Assessment of City of Portland Activities for Potential to Affect Steelhead

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I. INTRODUCTION

Background

On March 19, 1998, the National Marine Fisheries Service (NMFS) issued a final rule to list the Lower Columbia River Evolutionarily Significant Unit (ESU) of steelhead (*Oncorhynchus mykiss*) as threatened under the Endangered Species Act (ESA). This steelhead ESU occupies tributaries to the Columbia River between the Willamette and Hood Rivers in Oregon, inclusive. Excluded are steelhead in the upper Willamette River Basin above Oregon City. The City of Portland and vicinity are within this ESU (Figure 1). Steelhead are known to use various watercourses in the Portland area that are potentially affected by City activities, including the Columbia River, Columbia Slough, Willamette River, Johnson Creek, Tryon Creek, Fanno Creek[1], and the Bull Run/Sandy River basins.

NMFS identified several major concerns for steelhead within this ESU. Populations are at low abundance relative to historic levels and at risk for further decline. Adverse modification or curtailment of steelhead habitat has occurred from various human factors, such as forestry, agriculture, urbanization, hydropower, commercial fishing, and water diversions. NMFS is also concerned about widespread occurrence of hatchery fish in naturally-spawning steelhead populations and possible genetic introgression. Natural factors, such as competition, disease, predation, and climate conditions are also considered important factors.

The listing of the Lower Columbia steelhead ESU continues a recent trend of previous listings and anticipated future listings of anadromous salmonid species that use watercourses in the Portland area. Of particular importance to the City, listings are proposed for steelhead in the Upper Willamette and Middle Columbia ESUs, chinook salmon (*O. tshawytscha*) in the Upper Willamette and Lower Columbia ESUs, and chum salmon (*O. keta*) in the Lower Columbia ESU. Although this assessment focuses on steelhead, many of the findings and recommendations may be relevant to these other proposed species as well.

City's Position on Responding to the Steelhead Listing

Following the listing of steelhead in the Lower Columbia ESU, the City of Portland began development of a City-wide, comprehensive response to the listing. General agreement among the City Council on a four-pronged approach was achieved on 23 May 1998. First, the City would approach its response to the listing in a programmatic manner as much as possible. This would provide a City-wide response that would maximize effectiveness and efficiency. To this end, a City-wide ESA Steering Committee was established with staff representatives from all the affected bureaus. Second, the City would take a proactive approach that would work in collaboration with NMFS in preparing a program that would aid in salmonid recovery. Third, recognizing that these fish use watersheds that cross political boundaries, the City's response would be integrated with regional and state responses to the extent possible. And fourth, the City would need to enlist the help of its

[1]Although not within the boundaries of the Lower Columbia River ESU, Fanno Creek is included in this analysis because of the proposed listing of steelhead in the Upper Willamette River ESU of which Fanno Creek is a part.

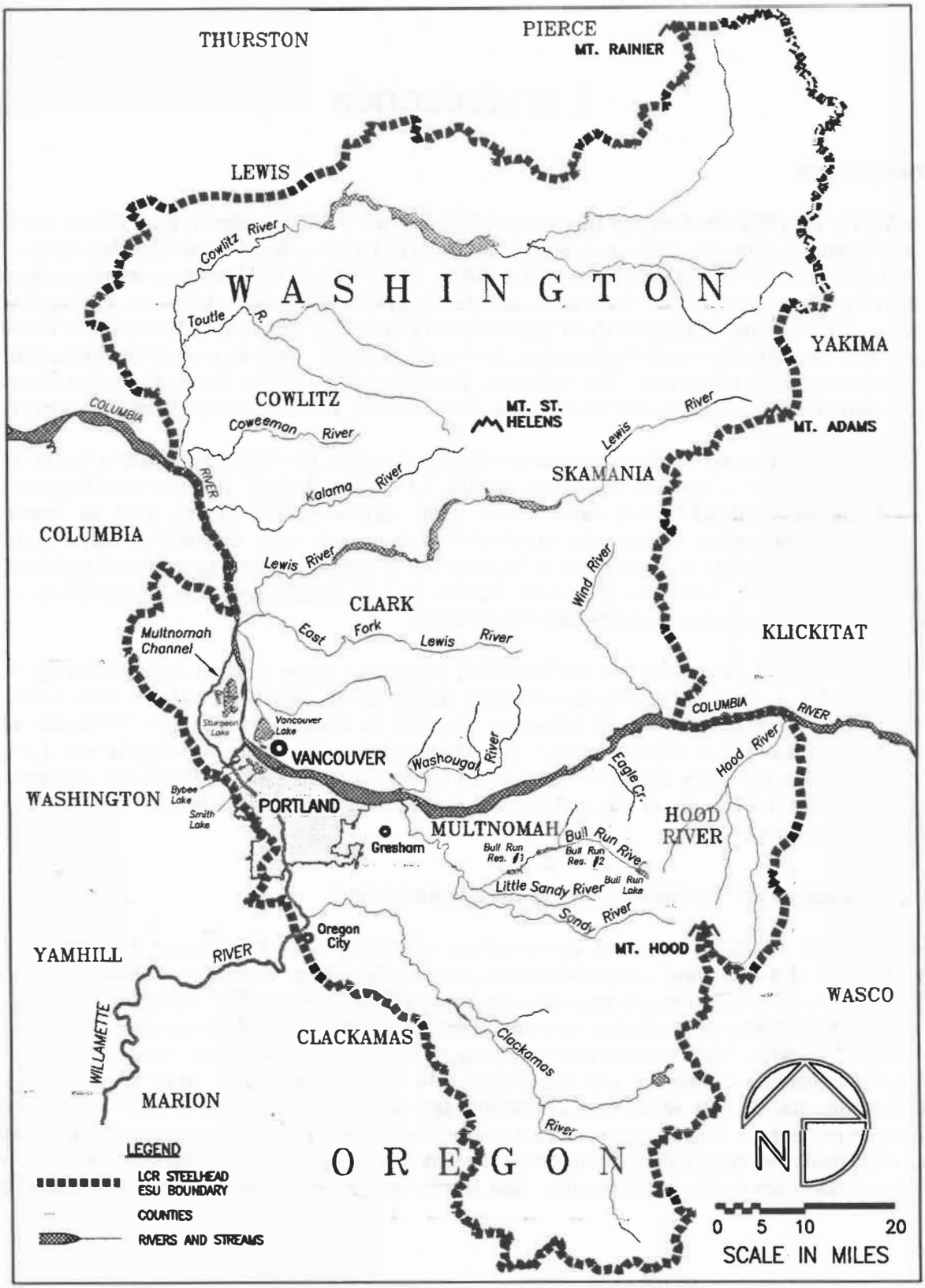

Figure 1. Map of Lower Columbia River steelhead ESU.

citizenry at a number of levels in developing the response to the listing. These four fundamental components of the City's response were adopted by the City Council on 22 July 1998 (Resolution No. 35715).

