SALMON-SAFE INC.

REPORT OF THE EVALUATION TEAM REGARDING SALMON-SAFE CERTIFICATION OF THE CITY OF SHORELINE, WASHINGTON

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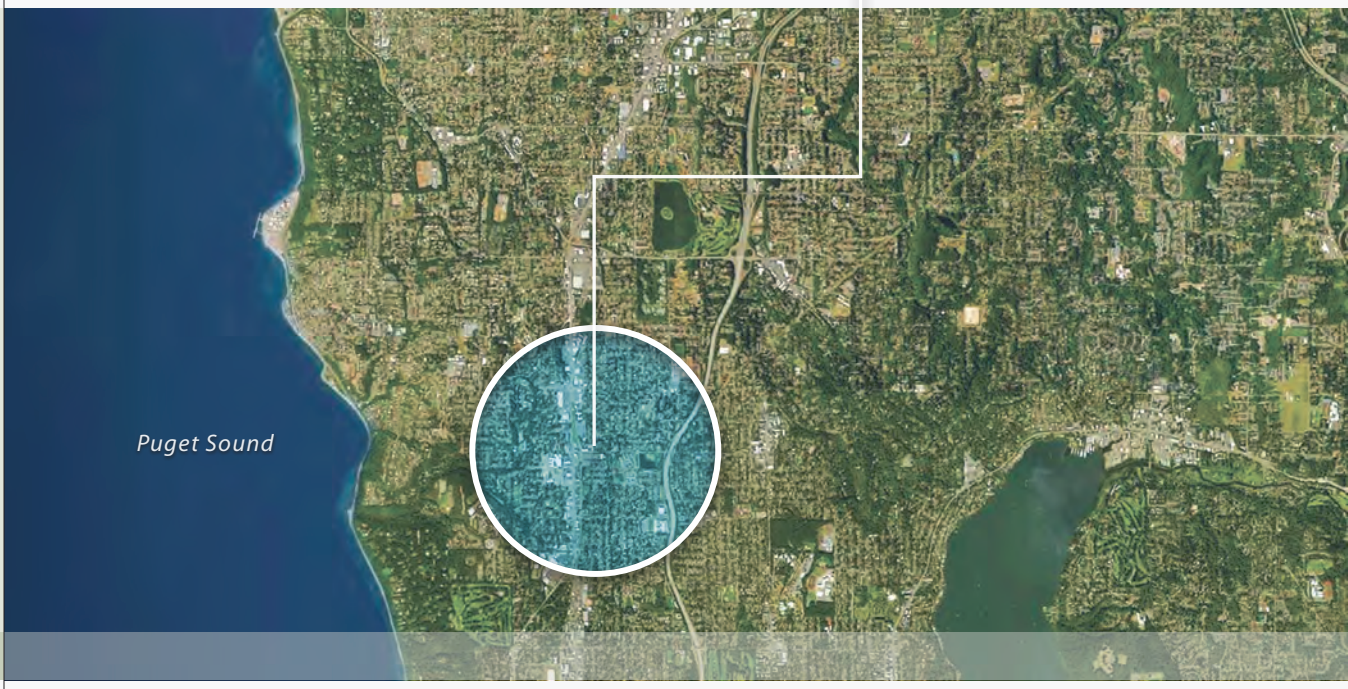

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RECOMMENDATION SUMMARY

The Salmon-Safe science team is pleased to recommend that the City of Shoreline, Washington, be certified Salmon-Safe, subject to the conditions detailed in this report. The City has demonstrated a commitment to environmental sustainability and stewardship through its *Environmental Sustainability Strategy*, *Climate Action Plan*, and *Deep Green Incentive Program*, thereby serving as a regional and national example of environmental innovation by a municipality.

Background

In 2000, Salmon-Safe expanded beyond agricultural land certification to apply the Salmon-Safe assessment and certification process to land and water management within the urban realm. This initiative significantly advanced restoration efforts in urbanized watersheds by developing urban aquatic protection guidelines and a citizen education campaign throughout the Pacific Northwest. Working closely with independent scientists and technical experts, Salmon-Safe developed a comprehensive certification framework oriented towards reducing impacts on water quality and fish habitat from urban land and water management practices. Since 2005, more than 50 urban sites have received Salmon-Safe certification in Oregon, Washington, and British Columbia.

In 2016, Salmon-Safe completed a three-year, phased assessment of the key City of Portland operations and facilities that impact the urban Willamette River watershed. Following on more than a decade of Salmon-Safe certification from Portland's 10,000 acre system of parks and natural areas, the citywide Salmon-Safe project included Bureau of Environmental Services, Water Bureau, Bureau of Transportation, Fire and Rescue, Fleet Services, Procurement and Facilities Services. In October 2016, Portland's Mayor and City Council formally committed to certification conditions, resulting in the first Salmon-Safe city.

The City of Shoreline is the first Washington city to seek Salmon-Safe certification. To evaluate watershed impacts from Shoreline's facilities, infrastructure and operations, Salmon-Safe convened the same independent science team that evaluated the City of Portland. Beginning in spring 2018, the science team conducted a comprehensive analysis of the City's environmental programs and policies.

The City's *Climate Action Plan* (CAP), adopted in 2013, established a commitment to reduce community greenhouse gas emissions. To fulfill one of the priority recommendations of the CAP, the City adopted the *Deep Green Incentive Program* (DGIP) in 2017 to encourage the highest standard for green building within the city to address greenhouse gas emissions from new buildings. During the development of the DGIP, the City adopted Salmon-Safe as a companion certification for the International Living Future Institute's *Net Zero Energy Building Program*. This dual certification will require projects to consider both innovative energy and stormwater solutions. The City also decided to pursue city-wide Salmon-Safe certification and to demonstrate commitment to environmental stewardship, providing leadership to the building development community in implementing environmentally sustainable practices.

OVERVIEW OF CITY OF SHORELINE FACILITIES AND POLICIES

The City of Shoreline covers 11.74 square miles at the northwestern edge of King County and includes more than 53,000 residents. Before becoming a city in 1995, The City of Shoreline was part of unincorporated King County. Shoreline is generally bounded by the City of Lake Forest Park to the east, the City of Seattle to the south, Puget Sound to the west, and Snohomish County to the north (including the Cities of Mountlake Terrace and Edmonds, and the Town of Woodway). It is primarily residential with more than 70 percent of the households being single-family residences.

City Hall
City of Shoreline, Washington
(architectural rendering, courtesy OPUS Northwest, LLC)

Shoreline has more than 400 acres of park land and open space, arrayed over 34 properties, nine of which also include athletic fields. The City has placed a high priority on preserving trees, which cover approximately 31% of the city surface area. Outside of the parks, other recreational activities take place primarily in two recreation centers, a community pool and a dedicated bike/pedestrian Interurban Trail that traverses the city in a north-south direction. Other municipal properties include City Hall and five fire stations.

In addition to Puget Sound, waterbodies in the City of Shoreline include nine streams, two lakes and two wetlands that include standing water for the majority of the year. Watersheds in the western half of the city (Middle Puget Sound and Boeing Creek basins) drain to Puget Sound while watersheds in the eastern half of the city (McAleer Creek, Thornton Creek, Lyons Creek, and West Lake Washington basins) drain to Lake Washington, through either Lake Forest Park or Seattle. All the streams include one or more barriers to fish passage, but salmonid use has been documented on McAleer Creek and, to a much lesser extent, on short reaches of other streams as well.

The City of Shoreline follows a council-manager form of governance whereby seven elected City Council Members determine policies that are responsive to

citizens' needs and wishes and the City Manager that is hired by the City Council implements those policies and oversees all City departments. Departments that oversee activities and facilities that pertain to Salmon-Safe include Parks, Recreation & Cultural Services; Planning & Community Development; Administrative Services; and Public Works. The Shoreline Surface Water Utility is responsible for managing stormwater drainage and protecting surface water quality. Drinking water is provided by Seattle Public Utilities in the western half of the city (generally west of Interstate 5) and by the North City Water District in the eastern half of the city. Wastewater services are provided by the Ronald Wastewater District. The City has established goals to assume and/or acquire the assets of these utilities in the future.

The City of Shoreline adopted an *Environmental Sustainability Strategy* in 2008. Of the 10 key program strategies, five are particularly relevant to Salmon-Safe, including:

(1) develop and integrate the sustainability program into all city functions;

(2) develop a residential green building program;

(3) build and support a sustainability leadership structure;

(4) adopt a clear and aggressive green building policy; and

(5) structure and prioritize natural resources enhancement.

