in a fair and timely manner (see Section 1.1). King County permitting processes must also allow for reasonable use of private property (Section 3.2.3).

While preparing updates to critical areas protections, King County reviewed 3 years of DLS permit data to determine what percentage of processed permits include a critical areas condition. Further analysis was completed to determine what percentage of these critical areas conditions were related to riparian areas (see Section 5) or wetland buffers (see Section 4). Table B.1 summarizes results of this analysis.

Table B.1 Critical Areas screening trends and housing development.

	Count	Percent
Processed Housing Permits (2019-2021)	933	100%
Any Critical Area Condition on Permit	370	40%
Riparian Area *or* Wetland Buffer Condition	270	29%
Wetland Buffer Condition	197	21%
Riparian Area Condition	158	17%
Riparian Area *and* Wetland	85	9%