The first step in the City-wide, programmatic approach was to determine the potential effects of the City's current activities on steelhead. This report is the first level of that review.

Purpose and Objectives of this Assessment

The purpose of this assessment is to provide an initial coarse screening of the City's activities to determine whether they have the potential to affect steelhead and steelhead habitat. The assessment is intended to provide some initial focus as to the steps the City should take to plan and implement a strategy for contributing to the conservation of steelhead. No individual activity has been examined in detail. **Therefore, this assessment should not be solely relied upon for conclusions or decisions regarding impacts of City activities on steelhead. Also, this report should not be used to determine the potential for "take" as defined under the ESA. Such determination should rely on appropriate consultation with NMFS.**

The specific objectives of the assessment were to:

1. Conduct interviews and compile information sufficient to define the types of City activities that have the potential to affect steelhead and steelhead habitat.
2. Determine the general factors, pathways, and linkages by which such effects might occur.
3. Describe the general options available to the City for planning and implementing ESA conservation planning and compliance.
4. Recommend tasks that may serve as next steps in the development of a strategy for this ESA planning and compliance effort.

II. CITY ACTIVITIES

Types of Activities Conducted by the City

The City conducts a wide range of activities that can basically be grouped into the following categories:

- planning, permitting, inspection, and enforcement activities (e.g., comprehensive planning, zoning, development approvals, environmental zone designation, environmental review)
- water delivery activities (e.g., water supply diversion, water main maintenance)
- stormwater and wastewater management activities (e.g., storm drain system discharge, wastewater discharge, combined system discharge)
- structure and road construction/maintenance activities (e.g., street and bridge maintenance, construction)
- environmental enhancement activities (e.g., stream and wetland enhancement, floodplain land acquisition)
- emergency response activities (e.g., firefighting)

Certain of these activities are directly carried out by the City. Others are not directly carried out by the City, but rather may be authorized (e.g., permitted), contracted (e.g., road construction) or enabled (e.g., zoning) by the City. The activities directly carried out by the City are perhaps the ones by which the City may have the most obvious and direct capacity to affect steelhead and steelhead habitat. Nonetheless, precedent exists for authorizing and enabling activities to require ESA compliance; thus, such activities should be incorporated into the City's ESA compliance strategy.

Range and Duration of City Activities

Most City activities occur within the City limits, but some occur outside, notably those activities related to the City's municipal water supply in the Bull Run watershed (Figure 2). The City also conducts a few activities in unincorporated areas adjacent to the City (e.g., road maintenance in some of these unincorporated areas).

Many of the City's activities occur continuously or on a regular basis (e.g., water delivery, wastewater treatment and discharge). Others occur only occasionally (e.g., combined system discharge, seawall dredging) or are one-time actions associated with a specific project (e.g., construction activities). Many of the City's activities involve collaboration or joint responsibilities with other entities, including the public.

As described in the following section, an understanding of the range and duration of activities is important for assessing potential effects on steelhead and steelhead habitat in the City's watercourses, since range and duration indicate the likely incidence, frequency, and magnitude of such potential effects.

III. LINKAGES AND POTENTIAL INFLUENCES

Assessment Methods

To identify the links between City activities and the potential for those activities to affect steelhead we: 1) compiled a list of City activities; 2) identified the mechanisms through which the activity could affect steelhead; 3) evaluated the general context in which the effect could occur (e.g., current conditions within the affected watercourse and fish life stages present), and identified the relative potential (i.e., low, moderate, high) for a given factor to affect steelhead; and 4) identified the potential (i.e., low, moderate or high) for the City to influence those factors that may affect fish. In order to develop a list of activities and to gain an understanding of the potential influences, we interviewed representatives from various City bureaus and entities, including:

- Bureau of Buildings
- Bureau of Environmental Services
- Bureau of Fire, Rescue & Emergency Services
- Bureau of Parks and Recreation
- Bureau of Planning
- Bureau of Water Works
- Portland Development Commission
- Portland Office of Transportation (Bureau of Transportation Engineering & Development and Bureau of Maintenance)

Through the interview process, we also determined the ways in which each activity could affect steelhead. In general, City activities could affect steelhead either positively or negatively through one or more of the following factors:

- alteration of watershed conditions through permitted development (e.g., reduced vegetation cover and increased impervious surfaces)
- introducing toxic materials, nutrients, fine sediment, or organic material to the watercourse (e.g., storm water discharge)
- modifying the flow regime (e.g., water diversions)
- influencing water temperature (e.g., modification of the riparian shade canopy)
- influencing riparian vegetation (e.g., riparian enhancement activities)
- influencing the rate of predation on juvenile fish (e.g., installation of instream structures)
- influencing fish passage (e.g., installation of culvert stream crossings)
- influencing the level of direct disturbance to fish (e.g., installation of streambank features).

The potential for any given activity to influence steelhead was dependent in part upon the watershed in which the activity occurred. For example, the delivery of small amounts of fine sediment to a large watercourse such as the Willamette River would likely be inconsequential due to the large volume of water transported in the river and the use of the river by steelhead primarily as a migration corridor.

However, the delivery of the same amount of sediment to a smaller stream, such as Johnson Creek, would have a higher potential to affect steelhead because of the small size of the stream and the possible presence of sensitive life stages (i.e., spawning and rearing). In order to address this consideration, we compiled a list of City activities organized by watershed/watercourse, including the Columbia River, Columbia Slough, Willamette River, Johnson Creek, Fanno Creek, Tryon Creek, and Bull Run/Sandy River (Figure 2). This allowed assessment of each of the activities in the context of the unique characteristics of the watercourse and how the watercourse is used by fish.

We also used the interview process to establish the link between the activity and a potential effect on steelhead in the watercourse, by identifying the various pathways through which each activity could affect steelhead. We identified several pathways (i.e., links) through which the City's activities could affect steelhead, including the storm drain system, wastewater system, combined system, natural drainage system, and direct influences in the channel or along the stream margin.

We compiled the information we developed through the interviews in a matrix format (Appendices A-C). Each matrix identifies the activities that potentially affect steelhead within a given watershed/watercourse, the ways (i.e., influencing factors) in which steelhead are potentially affected by each activity, and the pathways that link the activities to fish. The potential for each influencing factor to affect steelhead within a given watercourse was characterized as either low, moderate, or high. This screening-level characterization was based on general knowledge of existing conditions within the watercourse and the level of fish use. In addition, the City's capacity to influence each of these factors was characterized as either low, moderate, or high. The determinations of the City's capacity to influence these factors considered both the potential effects of the City's current activities on these factors and the City's potential to influence these activities and the activities of others through its planning, permitting, and related processes.