An interdepartmental Green Team was tasked with implementing the *Sustainability Strategy*. By 2013, when Shoreline's *Climate Action Plan* was completed, the Green Team had completed 42 of the 50 recommendations from the *Sustainability Strategy*.

THE ASSESSMENT PROCESS

The Salmon-Safe assessment process consisted of a gap analysis and field reviews, culminating in a certification report (this document). These tasks were conducted by Salmon-Safe staff and an interdisciplinary team of scientists (the Science Team) with expertise in aquatic ecosystems, innovative stormwater management, land management, and integrated pest management (IPM), as summarized below.

Science Team

The Science Team for this project was composed of Tad Deshler, Dr. Richard Horner, Peter Bahls, and Carrie Foss. This same team conducted the citywide assessment for the City of Portland.

Tad Deshler: *Environmental Scientist, Coho Environmental*

Mr. Deshler's practice focuses on environmental assessment and impact analysis, with particular focus on the interaction between built and natural environments. Much of his project work has centered around aquatic sites, or at the interface between aquatic sites and the adjacent upland environments, where understanding the transport mechanisms that connect upland and inwater environments is paramount. Tad earned a BA degree in Aquatic Biology from the University of California at Santa Barbara and an MS degree in Animal Science from the University of California at Davis. Tad also has specialized expertise in sediment assessment and management, risk assessment, and chemical transport and fate studies.

Dr. Richard Horner: *Stormwater Management Expert, University of Washington*

Dr. Horner received engineering BS and MS degrees from the University of Pennsylvania, and a PhD in civil and environmental engineering from the University of Washington in 1978. Following 13 years of college teaching and professional practice, he joined the University of Washington research faculty in 1981, where he held appointments in Civil and Environmental Engineering, Landscape Architecture, and the Center for Urban Horticulture. His principal research interests involve analyzing the effects of human activities, especially in urban areas, on freshwater ecosystems and solutions that protect these resources. Dr. Horner founded the Center for Urban Water Resources Management in 1990 to advance applied research and education in these areas. He is now emeritus research associate professor and splits his time between private practice and some continuing university research.

Peter Bahls: *Aquatic Ecologist and Salmon Biologist, Northwest Watershed Institute*

Mr. Bahls received an MS in Fisheries Science and Aquatic Ecology from Oregon State University and a BS in Environmental Studies-Biology from Middlebury College, Vermont. He worked for six years as the salmon habitat biologist for the Port Gamble S'Klallam Tribe followed by three years as the principal fish biologist for David Evans and Associates. In 2001, he founded Northwest Watershed Institute, a non-profit organization that provides scientific and technical assistance in watershed assessment and restoration.

Carrie Foss: *Urban IPM Director, Washington State University (WSU) Puyallup*

Ms. Foss manages the WSU IPM Certification Program and the Pesticide Safety Education Program in Western Washington. Landscape maintenance personnel are trained in plant problem diagnosis, integrated pest management, personal safety and environmental protection through lectures and workshops. Carrie earned a BS degree in Botany from the University of Washington and

an MS degree in Plant Pathology from the University of Hawaii. Her background includes plant problem diagnosis, research on beneficial microorganisms and management strategies for turf and ornamental diseases.

Kirk Petersen, City of Shoreline Parks Superintendent, leads the Salmon-Safe science team through Kruckeberg Botanic Garden.

Gap Analysis

The gap analysis was conducted from February to March 2018 and consisted of interviews with key staff identified by the City's Green Team, followed by a review by the Science Team of City policies and documents for consistency with relevant Salmon-Safe standards. A memorandum was prepared that summarized the findings. See Appendix A for a list of staff interviewed, documents reviewed, and Appendix B for the full gap analysis memo. The gap analysis review identified many areas of consistency with Salmon-Safe standards as well as concerns and opportunities to improve environmental performance across City operations, as summarized below:

Areas of alignment with Salmon-Safe

- Natural resource-related policies and activities are largely consistent with Salmon-Safe standards. The City has done a good job inventorying its resources and have some clearly stated policies about preserving and restoring natural resources.

- Excellent information has been collected and collated in the City's basin plans.
- The *Pesticide-Free Parks Initiative* and strategic planning for parks and open spaces are commendable and highly consistent with Salmon-Safe standards.
- The *CAP* and *Environmental Sustainability Strategy* include a commitment to investigate opportunities for rainwater harvesting and greywater reuse, as well as high-efficiency irrigation controls.
- The City is using the latest editions of the Department of Ecology's *Stormwater Manual for Western Washington* and *Puget Sound Low Impact Development Manual* with modifications for increased stringency as outlined in Shoreline's Engineering Development Manual.
- The *Green Stormwater Infrastructure Program* has facilitated valuable outreach to residents and a number of commendable projects between 2011–2017, including twelve neighborhood bioretention facilities plus two more awaiting grant funding, and a system of bioretention units of various configurations installed during the Aurora Avenue Corridor Project.

Opportunities for improvement

- Demonstrate that the capital projects underway are part of a comprehensive approach that is effectively reducing watershed impacts over time, taking into account continued development within the city.
- Increase the frequency of water quality monitoring efforts needs to effectively gauge success in meeting objectives and overall goals. In tandem, assess overall water quality trends since the start of data collection began in 2003 along with genetic testing to determine the source(s) of fecal coliform bacteria.
- Conduct a riparian habitat condition survey as well as fish surveys to document distribution of species during all life stages.
- Connect stormwater management policies to specific goals related to watershed impact.
- City staff provided responses and additional information related to topics raised in Salmon-Safe's memo in April 2018.

Field Reviews

The Science Team conducted field reviews of a representative selection of sites and facilities on May 14–15, 2018, accompanied by key City staff on a rotating basis, including:

Kirk Peterson, *Park Maintenance Superintendent*
John Featherstone, *Surface Water Engineer*
Miranda Redinger, *Senior Planner*
Nora Daley-Peng, *Senior Transportation Planner*
Tony Colinas, *Senior Park Maintenance Staff*
Melissa Ivancevich, *Surface Water Quality Specialist*
Jesse Peterson, *Wastewater Manager*
Brent Proffitt, *Wastewater Utility Specialist*

Above: John Featherstone (left) and Nora Daley-Peng (right) of City of Shoreline Public Works lead the Salmon-Safe science team on a walking tour of a green street demonstration project on 17th Avenue NE.

Above: The Salmon-Safe science team visits Richmond Beach Saltwater Park, one of the few locations in the city with public access to Puget Sound shoreline.

Multiple natural areas were visited and multiple examples of green stormwater infrastructure were observed (see Table 1, page 9). Additionally, maintenance practices and equipment were observed and discussed while visiting Hamlin Yard, a facility shared by Parks and Public Works departments and the North Maintenance Facility, which is under consideration for expansion to consolidate all Public Works operation at a single location. A representative wastewater lift station in the Innis Arden neighborhood was also visited. Throughout the site visits, the Science Team asked many questions about specific locations and also about citywide practices of the City staff accompanying them.

Peter Bahls inspects a culvert at Shoreview Park.

John Featherstone (right) gives the Science Team an overview of the Hidden Lake Dam Removal project.

Table 1. Sites Visited during Field Review

Site Name	Site Type	Visit Type
25th Avenue NE Flood Reduction Project	Stormwater Infrastructure	Comprehensive
Boeing Creek Park	Park	Comprehensive
Brugger's Bog Park	Park	Comprehensive
Cromwell Park	Park	Comprehensive
Green Streets Demonstration Project (17th Ave NE between NE 145th-150th Streets)	Stormwater Infrastructure	Comprehensive
Hamlin Park	Park	Visual inspection
Hamlin Yard	Operations	Comprehensive
Hidden Lake Dam Removal	Natural Area	Comprehensive
Hillwood Park	Park	Visual inspection
Kayu Kayu Ac Park	Park	Visual inspection
Kruckeberg Botanic Garden	Natural Area	Comprehensive
Lift Station 1	Operations	Comprehensive
North City Park	Park	Visual inspection
North Maintenance Facility / Fueling Depot	Operations	Comprehensive
Paramount School Park	Park	Visual inspection
Richmond Beach Community Park	Park	Visual inspection
Richmond Beach Saltwater Park	Park	Comprehensive
Ronald Bog Park	Park	Comprehensive
Shoreview Park	Park	Comprehensive
South Woods Park	Park	Comprehensive
Sunset Park (with Community Garden)	Park	Visual inspection
Trail Along the Rail	Natural Area	Comprehensive
Twin Ponds Park	Park	Comprehensive

At the end of the field review, the Science Team, supported by Salmon-Safe staff, met to review the certification criteria against notes taken during the process. On June 13, 2018, the team and Salmon-Safe staff finalized conditions for certification and reached a final unanimous decision on certification.