Potential Influences

The City engages in numerous activities and projects that either individually or collectively have the potential to affect steelhead both positively and negatively (see Appendices A-C). Many of these activities occur continuously or on a regular basis. Others occur only occasionally or are one-time actions associated with a specific project. Very few, however, affect fish directly or individually affect steelhead significantly. Instead, most of the City's activities produce low level effects that, in combination, contribute cumulatively to an effect on steelhead. For example, during rainfall events, runoff within the city collects various substances potentially detrimental to water quality (e.g., oil and grease, sediment), and concentrates and routes them to the stormwater drainage system. The substances generated by any one activity or event are likely minimal with respect to their potential to influence steelhead. However, when the combined load generated from daily activity in the city (e.g., traffic and landscape maintenance) is concentrated and discharged to the river, water quality in the river under certain conditions may be sufficient to affect steelhead.

The City also has the potential to affect fish through its capacity to influence watershed development. Urban and suburban development can directly and indirectly affect fish and fish habitat by modifying the natural characteristics of local watersheds and through the effects generated by the various activities that accompany urban development (as discussed above). The City has jurisdiction over urban development through its comprehensive planning and zoning processes and permitting, inspection, and enforcement activities. While urban development in general may have a negative effect on the natural environment, the City conducts a number of actions (planning, permitting, inspection, and enforcement) to avoid, minimize, or mitigate adverse effects on water quality, and fish and wildlife habitat. The extent of the influence (or degree of benefit) these actions have on fish

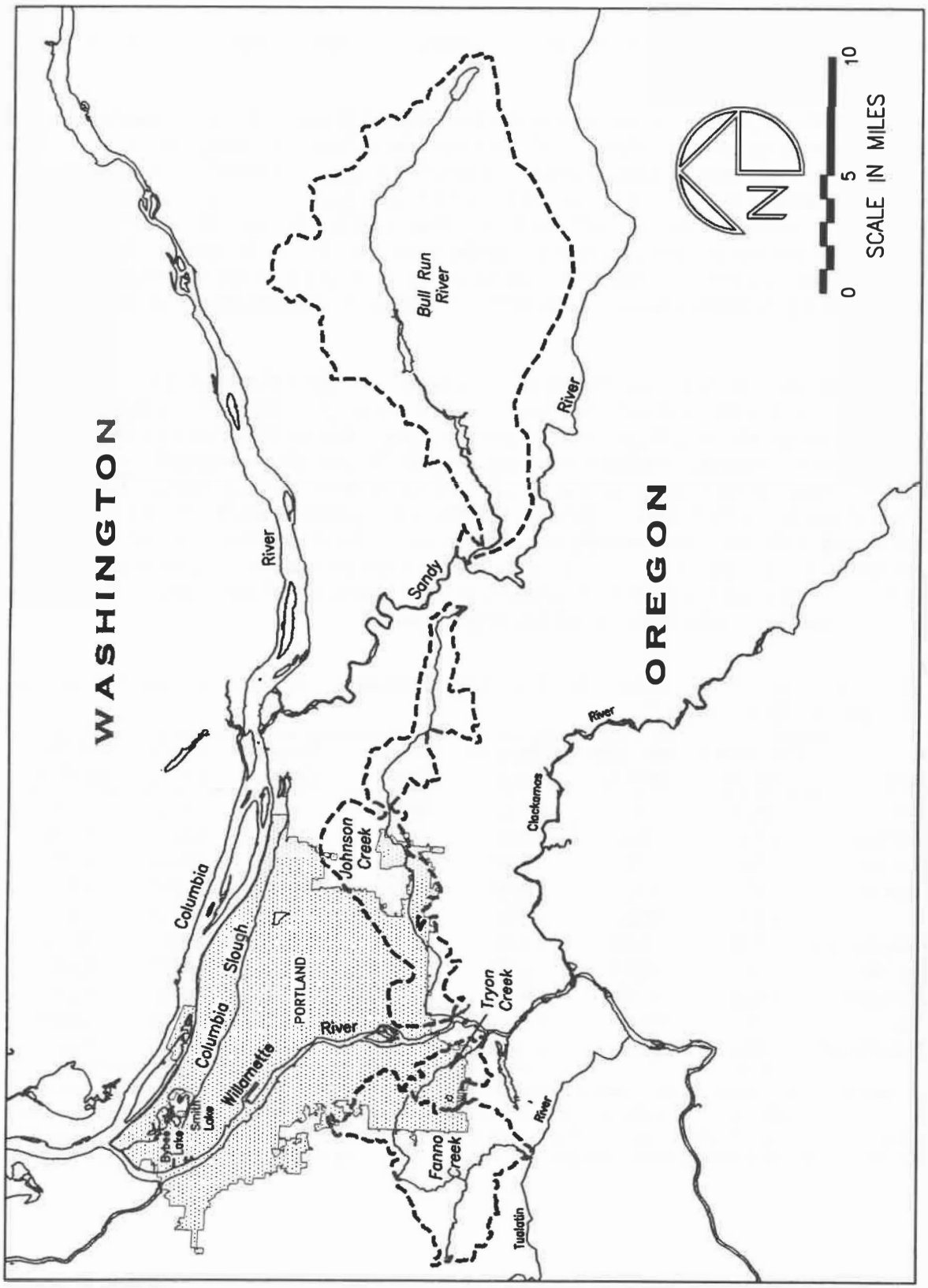

Figure 2. Map of basins and watercourses.

(particularly steelhead) is dependent upon the adequacy, effective implementation, and proper enforcement of these actions.

The City's potential to affect or influence steelhead is dependent upon the existing conditions within a given watercourse as they relate to fish and the City's ability to change or influence those conditions (i.e., integration of both the determinations of "Existing Potential of Factor to Affect Fish" and "City's Capacity to Influence Factor" as indicated in Appendices C1-C7). This overall potential for the City to affect or influence conditions is presented in Table 1 as either low, moderate, or high. Those factors indicated as having a potentially moderate or high effect or influence on the factors that affect steelhead represent the areas where adjustments in the City's activities or planning processes could have the greatest potential to benefit steelhead, and where resources and effort should initially be focused.

The City generally has limited potential to influence steelhead in the Columbia and Willamette rivers because these watercourses, at the City's location, serve primarily as migration corridors and do not support spawning, although these areas do provide rearing habitat for other juvenile salmonids, including chinook salmon. Steelhead migrating through the area do so seasonally, and typically transit the portion of the river adjacent to the city and downstream relatively quickly. The large size of these rivers in the Portland area provides conditions that generally allow City inputs to diffuse rapidly. Also, City inputs are generally minor compared to the already large load of water quality constituents carried in the rivers from their extensive upstream basin areas. Nevertheless, the City has a "moderate" potential to influence the delivery of toxic materials (primarily through the drainage network) to the rivers and to influence the rate of predation[2] .

Table 1. Summary of the relative potential for City activities and processes to change or influence the factors that affect steelhead.[a]

Factor	Columbia River	Columbia Slough	Willamette River	Johnson Creek	Fanno Creek	Tryon Creek	Bull Run/ Sandy R.
Toxics	MOD	MOD	MOD	MOD	LOW	LOW	LOW
Nutrients	LOW	MOD	LOW	MOD	MOD	LOW	LOW
Sediment	LOW	MOD	LOW	MOD	HIGH	HIGH	LOW
Organic	LOW	MOD	LOW	MOD	LOW	LOW	LOW
Flow	LOW	MOD	LOW	HIGH	MOD	MOD	HIGH
Temperature	LOW	MOD	LOW	MOD	MOD	MOD	HIGH
Riparian	LOW	MOD	MOD	HIGH	HIGH	MOD	LOW
Predation	MOD	MOD	MOD	LOW	LOW	LOW	LOW
Passage	LOW	MOD	LOW	MOD	MOD	MOD	HIGH
Disturbance	LOW	LOW	LOW	LOW	LOW	LOW	LOW

[a]The objective of this assessment is to focus attention on those activities and locations where the City could achieve the greatest benefit to steelhead. The screening-level nature of the assessment is intended to help the City decide where to initially direct resources. Activities were not examined in detail. Rather, this assessment focuses on potential effects and influences and does not determine whether the anticipated effect or influence to steelhead is actually occurring.

[2] It is possible that instream structures could increase predation by providing habitat, refuge, and cover for fish species that prey upon steelhead and other juvenile salmonids. However, the extent to which such structures would increase predation is uncertain and debatable.

The Columbia Slough generally does not provide preferable or suitable habitat for steelhead and other salmonids. Water quality conditions in the slough have been adversely affected by various factors including surrounding urban/industrial development and the slough's slow-flushing, backwater configuration. Unlike the Columbia and Willamette rivers, the slough conveys considerably less water. Because of its low volume and configuration, it flushes very slowly, and tends to accumulate potentially toxic materials and sediment. The slow flushing, combined with limited shading, may also contribute to elevated water temperatures. However, because of its interconnection with the Columbia River, the slough probably supports some occasional and low-level use by steelhead and other salmonids. Therefore, due to these considerations, the City's potential to change or influence conditions in Columbia Slough was determined to be "moderate" for many of the factors examined.

The three urban streams, Johnson, Fanno, and Tryon creeks, are relatively small and flow through the city for a large portion of their course. In addition, each of the streams supports or potentially supports steelhead spawning and rearing. Unlike the Columbia and Willamette rivers that support steelhead occasionally during migration, the three urban streams may support various life stages of steelhead throughout the year. Because of their relatively small size, these streams are generally more vulnerable to the effects of City activities, particularly those that may affect sediment delivery and riparian shade canopy. Flow and passage considerations are also important. Because large portions of these watersheds are within the jurisdiction of the City's comprehensive planning and zoning processes, the City has a greater potential to influence development and the activities conducted in these areas. This greater vulnerability and higher level of regulatory influence, combined with the possible year-round presence of various steelhead life stages, makes these streams more sensitive to the potential influences of City activities and processes. These streams also likely represent one of the City's greatest opportunities to protect and benefit steelhead.

The Bull Run and Sandy rivers are well outside the city limits, and beyond the influence of urban development and urban discharges. However, the City's potential to influence several factors that may affect steelhead is relatively high due to the presence of the diversion dam and the operation of the municipal water supply diversion. The City's diversion reduces downstream flows in the Bull Run River mostly in the summer, which can affect available habitat and water temperatures. The dam also blocks upstream fish passage.

As indicated in the watercourse matrices (see Appendices C1-C7), a large number of City activities and processes have the capacity to influence the factors that may affect steelhead. Many of these activities have only a minor or occasional capacity to influence, whereas others are more directly linked to possible effects and are continuous or longer term in nature. This latter group encompasses the activities and processes where the City, through directing additional attention and resources, would most likely achieve the greatest benefit to steelhead. These specific activities and processes include both those with a potential to negatively influence steelhead and those that may beneficially influence steelhead. With a focus on these activities and processes, the City could benefit steelhead by avoiding or minimizing the potential negative influences associated with certain activities and enhancing the positive effects of beneficial activities. Although the focus of this assessment is on steelhead and improving conditions for steelhead, benefits are also expected to accrue to other species of salmonids as a result of addressing steelhead issues. The specific activities and processes we identified as having the greatest potential to influence steelhead (positively or negatively) are listed below by general activity category.

Planning, Permitting, Inspection, and Enforcement Activities

- Comprehensive planning, zoning, and development approvals

- Environmental Overlay Zone designation (including Environmental and Greenway Overlays as well as Base Zoning Codes)
- Environmental zone review
- Greenway Overlay Zone designation
- Environmental zone standards check
- Environmental zone regulation enforcement
- Erosion control plan review
- Erosion control enforcement
- Floodplain code modification
- Natural Resources Management Plan implementation
- NPDES permit implementation (including stormwater manual)
- Plan District Regulations implementation

Water Delivery Activities

- Bull Run water diversion

Stormwater and Wastewater Management Activities

- Storm drain system discharge
- Wastewater discharge
- Combined system discharge
- Stormwater control structure operation (e.g., detention, retention facilities)
- Stormwater system/drainageway failures (including culverts)

Structure and Road Construction/Maintenance Activities

- Construction of instream structures
- Use of instream structures

Environmental Enhancement Activities

- Riparian enhancement (e.g., tree plantings)
- Wetland enhancement
- Instream habitat enhancement operation
- Floodplain land acquisition
- Natural areas acquisition and management

IV. ESA COMPLIANCE APPROACHES

Section 9 of the ESA prohibits the "take" of any fish or wildlife species listed under the ESA as endangered. Take of a species listed as threatened may also be prohibited by promulgation of rules under Section 4(d) of the ESA. The ESA defines take as "to harass, harm, pursue, hunt, shoot, kill, trap, capture, or collect, or to attempt to engage in any such conduct." However, the interpretation of take to specific activities has not always been clear to the regulated community. In the case of listed fish species, the ESA is administered by NMFS for marine and anadromous species (e.g., steelhead, chinook salmon) and the U.S. Fish and Wildlife Service (USFWS) for resident freshwater species (e.g., bull trout). Both USFWS and NMFS apply the definition of take broadly to any activity that harms a listed species. Recently, both the NMFS and USFWS provided additional guidance on their definition of take to activities that cause "significant habitat modification or degradation that actually kills or injures wildlife by significantly impairing essential behavioral patterns, including breeding, feeding, or sheltering" (see 63 CFR 24148; May 1, 1998). This guidance included examples of activities that may constitute take under the ESA, such as operation of barriers that prevent or impede migration to or within a listed-species' essential habitat; discharges of pollutants into such habitat; alteration of streamflows that is likely to impair migration, spawning, or other essential functions; or construction of bridges, roads, or trails along streams containing essential habitat.

Under provisions of the ESA, various approaches exist for seeking and ensuring ESA compliance, i.e., to ensure that activities do not result in an unlawful take of listed species or species proposed for listing. These approaches are basically aimed at either avoiding take altogether or gaining approval for take that occurs unintentionally or incidentally to otherwise lawful activities (i.e., "incidental take"). The following section describes these approaches and provides the advantages and disadvantages of each approach that the City should consider for further planning.