GENERAL OBSERVATIONS AND CONCLUSIONS

The Science Team took note of a strong organizational motivation and enthusiasm for environmentally sustainable policies and practices, as evidenced by their *Environmental Sustainability Strategy* (2008), *Climate Action Plan* (2013) and the *Deep Green Incentive Program* (2017). The latter program encourages the highest standards for green building and site ecological function, including LEED® and Salmon-Safe. The City Hall building, completed in 2009, was awarded LEED® Gold status.

The City's natural resource-related policies and activities are largely consistent with Salmon-Safe standards. The City has done a good job inventorying its resources, particularly in the numerous basin plans that have been completed. It has also clearly stated policies related to preserving and restoring natural resources. Some improvements should be made in organizing the existing inventory information to make a stronger and stream- or watershed-specific connection to salmon. This will facilitate the prioritization of capital projects through the lens of salmon protection.

The City has an ongoing water quality monitoring program and conducted stream monitoring for benthic invertebrates in 2003 and 2007. The conclusions from the most recent water quality assessment report indicate that the city's waterbodies are moderately to severely impacted by stormwater. While this may be a valid conclusion, the water quality monitoring program is not specifically designed to evaluate the impacts from stormwater input or provide an adequate basis for assessing potential changes in water quality over time. Improvements to the water quality monitoring program should be made, as discussed in more detail in the Certification Conditions section below. In addition, the biological monitoring program should be restarted.

The *Pesticide-Free Parks Program* is commendable and highly consistent with Salmon-Safe goals, as is the strategic planning in the *Parks, Recreation and Open Space Master Plan*. Some clarification on exceptions to the pesticide-free practices should be made in the updated IPM plan.

The *Climate Action Plan* and *Environmental Sustainability Strategy* include a commitment to investigate opportunities for rainwater harvesting and greywater reuse. The *Climate Action Plan* also indicates that high-efficiency irrigation controls are used routinely, particularly in the Aurora corridor and in right-of-ways (ROWs). The City has made large reductions in the amount of water being used for irrigation, resulting in significant cost savings. Additional planning to achieve further reductions is warranted.

The City is using the latest editions of the Department of Ecology's *Stormwater Manual for Western Washington* and *Puget Sound Low Impact Development Manual* with modifications for increased stringency as outlined in Shoreline's *Engineering Development Manual*, including:

- requiring infiltration where conditions are appropriate, with thorough investigation of soil and subsurface properties
- list of numerous criteria to be addressed in project layout and site design based on solid low-impact design principles
- requiring a stormwater pollution prevention plan for construction projects of any type and size
- more control of construction exits
- seasonal (wet season) Suspension Plans for some larger construction projects
- all runoff treatment at least at the level of the Enhanced Treatment Menu
- rescinds allowing existing land cover as the basis for stormwater management design where there has been at least 40 percent impervious land cover since 1985 and instead requires historic cover as the basis

It is recommended that the City create a checklist to be used for new, expanded, and redeveloped City facilities that reflects more stringent stormwater guidelines, as discussed below in the Recommendations section.

The *Green Stormwater Infrastructure Program* has facilitated valuable outreach to residents. A number of commendable projects have been completed between 2011–2017, including twelve neighborhood bioretention facilities plus two more awaiting grant funding, and a system of bioretention units of various configurations were installed during the Aurora Avenue Corridor Project. The *Soak it Up* rebate program being implemented by the Surface Water Utility should also incentivize green stormwater infrastructure on the scale of individual residences.

The City's *Snow Removal and Ice Control Plan* is not currently consistent with Salmon-Safe standards and should be updated. Specific recommendations are discussed below in the Certification Conditions section.

The City is making plans to double the miles of sidewalk within the city and recently completed the *Sidewalk Prioritization Plan* to evaluate alternative sidewalk designs, including incorporation of green stormwater infrastructure. The Science Team is highly supportive of alternatives that include features such as the complete street pilot project on 17th Avenue NE.

The Hamlin Yard appears well-organized and follows practices that are consistent with Salmon-Safe standards. The North Maintenance Facility, which was acquired by the City from King County in 2013, includes acceptable facilities related to fueling, but is in need of upgrades related to stormwater management, as discussed below in the Certification Conditions section.

RECOMMENDATIONS AND DISCUSSION

Certification Recommendation: The Science Team recommends that the City of Shoreline be certified as Salmon-Safe subject to two pre-conditions and 12 conditions listed below. The conditions are organized by certification standard categories. All conditions are subject to annual verification by Salmon-Safe. Timelines for accomplishing objectives are measured from the official date of this Salmon-Safe conditional certification.

Pre-Condition 1: *Ensure environmental regulatory compliance*

The City of Shoreline shall provide a signed statement to Salmon-Safe stating that it is not in violation of national, state or local environmental laws, or associated administrative rules or requirements as determined by a regulatory agency in an enforcement action, per General Standard A.1.

TIMELINE

Compliance is a pre-condition of certification, then subject to annual verification by Salmon-Safe.

Pre-Condition 2: *Commitment to adhere to Salmon-Safe standards for expansion or redevelopment*

The City of Shoreline shall provide a signed statement to Salmon-Safe confirming that it **will develop** a mechanism to ensure that all new, expanded, and redeveloped City facilities shall meet Salmon-Safe standards for urban development, including model permanent (see Appendix B) and construction-phase (see Appendix F of the Urban Standards) stormwater guidelines or a comparable LEED standard related to stormwater performance. Included in this commitment is an agreement to avoid the use of uncoated zinc and copper for any new building cladding.

TIMELINE

Compliance is a pre-condition of certification, then subject to annual verification by Salmon-Safe.

Condition 1: *Apply Salmon-Safe model stormwater guidelines to new, expanded, and redeveloped City facilities*[1]

The City of Shoreline has incorporated amendments to the Department of Ecology's *Stormwater Manual for Western Washington* in their *Engineering Development Manual*. These amendments effectively increase the stringency by which the City manages stormwater for all new developments, both City-owned and private. Salmon-Safe has developed model stormwater management guidelines for urban development or redevelopment, which are more stringent than Ecology's manual (see Appendix B) and differ from that manual by the inclusion of the goal of restoring the predevelopment hydrology at a given project site.

The City of Shoreline shall create a checklist based on Salmon-Safe's *Model Stormwater Management Guidelines* to supplement the *Engineering Development Manual* for application to City projects that incorporates Salmon-Safe guidelines for stormwater management (Appendix B). By doing so, the City will create a mechanism for leading the private sector by example over time.

TIMELINE

The companion checklist shall be created and provided to Salmon-Safe for review within three years. The guidelines and procedures included in the document should be implemented on new and redeveloped City facilities within five years.

[1] For the purposes of this Condition, Salmon-Safe refers to the same project size thresholds as the Department of Ecology's *Stormwater Manual for Western Washington*.

Condition 2: *Incorporate green stormwater infrastructure into the standard roadway cross-section to identify preferred low-impact development techniques for Right-of-Ways (ROWs)*

The City of Shoreline has adopted a *Complete Streets* policy that requires development of a transportation system that allows for safe and convenient travel for all users. The City has completed pilot projects that included vegetation in the amenity zone that provided stormwater management and urban habitat. Although the original *Complete Streets* concept is focused on facilitating multi-modal transportation, there is an opportunity for the City to incorporate green stormwater infrastructure elements into City standards for use in the rights-of-way (ROW).[2]

Therefore, the *Engineering Development Manual* shall be revised to reflect this expanded use of the ROW to include green stormwater infrastructure. In addition, the City shall incorporate such green stormwater infrastructure elements into all newly constructed sidewalks, as feasible.

TIMELINE

The City shall, within two years of certification, revise the *Engineering Development Manual*.

[2] Other national organizations, such as the National Association of City Transportation Officials *https://nacto.org/ publication/urban-street-stormwater-guide/streets-are-ecosystems/complete-streets-green-streets/* share this viewpoint.

Condition 3: *Improve stormwater management at North Maintenance Facility*

The stormwater management facilities and practices at the City's North Maintenance Facility do not appear to have been modified since the facility was acquired from King County in 2013 and do not currently meet Salmon-Safe standards. Stormwater from the facility is collected in a series of catch basins, which then ultimately discharge untreated to Ballinger Creek. Galvanized metal parts are stored in the open, as are bark, sand and gravel. Stormwater that comes into contact with these materials is likely to include substances that are detrimental to aquatic life in the creek.

Salmon-Safe understands that this property is undergoing a planned multi-phase redevelopment and repurposing over a several year period in the future, which will include improved stormwater management. The City will take steps to have the existing facilities operated, and the proposed new facilities designed and built in alignment with Salmon-Safe guidelines.

Specifically, the City will improve its material storage and handling practices at the site, including covering erodible and potentially turbidity causing material (e.g. bark, sand, and gravel) and galvanized metal pipes and parts, by placing them under tarps in the short term. New facilities will meet the Salmon-Safe guidelines that are incorporated in the design and construction requirements in place at the time of design and construction.

TIMELINE

The improvements to the current site facilities related to preventing the introduction of pollutants to stormwater through uncovered bulk materials and metal parts shall be implemented within one year of certification. Design documents for the first project of the permanent improvements to the North Maintenance property shall be provided to Salmon-Safe for review as soon as they are available.

Condition 4: *Improve inventory of stormwater infrastructure*

The City has done a good job creating a GIS inventory of stormwater infrastructure, including hard structures, such as catch basins and manholes, but also green stormwater infrastructure features such as bioswales, rain gardens, and permeable pavement. However, it does not appear that this GIS layer includes data for a drainage area assessment that would allow calculations of the drainage areas being managed by various stormwater management techniques. The collection and analysis of such data is important for tracking improvements in stormwater management and prioritizing stormwater management projects.

Per one of the performance requirements of Standard U.1.1, the City shall incorporate a drainage area assessment into the existing GIS layer of stormwater infrastructure that would enable a demonstration of reduction of watershed impacts over time.

TIMELINE

The City shall update the existing GIS layer in the next *Surface Water Master Plan* update and submit it to Salmon-Safe for review as soon as it is available.

Condition 5: *Assess water conservation efforts*

The City of Shoreline has done a good job at reducing the amount of water used for irrigation, as described above under General Observations.[3] The City of Shoreline shall continue its annual review and assessment of its efforts at conserving water and identify targets for additional water conservation in the Park system.

The City will expand this annual review, assessment, and identification of targets for additional water conservation practices to include the Public Works and Facility managed properties. Included in this expansion will be documentation of existing water use trends across City properties, areas targeted for water use reduction and methods, and identification and explanation of areas where water use has significantly increased. This effort will be conducted every two years in conjunction with the City's biannual budget development process.

TIMELINE

Within two years of certification, the City will provide an assessment of water use and documented water savings associated with recent water conservation efforts for Parks Department properties and a plan for implementing the expanded practice to Public Works and Facility properties.

[3] Salmon-Safe noted that water conservation has been set as Priority Recommendation for the City, with multiple initiatives in the works related to rainwater harvesting, Brightwater Treatment Plant, incorporating use of recycled water, and use of non-potable water for toilet flushing.

Condition 6: *Adopt Salmon-Safe construction standards*

The City's *Engineering Development Manual* specifies elements to be included in the Stormwater Pollution Prevention Plan. The requirements are generally protective of water quality, but improvements are warranted. Specifically, **a checklist for projects on City property** should be **developed** to specifically state a goal of avoiding the discharge of sediments and other pollutants and to provide a hierarchy of practices as a means to pursue the goal (see Appendix F of the Urban Standards).[4]

TIMELINE

The companion checklist shall be created and provided to Salmon-Safe for review within three years. The guidelines and procedures included in the document should be implemented on new and redeveloped City facilities within five years.

[4] This condition does not require the use of Salmon-Safe accredited contractors to demonstrate compliance.

Condition 7: *Improve water quality monitoring program*

The City has established a long-term water quality monitoring program at specific locations in Shoreline streams and lakes. Samples collected from these locations are measured for conventional parameters such as pH, temperature and dissolved oxygen. However, these parameters are not measured frequently enough to provide a reliable basis for assessing changes in water quality over time. Additionally, the City conducted benthic invertebrate monitoring in several Shoreline streams in 2003 and 2007 to assess temporal changes in water quality and overall stream health. The 2003 results indicated all sample sites were degraded. The 2017 results differed little from those reported in 2003. Although these parameters can provide some indication of waterbody health, by themselves they are insufficient for documenting the impacts from stormwater runoff, which is likely the most significant stressor to water quality within Shoreline streams.

In addition, since it has been over ten years since the last benthic invertebrate monitoring, the City shall re-establish the monitoring program to determine whether the significant capital investments the City has made in the last ten years have improved stream health and to provide a long-term foundation for monitoring potential future improvements in water quality citywide. The City shall modify its water quality monitoring program to provide a solid base for long-term monitoring and better characterize the impact from stormwater runoff. Suggested changes include:

- Analytes—include metals, particularly zinc, copper and lead, which are often associated with stormwater runoff;
- Benthic invertebrate monitoring—include sample collection methods, the qualifications of the personnel who will perform the sampling, taxonomic identifications, and data analysis;
- Sample locations—include specific sampling locations that may receive significant amounts of runoff during storm events; and
- Timing—include sampling events during both storm and non-storm events and conduct more frequent sampling using automated sampling systems for conventional and additional parameters, as feasible.

Enhancing the water quality monitoring program in this way would enable an analysis of the effectiveness of green stormwater infrastructure on stream water quality.

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The City shall prepare or modify an existing *Sampling and Analysis Plan (SAP)* for water quality monitoring. The SAP should describe the study design, methods and analytes. The plan shall be developed through the next *Surface Water Master Plan* update, with results provided to Salmon-Safe for review after completion of each monitoring round.

TIMELINE

Scoping for the *Surface Water Master Plan* update shall be developed and submitted for Salmon-Safe review when available, in 2021/2022. The draft Sampling and Analysis Plan shall be developed and submitted to Salmon-Safe for review during the 2023/2024 *Surface Water Master Plan* update.

Condition 8: *Improve Snow Removal and Ice Control Plan*

The City's *Snow Removal and Ice Control Plan* (2016) is not fully in alignment with Salmon-Safe standards. The City will conduct an investigation into snow and ice control operational practices that take into consideration impacts on aquatic life. The investigation shall seek information on best industry practices including:

- Snowfighters *(http://pnsassociation.org)* or Clear Roads *(http://clearroads.org)* to develop best practice snow and ice control operations joining or participating in regional or national associations, like the Pacific Northwest; and
- other agencies' experiences and programs that provide snow and ice control services in the temperate and wet climate of the Pacific Northwest, such as the City of Portland, Oregon, and its Bureau of Transportation, a Salmon-Safe certified municipality.

The investigation will include, but not be limited to, consideration of the following activities:

- assessing existing or potential salmon habitat in relation to snow and ice control routes;
- assessing operational practices that balance environmental impacts of snow and ice control with agency and community

> C8 continues on next page

economic and life safety factors with a view toward using the minimum amounts of anti-icing and deicing agents near water bodies or groundwater recharge areas;

- reviewing the current use of anti-icing and de-icing equipment and products and

    1) *evaluating the ability to avoid use of chloride-based deicers where runoff can flow to a headwaters (third-order or smaller) salmon spawning or rearing stream;*

    2) *assessing use of highly targeted application of non-chloride-based deicers, such as calcium magnesium acetate, where runoff can flow to a headwater (third-order or smaller) salmon spawning or rearing stream. Areas where runoff passes through green stormwater infrastructure (GSI treatment) do not need considerations of this activity (see Appendix D for Salmon-Safe guidelines for alternative road deicers); and*

    3) *assessing equipment and material storage needs for inclusion of road deicing equipment in development of the City Maintenance Facility where snow and ice operations are staged.*

The investigation will inform operational aspects of the 2022/23 update of the City *Snow and Ice Plan*, and will inform equipment choices in the proposed City Maintenance Facility where snow and ice operations are staged.

TIMELINE

A draft update to the *Snow Removal and Ice Control Plan* shall be submitted to Salmon-Safe for review after completion, by 2021, with the final plan submitted to Salmon-Safe, when available, in 2022/2023.

Condition 9: *Update the Integrated Pest Management Plan*

The City's IPM plan requires an update to be fully consistent with Salmon-Safe standards. The City will develop a pest management and pesticide use policy that encompasses all City properties. This policy or another document should document fertilization practices. The City's desire to be largely pesticide-free should be documented in the policy, along with any allowable exceptions.

TIMELINE

The pest management and pesticide use policy and fertilization practices document shall be submitted to Salmon-Safe for review in conjunction with the next update of the *Parks Operations and Maintenance Standards Manual* in 2021. The policy may be incorporated into the manual by reference.