Avoid Take Altogether

Using existing take guidelines and the soon-to-be-published special 4(d) rule for steelhead (see discussion below), the City may determine that certain activities do not cause take for various reasons, such as no species or suitable habitat present in areas affected by the activity or no link whatsoever between the activity and a species/habitat effect. The City may choose to proceed with these activities without consulting or pursuing agreement with the agencies, under the assumption that the risk of violating the ESA via such activities is nil. Alternatively, the City may choose, with sufficient technical justification supporting a no-take finding, to consult with NMFS and seek "no-take concurrence" from NMFS.

The primary advantage of avoiding take altogether is that it provides the most clear and direct way to meet the ESA's fundamental objective of protecting and conserving listed species. By ensuring that activities avoid take altogether, the City could plan and conduct such activities with no required ESA consultation, contract, or agreement with the federal government. However, if the City pursues no-take concurrence, NMFS might impose certain take avoidance measures to be assured of no-take in providing their concurrence.

A disadvantage of the take avoidance approach is that take guidelines provided by NMFS, particularly for the Lower Columbia steelhead ESU, are still vague. Even as new guidelines and rules emerge (see 4(d) discussion below), the definition and description of activities potentially causing take are likely to remain broad and generic. Also, such guidelines and rules are likely to be conservative (i.e., incorporate a "margin-of-safety") and could restrict activities that might otherwise

be allowable under one of the other approaches involving more-specific assessment and consultation. Regardless, avoiding take as a primary goal in the City's activities is consistent with both the primary intent of the ESA and the expressed policy of the Portland City Council (Resolution No. 35715).

Avoid Take by Developing and Adhering to Section 4(d) Rules of the ESA

Section 4(d) of the ESA authorizes NMFS or the USFWS to issue a special rule that regulates take prohibitions for a species listed as threatened. In doing so the rule relieves the prohibitions on incidental take of a threatened species if the prohibitions are not necessary or advisable to provide for the conservation of the species, or if relaxation of the prohibitions would in fact promote the overall recovery of the species. A special rule under Section 4(d) may relieve take restrictions associated with specific lawful activities or in specific portions of the geographic range of the species. Often a 4(d) rule accompanies the listing decision for a threatened species. So far a 4(d) rule has not been issued for the Lower Columbia steelhead ESU, although NMFS intends to do so in the near future.

The primary advantage to the City of a 4(d) rule is that it could simplify aspects of the ESA process by passing day-to-day responsibility for ensuring species/habitat conservation from the federal government to state and local jurisdictions like the City. It also enables NMFS and USFWS to account for all on-going programs on federal and non-federal lands when determining the necessary level of take restriction and allows them to extend the benefits of federal conservation efforts to other affected parties (such as the City) within the species' range. The 4(d) rule could identify types of activities or programs in all or part of the species' range for which incidental take is not prohibited. This could apply directly to City activities and programs and thereby could provide important guidance on the City's approach to ESA compliance. NMFS has indicated an interest in the City's input and may be willing to develop 4(d) provisions incrementally as information is gathered and ideas are formed.

The primary disadvantage of the 4(d) rule is that it is written for the individual listed species and would not address multi-species planning efforts or solve long-term issues relative to other listed species or species proposed for listing in the area. Also, 4(d) rules are mostly written to be broadly applicable to an ESU or region; therefore, they are mostly general and generic. As such, the City should expect that a certain level of detailed analysis and planning will still be required to apply the 4(d) rule to City activities. Finally, the 4(d) rule is only applicable to a threatened species; therefore, should the status of a species change from threatened to endangered, the 4(d) rule would no longer be applicable.

Obtain Incidental Take Authorization Under Section 7 of the ESA

Where a project must obtain federal approval or funding, Section 7 of the ESA applies. If a federal agency permits, authorizes, or funds a certain City activity, that agency must consult with NMFS and/or USFWS to ensure that action taken by the federal agency on the activity does not jeopardize the species or detrimentally affect critical habitat. The City has been and is currently involved in many Section 7 processes, such as some roadway improvement projects that involve interaction with the Federal Highway Administration and other development activities that require federal permits.

Under the Section 7 process, consultation with NMFS and/or USFWS usually begins with preparation of a Biological Assessment (BA) by the "action agency" (or the actual permit applicant). Based on review of the BA, consultation may conclude in a timely, straight-forward manner if the

on whether the action will jeopardize the species or adversely modify critical habitat, and identify needed conservation measures, or reasonable and prudent alternatives. If a project is allowed to proceed, the process may conclude with issuance of an incidental take statement that allows for incidental take from the approved actions (and implemented measures) that is not a violation of the ESA.

The Section 7 process is mandatory where federal approval or funding is involved. Its primary advantage is that it is an already-existing ESA compliance mechanism, available for any of the City's activities with a federal connection or "nexus." In many cases it is a routine and straight-forward process wrapped into another required permitting process, thereby providing some permitting efficiency. Because Section 7 is a routine and often-applied ESA compliance mechanism, it is perhaps the most predictable and least time-consuming of the various approaches. Also, it is sometimes possible to package similar types of actions or projects into a single "programmatic" Section 7 process, thereby gaining some potential planning efficiencies.

Aside from being only available for actions with a federal connection, the primary disadvantage of the Section 7 process is that it is not likely to provide the City with long-term incidental take permission for those activities where such assurance is crucial for planning and implementation. An incidental take authorization under Section 7 applies only to the term of the federal action or permit that initiated the Section 7 process. Also, Section 7 incidental take authorization can be reconsidered by NMFS at any time if, for example, new information on a species emerges that would prompt NMFS to change its previous findings or requirements.

Obtain an Incidental Take Permit Under Section 10 of the ESA

Section 10 of the ESA allows NMFS to permit the incidental take of listed species by private parties and non-federal jurisdictions, such as the City, as long as:

- The take is incidental to an otherwise lawful activity;
- The applicant demonstrates that they will, to the maximum extent practicable, minimize and mitigate the impacts of the incidental take;
- The applicant ensures adequate funding for the mitigation measures;
- The incidental take will not appreciably reduce the likelihood of the survival and recovery of the species in the wild; and
- Any additional mitigation measures required by NMFS are met.

In order to obtain an Incidental Take Permit (ITP), an applicant must prepare a Conservation Plan or a Habitat Conservation Plan (HCP)[3] , either of which details, among other things, the activities that will be covered by the permit, the impacts that will likely result from the incidental take, and the mitigation measures that will be implemented. The applicant and federal agency (USFWS and/or NMFS) must also prepare an Implementation Agreement (IA), which is essentially a contract between the two parties that spells out the terms and conditions associated with the permit and the Conservation Plan. Lastly, the USFWS or NMFS must comply with the National Environmental Policy Act (NEPA) by issuing an Environmental Assessment or Environmental Impact Statement, which is typically prepared by the applicant or a consultant under the direction of the federal lead

[3] These two processes are slight variations of each other but the substantive requirements are the same. Therefore, for the purposes of this report they will be jointly referred to as Conservation Plans.

agency. The process of preparing a Plan, NEPA document and IA, and obtaining an ITP can take one to three years from start to finish.

The ITP process in general has a number of advantages. Perhaps foremost is the "no surprises" policy which provides the applicant with regulatory and planning certainty over the entire term of the Conservation Plan and ITP. This policy ensures that, once the ITP is issued, the applicant will not be required to accept additional mitigation obligations except in certain extraordinary circumstances. The ITP process is a proven method of facilitating land use activities in habitat known to be used by federally-listed species. ITPs have been issued for a wide array of species and land use activities, from residential development to commercial forestry. Supporting Plans have incorporated both certainty and adaptive management to satisfy the needs of landowners and regulators alike. Congress designed the process to be flexible and work under a wide range of conditions. The process is also predictable and relatively certain of success; it has been challenged a number of times, yet continues to be found legally defensible. Lastly, the ITP is the only practical means of securing coverage for multiple species. It can be used to cover one or several species, and can involve one or both of the agencies entrusted to carry out the ESA (USFWS and NMFS).

The ITP process has at least two distinct disadvantages. First, it can be quite costly. Recent Conservation Plans prepared by private landowners in the Pacific Northwest have cost $1,000,000 or more when all legal, technical, and process costs are considered. The second major disadvantage of the ITP process is that, by its contractual nature, a Conservation Plan with multiple stakeholders can be difficult to negotiate. The diversity of land ownership and jurisdictions in the Portland area indicates that the City will be dealing with a potentially large stakeholder base. Agreements between single landowners and a single agency, such as the NMFS or USFWS, can take several years to negotiate, and the process can only be expected to get more difficult with several dozen or several hundred potential stakeholders. The City's proactive, collaborative approach may eliminate much of the difficulty in negotiating. However, NMFS should be consulted on approaches for effectively incorporating stakeholders, especially in a legally-binding IA that would result from an approved Conservation Plan. For example, precedent may exist for a blanket permit process (with Certificate of Inclusion) that could eliminate much of the difficulty by allowing individual landowners to enter the process voluntarily after they have been able to observe the success of those already covered (e.g., North Carolina Sandhills Region Red-Cockaded Woodpecker Conservation Agreement).

V. POTENTIAL CONSERVATION STRATEGIES

The City's Conservation Strategy Will Likely Involve Various Approaches and Components

The City's conservation strategy for addressing the recently-listed steelhead and any further listed salmonids will likely involve a combination of strategy components. This combination should make best use of the available ESA compliance approaches (as described in section IV of this report) and most-efficiently address the many City programs, processes, and activities that have a potential to affect steelhead and other species that are listed or proposed for listing under the ESA. Thus, the City's strategy will likely use a combination of these compliance mechanisms wherein City activities are "packaged" in logical fashion by certain common features. For example:

- First and foremost, the City should identify activities and alternatives that avoid take altogether. Once the City has identified activities it considers to have no potential to affect steelhead or steelhead habitat, the City then could consult with NMFS to acquire "no-take concurrence" or inclusion in special rules under Section 4(d) of the ESA.
- The City could identify emergency-type activities that are episodic, unpredictable, and vital to human health and safety and seek inclusion in special rules under Section 4(d) of the ESA.
- The City could identify activities that are already regulated under relevant or related federal environmental programs, such as various Clean Water Act (CWA) programs, and seek recognition of these programs and their permits in special rules under Section 4(d) of the ESA. This recognition, if forthcoming, would likely apply to the program(s) in general and would no doubt require full program compliance and perhaps additional conditions imposed by NMFS. However, we believe the connection between the ESA and CWA could be very significant to the City's ESA compliance strategy as discussed further below.
- The City's strategy for activities with a federal "nexus" could rely on incidental take authorization via Section 7 of the ESA. For such activities/projects that are virtually identical and repetitive, the City could approach the relevant federal "action" agencies and NMFS about developing a programmatic Section 7 approach (i.e., a "programmatic" BA) to enhance permitting efficiency.
- The City could identify those activities that cannot be categorized as indicated above or for which the City desires a long-term incidental take permit that provides for greater planning certainty. Such activities, either together or in logical groups by activity-type (e.g., water supply activities in the Bull Run watershed), could be packaged into a Conservation Plan.

In any event, the City's strategy should be evaluated in light of other regulatory constraints, particularly the state's land use planning programs. Such evaluation will ensure that the strategy can be implemented in a manner that is consistent or does not conflict with these other regulatory programs.

The City's Strategy Should Make Use of Other Relevant Federal Regulatory Programs

Although ESA issues are likely to be the primary driver of the City's strategy, other regulations have important linkages that the City should consider in its strategy formulation. Foremost among these is the Clean Water Act (CWA), for two key reasons. First, City activities can be viewed as delivering a

potential effect on steelhead by three routes: (1) via water quality (e.g., turbidity/fine sediment from erosion); (2) via water quantity (e.g., diversion of water from the Bull Run River for municipal water needs); and (3) via physical means or disturbances (e.g., placement of instream structures). Of these, potential water-quality effects pose the most numerous and significant concerns with City activities related to steelhead conservation and recovery. Second, most City activities that affect or potentially affect water quality are currently regulated by a variety of CWA programs and permits. For example, the City's wastewater and stormwater discharges are regulated under permits issued under the National Pollution Discharge Elimination System (NPDES) program of the CWA. The NPDES permits are issued for these "point-source" discharges every five years and require that the City comply with water quality standards. These water quality standards are in most cases aimed at protection of coldwater biota including steelhead. Hence, the CWA and ESA share an important and significant link in ensuring that water quality is adequate to protect coldwater biota including steelhead.

Other CWA programs regulate and/or guide other water quality-related activities with similar potential links to ESA. For example, Section 404 of the CWA administered by the U.S. Army Corps of Engineers (Corps) and the Oregon Division of State Department of State Lands (DSL) regulates water quality compliance associated with removal and fill activities in waterways, such as associated with construction activities in streams, wetlands, and floodways. Section 401 of the CWA administered by the Oregon Department of Environmental Quality (DEQ) certifies compliance with water quality standards for a variety of federal programs and actions affecting the City (e.g., the Bull Run hydroelectric license issued by the Federal Energy Regulatory Commission (FERC); CWA Section 404 permits).

Another important CWA program with a probable link to ESA and steelhead conservation program is the CWA Section 303(d) program. This program requires that DEQ identify "water quality limited" watercourses in Oregon (i.e., watercourses that do not comply with one or more of the state's water quality standards). Once on the "303(d) list", DEQ develops and allocates Total Maximum Daily Loads (TMDLs) of pollutants in these waters at a basin-wide level. In the Portland area, TMDLs have been developed for the Columbia Slough and Fanno Creek and are planned within a few years for the lower Willamette River and Sandy River basins.