Condition 10: *Enhance biodiversity in parks when converting turf or landscaped areas*

The City of Shoreline has an extensive park system that provides a wide variety of ecological and human services. Periodically, Parks Department staff alter the landscaping at specific locations within their parks to reduce maintenance costs (e.g., removing a landscaped bed) and/or to enhance the ecological functioning of an area that is otherwise underutilized. The City of Portland, Oregon, is also engaged in improving the habitat in their parks through the concept of a "nature patch."[5]

Consistent with Standard U.5.4, the City of Shoreline shall look for opportunities to create nature patches within their park systems. The City shall prepare a memorandum that identifies potential nature patch opportunities for each park in their system. Although not required for certification, the City shall attempt to create nature patches as funds allow.

TIMELINE

The memorandum shall be completed and submitted to Salmon-Safe for review within two years.

[5] Spurred by their 2015 *Ecologically Sustainable Landscape Initiative* (https://www.portlandoregon.gov/parks/article/540631), the City of Portland identified ten park locations where nature patches can be created during a five-year pilot project. The goals of the program include:

- provide spaces for people to explore, play, and interact with nature;
- create ecologically robust landscapes that support native pollinators within developed parks;
- provide environmental education and stewardship opportunities;
- increase soil and plant health, and expand the diversity of natural landscapes within parks;
- foster community partnerships and Parks Department collaboration; and
- decrease maintenance costs over time.

Condition 11: *Complete substantial design of stormwater management projects with habitat restoration elements*

The City of Shoreline has demonstrated a commitment to completing projects that improve habitat and stormwater management. Salmon-Safe applauds this commitment and would like to see it continue. Accordingly, the City shall complete at least three **stormwater management** projects that also include **habitat restoration** features, such as the stormwater detention facility at Cromwell Park. Specific projects to be completed are at the discretion of the City, but candidate projects that are already underway or partially completed include:

- Hidden Lake dam removal—includes restoration of Boeing Creek within the lake area and replacement of culverts crossing below NW Innis Arden Way;
- 25th Avenue NE Flood Reduction Project—includes habitat restoration elements at Brugger's Bog Park and Ballinger Creek;
- Ronald Bog—a Sound Transit funded and implemented project that includes a wetland restoration at Ronald Bog Park to replace wetlands affected by Sound Transit's Lynnwood Link light rail project;
- Brugger's Bog Park Expansion—after completion of the City Maintenance Facility and after or coincidentally with the 25th Ave. NE Flood Reduction Project, expansion of the park into remnant North Maintenance Facility property may occur; and
- Ballinger Open Space Restoration—environmental restoration project at Ballinger Open Space will remove invasive plants and install native vegetation.

TIMELINE

Three projects with habitat restoration and stormwater management elements shall have substantial design completed within five years, assuming project funding is available. Design documents shall be submitted to Salmon-Safe for review as soon as they are available.

Condition 12: *Incorporate habitat and fish use information into Surface Water Master Plan*

The *Surface Water Master Plan* discusses stream geomorphic and water quality characteristics, but there is no mention of present or historic salmon use, habitat features supportive of salmon, impediments to salmon functioning, salmon restoration potential, or actions needed to protect existing and increase future salmon populations. Accordingly, the City of Shoreline shall make a stronger and stream- or watershed-specific connection to salmon by including these elements in the updated *Surface Water Master Plan*. Specifically, the Plan shall include a prioritized list of potential instream, riparian and upland water management plus monitoring projects that benefit salmon. Much of this information is already contained in other documents prepared for the City, including the various basin plans.

TIMELINE

The *Surface Water Master Plan* update (2023/2024) shall incorporate habitat and fish use information and be submitted to Salmon-Safe for review when available.

Continuing Improvement Recommendations

In addition to the conditions for certification listed above, Salmon-Safe offers the following continuing improvement recommendations, the adoption of which is not mandatory to achieve certification, but is considered Salmon-Safe best practice:

1. Apply Salmon-Safe model stormwater guidelines to private developments.

   As discussed above under Condition 1, the City has adopted more stringent requirements than Ecology for stormwater management. Although laudable, these requirements do not quite meet Salmon-Safe standards, hence the condition. That condition applies only to City-owned projects, which are admittedly a small fraction of the capital projects that occur in the City. It is hoped that the City can encourage private developers and the design community to follow their example. One recommended step beyond encouragement that the City could take would be to modify the *Engineering Development Manual* to incorporate Salmon-Safe's model guidelines. In addition, as commercial zone areas that are being redeveloped, consider requiring stormwater management to meet these standards.

2. Develop a priority point system for Salmon-Safe accredited contractors.

   Salmon-Safe's contractor accreditation program is the nation's first independent accreditation program to recognize construction professionals' excellence in water quality protection practices. Contractors accredited under this program have adopted a goal of zero sediment runoff across their entire operations. The City should consider adopting a priority point system that incentivizes Salmon-Safe contractors to bid on Shoreline projects, including capital projects and any public partnership investments such as future public housing and transportation-oriented developments.

3. Look for opportunities to incorporate pollinator habitat for the Trail Along the Rail project.

   The Trail Along the Rail project represents a unique opportunity to create a shared-use path running roughly parallel to the light rail alignment through Shoreline. While recognizing that there may be limited potential for creating large areas of habitat adjacent to such a trail, given its linear nature, we recommend the City explore opportunities for establishing vegetation that support pollinator species. Such pollinator pathways are well suited to such linear features, particularly when these features provide links to larger habitat patches.

4. Restore all Hidden-Lake bottom land.

   The Hidden Lake Dam Removal project is expected to remove what is now known as Hidden Lake, thereby creating a true riparian corridor formed by

Boeing Creek. Although some of the restoration alternatives considered for this project included the entirety of the former lake bed and valley bottom, the current conceptual design pushes the new stream channel close to the hillside to the southeast to avoid a significant portion the lake bed that is privately owned. We recommend that all the former lake bed be considered as part of the stream relocation and riparian and wetland riparian revegetation effort.

5. **Expand riparian forest at Brugger's Bog Park.**

   This park contains one of the few headwater streams in Shoreline that is not buried in an underground culvert. Given its high value for potential salmonid and riparian habitat, consider expanding the riparian buffer along this creek into the adjacent turf areas on both sides of the creek.

6. **Create educational signage.**

   The City of Shoreline contains many green stormwater infrastructure features and water use reduction elements that are consistent with Salmon-Safe standards. These elements should be highlighted and publicized to foster environmental stewardship among residents and visitors. Salmon-Safe can assist the City by providing examples of appropriate signage.

7. **Create stewardship staff positions to coordinate volunteers for natural area restoration projects.**

   The City has been largely successful in recruiting volunteers for habitat restoration projects, including projects facilitated by EarthCorps. However, the responsibility for coordinating these volunteer efforts has fallen to staff that have a wide array of other responsibilities. We recommend that a staff position be created to conduct outreach and coordinate volunteers for habitat restoration projects. The result of such a position would likely be increased participation.

CONCLUSIONS

Salmon-Safe and the science team commend the City of Shoreline for a commitment to implement the conditions listed in this report, and to continue to improve water quality and urban habitat over the next five years. We extend appreciation and congratulations to the City of Shoreline team for their work in preparing for the certification assessment and assisting the science team in its assessment.

APPENDIX A: GAP ANALYSIS COMPONENTS

Table A1. City of Shoreline Staff Interviewed

Interviewee	Title, Area of Expertise
Nora Daley-Peng	Senior Transportation Planner, Public Works
John Featherstone	Surface Water Engineer, Public Works
Eric Friedli	Director, Parks Department
Melissa Ivancevich	Water Quality Specialist, Public Works
Dan Johnson	Fleet and Facilities Manager, Administrative Services Division
Kevin Kinsella	Development Review Engineer, Public Works
Lance Newkirk	Utilities Manager, Public Works
Kirk Peterson	Superintendent, Parks
Brent Proffitt	Wastewater Utility Specialist, Ronald Wastewater District