Once basin-wide TMDLs are established, allocation for point sources probably will be done mostly through existing NPDES permits. Allocation for non-point sources (i.e., runoff that is diffuse with no specific discharge points) will be done mostly through water quality management plans (WQMPs) that will likely rely on best management practices (BMPs) to control such runoff. DEQ guidance indicates that these WQMPs will be closely tied to aquatic species protection and, in fact, this guidance suggests that Conservation Plans developed under Section 10 of the ESA might possibly serve as the basis for certain WQMPs. Therefore, the City should consider and potentially integrate local plans for developing of TMDLs and WQMPs into its ESA strategy development.

The City's Strategy Should Build on Existing City Environmental Plans and Programs

The City already has environmental planning processes and programs in place that provide a logical framework on which to build a conservation strategy that will also contribute to ESA compliance solutions for City activities. In particular, the City has a comprehensive planning process for designating environmental zones (i.e., e-zones, greenway zones), conducts environmental review processes for activities in environmental zones, has developed and is developing resources plans for the City's watersheds (e.g., Johnson Creek and Fanno Creek Watershed Management Plans), requires erosion and sediment control on private and public projects, and is developing or updating a variety of guidance documents aimed at water quality and aquatic habitat protection (e.g., Erosion Control

Manual, Stormwater Management Manual, Integrated Pest Management Plan). In addition, the City's approach to planning adheres to the regional urban growth plan, which emphasizes contained growth within an Urban Growth Boundary (UGB). Protection of the region's natural environment is a stated goal of this plan. These processes and programs could serve, for example, as important components of a Conservation Plan or for demonstrating adherence to possible provisions of a special 4(d) rule.

To determine the utility and applicability of these and other City processes and programs to its ESA conservation strategy the City should specifically:

1. Evaluate and document the adequacy of the processes and programs for protecting the needs of steelhead and steelhead habitat function (we also recommend including the needs of other species that are listed or proposed for listing);
2. Evaluate and document procedures for ensuring implementation and enforcement of these processes and programs;
3. Implement necessary changes to achieve protection of salmonids and their habitat; and
4. Monitor and document the effectiveness of these processes and programs.

We expect that NMFS will require such assurances before endorsing these processes and programs as components of an approved Conservation Plan or 4(d) rule. Successful implementation of the above steps will likely require concerted collaboration and coordination among City bureaus and departments to ensure consistent and complete implementation and effectiveness. The City has already formed an ESA Steering Committee with broad interbureau representation. This committee provides the City a solid, proactive basis for this needed collaboration and coordination.

VI. RECOMMENDATIONS

Next Steps in Conservation Strategy Development

We recommend that the City conduct several tasks as follow-up to this assessment to further develop a conservation strategy. (These tasks are not necessarily in a recommended order of priority.)

1. Although our assessment focused on steelhead, we recommend that the City's follow-up tasks and strategy development consider and incorporate the needs of other listed species or species proposed for listing that may use City watercourses (the attached matrices list these species by watercourse).
2. The City should conduct a focused, detailed analysis of selected activities and programs to confirm and more explicitly determine possible effects on steelhead and steelhead habitat. Particular emphasis should be initially directed at those activities and factors that this screening assessment highlighted as potentially most influential.
3. The City's planning and permitting programs/processes, especially those aimed specifically at water quality and natural resources protection, should be evaluated as to their adequacy for specifically protecting steelhead and steelhead habitat needs. These programs/processes should also be evaluated for the adequacy of their implementation and enforcement.
4. Activities should be assessed and organized in categories according to activity pathway/effect and existing regulatory planning and permitting processes. This assessment and organization should then be evaluated as to the possible linkages of these existing regulatory processes to various ESA compliance approaches. The outcome would be an initial strategy framework for "packaging" City activities for ESA consultation and permitting purposes. An abbreviated example of such a framework is depicted in matrix form in Figure 3.
5. Based on results of the above tasks, the City should conduct a focused, more detailed assessment of the most appropriate ESA compliance approaches for various city activities. Also, it is likely that more than one approach will be available for an activity or group of activities. As described in section IV of this report, the various approaches each have advantages and disadvantages that should be evaluated on an activity-specific basis.
6. The City has already had a number of discussions and meetings with NMFS related to city-wide ESA issues and compliance. The City should continue to engage NMFS in a well-planned and on-going program of coordination and consultation. The City's activities and their potential influence on steelhead (and other key species) are varied and complex. A thorough understanding by NMFS of these activities and potential influences will be vital to achieving complete and timely ESA compliance. In addition, the City has specific information and knowledge on fisheries issues and solutions in the urban area that would be valuable to NMFS.
7. The City should become proactively involved in, and assist NMFS with, development of a 4(d) rule for the Lower Columbia steelhead ESU and in continued incremental improvements and amendments to such a rule. The rule is likely to provide crucial guidance on take restrictions and could provide relief provisions for certain types of City activities. For such activities, 4(d) guidance would likely offer a clear and efficient pathway for ESA compliance.

8. The City should work closely with NMFS on understanding and defining the criteria that NMFS will use to assess steelhead factors and effects in the City environment. The City's specific information and knowledge on fisheries issues and solutions in the urban area could be of value for NMFS in actually determining such criteria. A solid understanding of these criteria will enable the City to more precisely assess effects of certain activities and determine needed conservation measures.

9. In addition to NMFS, the City should also consult with DEQ (and perhaps EPA) to determine the opportunities and practicalities of linking CWA programs and permits with ESA compliance mechanisms. As discussed in section VI, the ESA's possible link with the CWA could be very important to the City. If needed, the City should facilitate discussions between these agencies to obtain guidance and decisions on such links and their implications.

10. The City should identify and engage potential collaborative partners and stakeholders, and also consider including a public involvement component to an ESA compliance strategy. While the City has a major, and perhaps lead, role to play in steelhead conservation in Portland, the success of conservation efforts will require support and participation by other entities, jurisdictions, and the public. From a practical standpoint, many City activities involve direct participation of, overlap with, or shared responsibility with other entities, jurisdictions, and the public.

EXISTING PLANNING & PERMIT PROCESSES	Point Sources	Construction Runoff	Non-point Sources	Waterway Removal / Fill	Water Diversion	Floodway / Floodplain	Instream Structures
	TYPES OF ACTIVITIES (√)						
CWA 402 (NPDES) Program	√	√					
Wastewater Discharge Permits	√		√				
Construction Runoff Permits		√					
CWA 303(d) (TMDL) Process	√		√		√	√	
Water Quality Management Plans	√		√		√	√	
CWA 401 Process	√	√	√		√		
Water Quality Certification	√	√	√		√		
CWA 404 Program				√		√	√
Removal-Fill Permits				√		√	√
FEMA Floodway Programs						√	√
Floodway Activities Approvals						√	√
City Programs / Processes	√	√	√	√	√	√	√
E-Zone / Greenway Planning	√	√	√			√	√
Environmental Zone Review	√	√	√			√	√
Watershed / Basin Plans	√	√	√	√	√	√	√
Emergency Response Activities							