Table A2. City of Shoreline Documents Reviewed

City of Shoreline Document Title
2009 Bio-assessment Report
2016 Echo Lake Aquatic Vegetation Report
2016 Freshwater Assessment Report
2017 Stormwater Management Program (SWMP) Plan
Boeing Creek Basin Plan
Carbon Wedge Analysis
Climate Action Plan
Complete Streets Ordinance
Comprehensive Plan
Critical Areas Regulations
Engineering Development Manual
Environmentally Preferred Purchasing Guide
Green Stormwater Infrastructure
Greenworks Brochure
Lyon Creek Basin Plan

table continues next page

Table A2. *City of Shoreline Documents Reviewed, continued*

City of Shoreline Document Title
McAleer Creek Basin Plan
NPDES Permit and 2016 Annual Report
Parks, Recreation and Open Spaces Plan
Pesticide-free Parks Brochure
Puget Sound Basin Plan
Soak It Up Rain Garden Incentive Plan
Shoreline Master Program
Snow Removal and Ice Control Plan
Storm Creek Basin Plan
Stormwater Management Manual
Surface Water Master Plan
Sustainability Strategy
Thornton Creek Basin Plan
Train Along the Rail Feasibility Study
Tri-County Integrated Pest & Vegetation Management Model Policy
Urban Forest Strategic Plan
Washington Department of Ecology Low-impact Development (LID) Stormwater Manual

APPENDIX B

Salmon-Safe Gap Analysis Memo

to the City of Shoreline

April 4, 2018

4 April 2018

Miranda Redinger
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Dear Miranda:

As the first step in our third-party Salmon-Safe assessment of the City of Shoreline, the Salmon-Safe team has been working over the last two months on a gap analysis effort. Ellen Southard and I conducted interviews with nine staff members identified by the City's Green Team and yourself.(i) Subsequently, Salmon-Safe collected plans, policies, informational brochures and reports, etc. for expert review by our staff and independent Science Team.(ii) The gap analysis review identified many areas of consistency with Salmon-Safe standards as well as identified concerns and opportunities to improve environmental performance across City operations, and within specific division programs. Below you will find a summary of our findings. In general, the bulk of the City of Shoreline's policies and plans are largely consistent with Salmon-Safe principles for land management. Many of the gaps lie in adding greater specificity and enhancing watershed protection within existing programs.

Areas of alignment with Salmon-Safe standards:

- Natural resource-related policies and activities are largely consistent with the standards. The City has done a good job inventorying its resources and have some clearly stated policies about preserving and restoring natural resources.

- Shoreline has some excellent information in its basin plans and has probably completed, and is planning, a number of impressive capital projects, relative to other cities of similar scale.

- The Pesticide-Free Parks program is commendable and highly consistent with Salmon-Safe goals as is the strategic planning in the Parks, Recreation, and Open Space Master Plan.

- The Climate Action Plan (CAP) and Environmental Sustainability Strategy include a commitment to investigate opportunities for rainwater harvesting and greywater reuse. The CAP also indicates that high-efficiency irrigation controls are used routinely, particular in the Aurora corridor and in right-of-ways.

- The City is using the latest editions of the Department of Ecology's Stormwater Manual for Western Washington and Puget Sound Low Impact Development Manual with modifications for increased stringency as outlined in Shoreline's Engineering Development Manual, including:

    - (1) more control of construction exits; (2) Seasonal [wet season] Suspension Plans for some larger construction projects; (3) all runoff treatment at least at the level of the Enhanced Treatment Menu; (4) rescinds allowing existing land cover as the basis for stormwater management design where there has been at least 40 percent impervious land cover since 1985 and instead requires historic cover as the basis.

    - Requiring infiltration where conditions are appropriate, with thorough investigation of soil and subsurface properties

- List of numerous criteria to be addressed in project layout and site design based on solid LID principles.

- Requiring a stormwater pollution prevention plan for construction projects of any type and size.

- The Green Stormwater Infrastructure Program has facilitated valuable outreach to residents and a number of commendable projects between 2011-2017, including 12 neighborhood bioretention facilities plus two more awaiting grant funding, and a system of bioretention units of various configurations installed during the Aurora Avenue Corridor Project.

Questions for further investigation:

- Summary on progress in completing water quality and habitat projects – It would be very helpful to have a succinct table that lists the projects originally proposed in each basin plan (or for NPDES permitting), a short description of the project, priority, estimated cost, and current status (e.g., completed, seeking funding, not done yet)

- Summary of NPDES permit situation – Are requirements, plans be implemented? Are all streams now listed on Ecology's 303d and under NPDES permits?

- Was North Branch Thornton floodplain mapping completed in 2009 and how has this study been used?

- Summary table of *current* total impervious surface percentage in each basin, relative to 2007 data (as provided in bio-assessment report), and estimate of projected build out percentage.

- Explanation for no B-IBI monitoring since 2003 and 2007 studies and no use of 2003-2007 data in 2016 WQ assessment.

- Map and prioritized list of fish passage barriers in each basin.

- What city staffing and support is there for enforcement of Shoreline Master Program (SMP) and Critical Areas Ordinance regulations?

- What additional shoreline habitat impacts are being caused by SMP exemptions for building single-family residences, docks and bulkheads?

- If possible, please explain how water quality and habitat projects tie to basin wide objectives, such as percent of basin to be treated for stormwater.

Initial recommendations:

- Demonstrate that the capital projects underway are part of a comprehensive approach that is effectively reducing watershed impacts over time, taking into account continued development within the City. This could include basin wide quantitative goals, such as to meet water quality standards, and objectives, such as a specified percent of each basin to receive retrofit stormwater treatment. Then, the proposed projects need to clearly demonstrate how they will cumulatively meet the objectives.

- Frequency of water quality monitoring efforts needs to be increased to effectively gauge success in meeting objectives and overall goals. In tandem, an assessment of overall water quality trends since the start of data collection began in 2003 should be conducted along with genetic testing to determine the source(s) of fecal coliform.

- Conduct a riparian habitat condition survey as well as fish surveys to document distribution of species during all life stages.

- Connect stormwater management policies to specific goals related to watershed impact. For example,
    - Update the Engineering Development Manual to specifically state a goal to avoid the discharge of sediments and other pollutants from construction sites, and provide a hierarchy of practices as a means to pursue the goal.

    - Modify the Surface Water Master Plan to make a stronger and stream- or watershed-specific connection to salmon. Stream geomorphic and water quality characteristics are covered with no mention of present or historic salmon use, habitat features supportive of salmon, impediments to salmon functioning, salmon restoration potential, or actions needed to protect existing and increase future salmon populations.

    - Enhance the Snow Removal and Ice Control Plan to take into consideration impacts on aquatic life, such as mentioning existing or potential salmon habitat in relation to snow and ice control; encouraging caution to carefully use the minimum needed with any deicer in the drainage of any water body or groundwater recharge area; directing avoidance of all chloride-based deicers where runoff can flow to a headwaters (third-order or smaller) salmon spawning or rearing stream, unless runoff passes through green stormwater infrastructure (GSI); and directing use of highly targeted application of calcium magnesium acetate, if providing adequate GSI treatment is impossible and deicing is still essential (applying minimum amount, number of applications, and area covered necessary for safety).

Our overall impression is positive and we also see areas where the City of Shoreline may benefit from Salmon-Safe's expertise in utilizing a watershed-specific lens when carrying out its operations. The City is an excellent candidate for certification and we look forward to next month's site assessments and time in the field with staff.

Thank you!

Anna Huttel
Certification Manager

Cc: Dan Kent, Executive Director
Ellen Southard, Outreach Manager

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[i] City staff interviewed included the following individuals –

1. Nora Daley-Peng, Senior Transportation Planner, Public Works
2. John Featherstone, Surface Water Engineer, Public Works
3. Eric Friedli, Director, Parks Department
4. Kevin Kinsella, Development Review Engineer, Public Works
5. Kirk Peterson, Superintendent, Parks
6. Lance Newkirk, Utilities Manager, Public Works
7. Dan Johnson, Fleet and Facilities Manager, Administrative Services Division
8. Brent Proffitt, Wastewater Utility Specialist, Ronald Wastewater District
9. Melissa Ivancevich, Water Quality Specialist, Public Works

[ii] City documents reviewed included the following –

1. Comprehensive Plan, specifically the Natural Environment Plan, 185th Plan, and 145th Street Station Subarea Plan

2. Parks, Recreation, and Open Space Master Plan
3. Surface Water Master Plan
4. DOE LID Stormwater Manual
5. Stormwater Management Manual for Western Washington
6. Engineering Development Manual, specifically Division 3 – Surface Water and Development Code Regulations for Erosion Control
7. Critical Areas regulations
8. Pesticide-free Parks Brochure
9. Tri-County Integrated Pest and Vegetation Management Model Policy
10. Urban Forest Strategic Plan
11. Environmentally Preferred Purchasing Guidelines
12. Boeing Creek Basin Plan
13. Storm Creek Basin Plan
14. McAleer Creek Basin Plan
15. Lyon Creek Basin Plan
16. Thornton Creek Basin Plan
17. Puget Sound Basin Plan
18. 2016 Echo Lake Aquatic Vegetation Report
19. 2016 Freshwater Assessment Report
20. 2009 Bioassessment Report
21. NPDES Permit
22. NPDES Permit 2016 Annual Report
23. “Soak It Up” Rain Garden Incentive Program
24. Green Stormwater Infrastructure Program brochure
25. Greenworks brochure
26. Trail Along the Rail Feasibility Study
27. Complete Streets Ordinance
28. Shoreline Master Program (coastline regulations)
29. Sustainability Strategy
30. Climate Action Plan
31. Carbon Wedge Analysis
32. Snow Removal and Ice Control Plan
33. 2017 Stormwater Management Program (SWMP) Plan

APPENDIX C

Model Stormwater Management Guidelines
for Ultra-Urban Redevelopment

May 2018

SALMON-SAFE INC.

MODEL STORMWATER MANAGEMENT GUIDELINES FOR ULTRA-URBAN REDEVELOPMENT

MAY 2018

Introduction

Polluted stormwater is the largest threat to the health of the Pacific Northwest's urban watersheds. Pollutants targeted by Salmon-Safe's urban initiative such as heavy metals, petroleum products, pesticide runoff and construction sediment have an adverse impact on the watershed and severely compromise downstream marine health. With the goal of inspiring design that has a positive impact in our watersheds, Salmon-Safe offers stormwater design guidance for ultra-urban areas, which we define as typically those densely developed "downtown" locations mostly covered by structures and pavement. Generally first developed long ago, many such areas are brownfields now undergoing redevelopment, mostly for commercial and residential purposes.

The very extensive impervious surfaces in ultra-urban spaces create a hydrologic environment dominated by surface runoff, with little of the soil infiltration and evapotranspiration predominating in a natural landscape. Vehicle traffic drawn to such areas and the activities occurring there deposit contaminants like heavy metals, oils and other petroleum derivatives, pesticides and fertilizers (nutrients). These pollutants wash off of the surfaces with the stormwater runoff and drain into the piping typically installed to convey water away rapidly. If the piping network is a combined sanitary-storm sewer system, the large stormwater runoff volumes draining from an ultra-urban area exceed the capacity of the wastewater treatment plant at the end of the line in some storms, resulting in releases of untreated, mixed sewage and stormwater to a water body. If the piping network is a separated storm sewer system, the runoff and the pollutants it carries enter a receiving water body without treatment, to the detriment of water quality and the aquatic life there. Although salmon-spawning and rearing streams are rarely present in an ultra-urban location, if they are, the elevated runoff quantity itself is damaging to the downstream habitat that salmon and their food sources rely on and directly to the fish themselves.

Many of the pollutants conveyed by stormwater runoff are toxic to salmon and their invertebrate food sources. The toxicity of heavy metals like copper and zinc to aquatic life has been well studied. However, salmon face many more potentially toxic pollutants in both their freshwater and saltwater life stages. These contaminants include other heavy metals; petroleum products; combustion by-products; and industrial, commercial, and household chemicals. Emerging science from NOAA Fisheries shows that these agents collectively create both lethal and non-lethal impacts, the latter negatively affecting salmon life-sustaining functions to the detriment of their migration, reproduction, feeding, growth and avoidance of predators.

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Despite these challenges, an array of options exists to reduce, or even in the utmost application, eliminate the negative impacts of ultra-urban development stemming from the large quantities of contaminated stormwater runoff potentially generated there. This management category addresses practices to control ultra-urban stormwater runoff to reduce both water quantity and water quality impacts with the following goal.

Goal

Any development or redevelopment project with a footprint that exceeds 5,000 square feet shall use low-impact site planning, design, and operational strategies[1] for the property to maintain or restore, to the maximum extent technically feasible, the predevelopment hydrology of the property with regard to the water quality, rate, volume, and duration of flow.

Objectives

1. Prime objective

   Implement low-impact practices, especially runoff retention[2] practices,addressing both water quantity and water quality control to the maximum extent technically feasible in redeveloping ultra-urban parcels to achieve the stated goal of restoring the predevelopment hydrology. Provide documentation of how the objective will be achieved. If full achievement of the goal is technically infeasible, assemble documentation demonstrating why it is not and proceed to consider Objective 2A and/or 2B, as appropriate to the site.

2. Alternative objectives

   Assess if achieving Objective 1 is documented to be technically infeasible.

   2A **Alternative water quantity control objective when the site discharges to a combined sanitary-storm sewer or a stream**—Start with the low-impact practices identified in the assessment pursuant to Objective 1. To the extent that they cannot prevent the generation of stormwater runoff peak flow rates and volumes greater than in the predeveloped condition[3,4], implement effective alternative measures to diminish and/or slow the release of runoff to the maximum extent technically feasible, with the minimum objective of reducing the quantity discharged to comply with any applicable water quantity control requirement[5] and, in any case, below the amount released in the preceding developed condition.[6]

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[1] Collectively termed "low-impact practices" in the following points.

[2] Retention means keeping runoff from flowing off the site on the surface by preventing its generation in the first place, capturing it for a water supply purpose, releasing it via infiltration to the soil or evapotranspiration to the atmosphere, or some combination of these mechanisms.

[3] A predeveloped condition is the natural state of the site as it typically would be for the area prior to any modification of vegetation or soil.

[4] As determined through hydrologic modeling of the previously developed and modified conditions.

[5] Specified for discharges to combined sewers by the municipal jurisdiction; specified for discharges to Western Washington streams by the Washington Department of Ecology's Stormwater Management Manual for Western Washington, Minimum Technical Requirement #7.

[6] As determined through hydrologic modeling of the previously developed and modified conditions.

2B **Alternative water quality control objective when the site discharges to a water body or a separate storm sewer leading to a water body**—Start with the low-impact practices identified in the assessment pursuant to Objective 1. To the extent that they cannot prevent the generation of stormwater runoff containing pollutants, implement alternative effective measures to reduce contaminants in stormwater to the maximum extent technically feasible, with the minimum objective of complying with the regulatory requirements for water quality control applying to the location.[7]

Plan Elements

1. **Inventory and analysis**—Narrative, mapping, data, and quantitative results that summarize: (1) site land uses and land covers in the redeveloped and preceding developed conditions; (2) results of hydrologic modeling of the undeveloped, previously developed and modified conditions, as the basis for pursuing quantity control objectives; and (3) stormwater drainage sub-basins, conveyance routes, and locations of receiving stormwater drains and natural water bodies in the redeveloped state.

2. **Low-impact practices—**Low-impact practices are systematic methods intended to reduce the quantity of stormwater runoff produced and improve the quality of the remaining runoff by controlling pollutants at their sources, collecting precipitation and putting it to a beneficial use, and utilizing or mimicking the hydrologic functioning of natural vegetation and soil in designing drainage systems.

   The following low-impact practices are particularly relevant to ultra-urban sites:

   - source control practices
     - √ minimizing pollutant introduction by building materials (especially zinc- and copper-bearing) and activities conducted on the site
     - √ isolating pollutants from contact with rainfall or runoff by segregating, covering, containing, and/or enclosing pollutant-generating materials, wastes and activities
     - √ conserving water to reduce non-stormwater discharges
   - constructing vehicle travel ways, sidewalks and uncovered parking lot aisles to the minimum widths necessary, provided that public safety and a walkable environment for pedestrians are not compromised
   - harvesting precipitation and putting it to a use such as irrigation, toilet flushing, vehicle or surface washing, or cooling system make-up water
   - constructing low-traffic areas with permeable surfaces, such as porous asphalt, open-graded Portland cement concrete, coarse granular materials, concrete or plastic unit pavers, and plastic grid systems (Areas particularly suited for permeable surfaces

[7] In Western Washington, specified by the Washington Department of Ecology's Stormwater Management Manual for Western Washington, Minimum Technical Requirement #6, which is equivalent to the City of Seattle's SMC, Section 22.805.090.B.1.a.

are driveways, walkways and sidewalks, alleys, and overflow or otherwise lightly-used uncovered parking lots not subject to much leaf fall or other deposition.)

- draining runoff from roofs, pavements, other impervious surfaces, and landscaped areas into one or more of the following green stormwater infrastructure (GSI) systems:

  √ bioretention area* (also known as a rain garden)[8]

  √ planter box*, tree pit* (bioretention areas on a relatively small scale)

  √ vegetated swale[9] *

  √ vegetated filter strip*

  √ infiltration trench

  √ green roof

  * *signifies compost-amended soils as needed to maximize soil storage and infiltration*

The following low-impact practices are of limited applicability to ultra-urban sites but may contribute to meeting objectives in some circumstances:

- conserving natural areas including existing trees, other vegetation and soils
- minimizing soil excavation and compaction and vegetation disturbance
- minimizing impervious rooftops and building footprints
- designing drainage paths to increase the time before runoff leaves the site by emphasizing sheet instead of concentrated flow, increasing the number and lengths of flow paths, maximizing non-hardened drainage conveyances and maximizing vegetation in areas that generate and convey runoff

3. Alternatives—When on-site low-impact practices alone cannot achieve Objectives 2A and/or 2B, implement one or more of the following strategies to meet at least the minimum water quantity and quality control objectives stated above:

   - For runoff quantity and/or quality control—

     √ contribute materially to a neighborhood project using low-impact practices and serving the stormwater control needs of multiple properties in the same receiving water drainage basin, with the contribution commensurate with the shortfall in meeting objectives on the site itself.

     √ implement low-impact practices on-site to manage the quantity and quality of stormwater generated in a location off the redevelopment site but in the same receiving water drainage basin, with the scope of the project commensurate with the shortfall in meeting objectives using practices applied to stormwater generated by the site itself.

[8,9] Preferably with an open bottom for the fullest infiltration, but with a liner and underdrain if the opportunity for deep infiltration is highly limited or prohibited for some specific reason, e.g., bedrock or seasonal high-water table near the surface, very restrictive soil (e.g., clay, silty clay) that cannot be adequately amended to permit effective infiltration, non-remediable contamination below ground in the percolating water pathway.

- **For runoff quantity control**—install a vault or tank[10] to store water for delayed release after storms to help avoid combined sewer overflows or high flows damaging to a stream.
- **For runoff quality control**—install an advanced engineered treatment system suitable for an ultra-urban site.[11]

Considerations for Salmon-Safe Certification

Fulfilling the stormwater component of the Salmon-Safe certification process requires submission of documentation of how Objective 1 will be achieved based on the inventory and analysis conducted for the site. On the other hand, if Objective 1 has been judged to be unachievable, pursuing certification requires documentation establishing the technical infeasibility of doing so. Relevant documentation includes, but is not necessarily limited to, site data, calculations, modeling results, and qualitative reasoning. If achieving Objective 1 is demonstrably technically infeasible, the certification process then requires similar documentation of how Objectives 2A and/or 2B, as appropriate to the site, will be achieved.

Prepared for Salmon-Safe Inc. by Dr. Richard Horner, et. al.

[10] While useful for runoff quantity control, passive vaults and tanks provide very little water quality benefit.

[11] The most effective candidate treatment systems now available are chitosan-enhanced sand filtration and advanced media filtration coupled with ion exchange and/or carbon adsorption. Basic sand filtration is another option suitable to an ultra-urban site but is less effective than the more advanced alternatives.

APPENDIX D

Salmon-Safe Information Sheet

A Comparison of Alternative Road Deicers

May 2018

(revised February 2019)

SALMON-SAFE INC.

SALMON-SAFE INFORMATION SHEET

A Comparison of Alternative Road Deicers

Salmon-Safe recognizes the wintertime balance between public safety on ice- or snow-covered roads and environmental protection. We seek to inform companies and institutions that have achieved Salmon-Safe accreditation and certification, including road maintenance departments, about options for reducing toxicity of road deicing chemicals and potential negative effects on salmon and other aquatic life in water bodies receiving road runoff.

From the salmon perspective, the specification of a deicer should be especially carefully evaluated when a road drains to any relatively small, salmon-supporting water body. If deicer use cannot be avoided in such cases, the best protection would be to channel runoff through an extensive vegetated area to capture and hold the potentially harmful deicer components.

Sodium chloride is by far the most common deicer for roads. Magnesium and calcium chlorides are in some use, being effective to lower temperatures although more expensive and requiring greater application mass because of decreased freezing point depression. All chloride-based deicers are potentially toxic to aquatic life, damage roadside vegetation, and corrode metals in bridge structures and concrete reinforcing bars. Sodium can diminish human cardiovascular health when contaminating wells and other water supplies. Chloride is usually not a threat to human health but can cause taste and odor problems in drinking water. Magnesium, especially, but also sodium, calcium and potassium damage concrete. All of these light metals can release potentially toxic heavy metals from contaminated soils through ion exchange reactions. Additives to counter corrosion, concrete damage, and the tendency of the products to cake can also be toxic to aquatic life. The potential impact of all of these negative effects is dependent on the concentration of the chemical, pointing out the importance of using the minimum needed. In proper use, elevated potential for aquatic toxicity problems should only occur in relatively small water bodies.

Exhaustive research on calcium magnesium acetate (CMA) has demonstrated the only potential environmental problems at any anticipated environmental concentration are aquatic dissolved oxygen reduction and soil metal release (Horner 1988).[1] The concentration necessary to depress oxygen, however, is sufficiently high that it would only be expected to occur in small, poorly flushed lakes and small, slowly flowing streams. Metals in soils were not mobilized in sufficient quantities to be a concern but could be if CMA meltwater flows over a highly contaminated soil, as with any deicing option other than urea. Because of its high cost, CMA use is mostly limited to locations sensitive to aquatic toxicity or corrosion. It has, for example, been the choice for new bridges to avoid the beginning of progressive chloride corrosion. The University of Oregon, a campus transitioning to Salmon-Safe certification, uses CMA exclusively for its deicing.

Road deicers on the market differ in their deicing ability, negative effects on the environment, price and secondary costs resulting from damage to roadway materials. The following table is a summary comparison of alternative

[1] Horner, R.R. 1988. "Environmental Monitoring and Evaluation of Calcium Magnesium Acetate (CMA)", *National Cooperative Highway Research Program Report 305*. Transportation Research Board, Washington, DC.

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road deicers with respect to these factors. In general, Salmon-Safe recommends avoiding all chloride-based deicers where the runoff can flow to a headwaters (third-order or smaller[2]) salmon spawning or rearing stream, unless it passes through green stormwater infrastructure (GSI) designed to reduce the discharge quantity through infiltration and evaporation and decreases chloride in the remaining runoff through plant and soil contact. If providing adequate GSI treatment is impossible and deicing is still essential, Salmon-Safe recommends highly targeted application of CMA, using the minimum amount, number of applications, and area coverage necessary for safety. With respect to any deicer involved in the drainage of any water body or groundwater recharge area, careful use of the minimum needed is the best rule.

A Comparison of Alternative Road Deicers[3]

Deicer	Aquatic Ecosystem Effects	Other Environmental Effects	Material Effects	Low Temperature Limit (°F)	Freezing Point Depression (°C/unit weight)	Usage Consistent with Salmon-Safe Certification	Cost Relative to Sodium Chloride
Sodium chloride (rock salt)	Chloride and additive toxicity	Sodium contamination of drinking water source; vegetation damage; mobilization of heavy metals in soil	Corrosive; concrete damage	20	1	Avoided in drainages to headwater streams unless adequate GSI treatment; used in minimum needed amounts in drainages to larger water bodies and groundwater recharge areas	1.0x
Magnesium chloride	Chloride and additive toxicity	Vegetation damage; mobilization of heavy metals in soil	Corrosive; concrete damage	5	0.29		2.5x
Calcium chloride	Chloride and additive toxicity	Vegetation damage; mobilization of heavy metals in soil	Corrosive; concrete damage	-25	0.53		5.5x
Potassium chloride	Chloride and additive toxicity	Vegetation damage; mobilization of heavy metals in soil	Corrosive; concrete damage	12	0.78		1.5x
Calcium magnesium acetate	Dissolved oxygen reduction	Mobilization of heavy metals in soil	Concrete damage	0	0.30	Targeted usage in minimum needed amounts in drainages to headwaters streams	20x
Potassium acetate	Dissolved oxygen reduction	Mobilization of heavy metals in soil	Concrete damage	-15	0.60		25x
Urea	Ammonia and additive toxicity; eutrophication			15	0.97	same as chloride deicers	1.5x

[2] When two first-order streams come together, they form a second-order stream. When two second-order streams come together, they form a third-order stream. Streams of lower order joining a higher order stream do not change the order of the higher stream.

[3] After: (1) Kelly, V.R., Findlay, S.E.G., Schlesinger, W.H., Chatrchyan, A.M., Menking, K. 2010. "Road Salt: Moving Toward the Solution", *The Cary Institute of Ecosystem Studies*, Milbrook, NY. (2) Public Sector Consultants, Inc. 1993. "The Use of Selected Deicing Materials on Michigan Roads: Environmental and Economic Impacts", Michigan Department of Transportation, Lansing, MI.

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