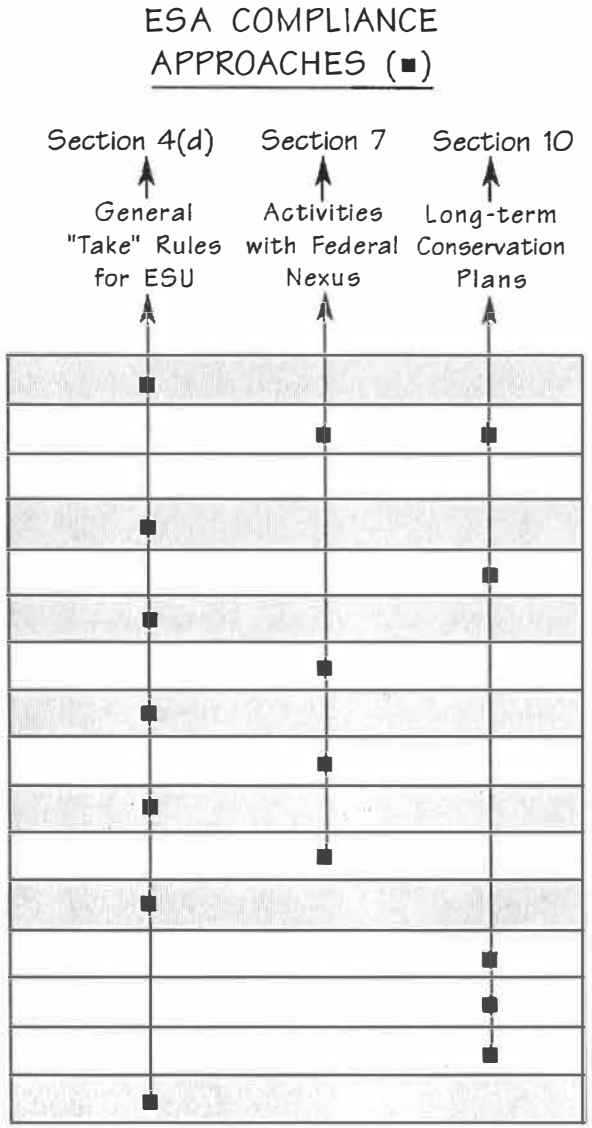

Figure 3. Matrix showing examples of possible links between types of activities, ESA compliance approaches, and existing regulatory programs and permitting processes. Refer to the Potential Conservation Strategies section of this report for a description of these existing regulatory processes, particularly those related to the Clean Water Act (CWA).

APPENDIX A

Matrix Organization and Interpretation

Appendix A

Organization and Interpretation of the Influence Matrices

Matrix Organization

Watercourse

The influence matrices (Appendices C1-C7) are organized by individual watercourse corresponding to the Columbia River, Columbia Slough, Willamette River, Johnson Creek, Fanno Creek, Tryon Creek, and Bull Run/Sandy River. The matrix for each watercourse contains the following information.

Watercourse Fish Use

Each matrix identifies how the particular watercourse is used by steelhead and other salmonids, their federal status, and the evolutionarily significant unit (ESU) in which they are listed. Fish use is indicated through reference to the various life stages present in the watercourse (i.e., spawning, rearing, migration). Spawning use is indicated where the segment of the watercourse in the Portland area or segments immediately downstream are used for spawning. Rearing use is indicated for stream segments used by juvenile salmonids during their freshwater residence. Migration refers to both upstream passage by adult fish during their spawning migration and the seaward downstream migration (emigration) of juvenile fish.

Pathways and Factors

Each matrix identifies the various pathways through which the City could influence steelhead (e.g., storm drain system) and the factors that affect steelhead (e.g., toxic materials and water temperature).

Potential to Influence

Existing Potential of the Factor to Affect Fish
For each factor affecting fish identified in the matrices, the existing potential of that factor to affect fish is indicated as either low, moderate, or high. This refers to the potential of a given factor to affect steelhead in the watercourse under consideration, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which fish use the watercourse. A brief description is provided on the general conditions within the watercourse relative to the specific factor.

City's Capacity to Influence Factor
Each individual matrix also identifies the City's relative capacity (i.e., low, moderate, high) to influence the factors in the watercourse through its various activities and planning/permitting processes. For each factor, a brief rationale is given for the influence determination. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

Activities/Factors and Pathways

This portion of the matrix lists each of the City activities that may influence steelhead in the watercourse and identifies the ways in which the activity may affect steelhead (i.e., influencing factors), as well as the pathways that link these factors to the watercourse. The pathways are indicated in the matrix as letters; lower case letters indicate a possible negative influence and capital letters indicate a potential beneficial influence on steelhead. Activities determined to have the greatest potential to influence steelhead and that should perhaps receive priority focus are indicated by shading.

Interpretation of the Matrices

The information contained in the matrices is the result of a screening-level analysis intended to initially identify the potential level of influence City activities have on steelhead. It is also intended to be used as a guide to taking the initial steps in developing a long-term strategy. This assessment focuses on potential influences and does not determine whether these influences are actually occurring. No individual activity has been examined in detail. Therefore, these matrices should not be solely relied upon for conclusions or decisions regarding impacts of City activities on steelhead. Also, these matrices should not be used to determine the potential for "take" as defined under the ESA. Such determination should rely on appropriate consultation with NMFS.

APPENDIX B

Planning, Permitting, Inspection, and Enforcement Activities and Processes

PLANNING, PERMITTING, INSPECTION, AND ENFORCEMENT ACTIVITIES AND PROCESSES

Urban and suburban development can directly and indirectly affect fish and fish habitat by modifying the natural characteristics of local watersheds and through the effect generated by the various activities that accompany urban development. The City of Portland has jurisdiction over urban development through comprehensive planning and zoning processes and permitting, inspection, and enforcement activities. While urban development in general may have a negative effect on the natural environment, the City conducts a number of actions (planning, permitting, inspection, and enforcement) to avoid, minimize, or mitigate adverse effects on water quality, air quality, and fish and wildlife habitat. The extent of influence (or degree of benefit) these actions have on fish (particularly steelhead) is dependent upon the adequacy, effective implementation, and proper enforcement of these actions.

The following represents a list of the City's ongoing planning, permitting, inspection, and enforcement activities and processes and the watershed/watercourse in which these processes and actions have the capacity to influence. The processes/activities with the greatest potential to benefit steelhead are indicated with shading. As described in the preceding report, it is recommended that such processes and actions be further evaluated as to adequacy, implementation, and enforcement.

Process/Activity	Columbia River	Columbia Slough	Willamette River	Johnson Creek	Fanno Creek	Tryon Creek	Bull Run/ Sandy River
Building code enforcement	✓	✓	✓	✓	✓	✓	
Building demolition authorization	✓	✓	✓	✓	✓	✓	
Bull Run Road Maintenance Plan							✓
Comprehensive planning, zoning, and development approvals	✓	✓	✓	✓	✓	✓	
Development review (not in e-zones)	✓	✓	✓	✓	✓	✓	
Environmental Overlay Zone designation	✓	✓	✓	✓	✓	✓	
E-zone regulation enforcement	✓	✓	✓	✓	✓	✓	
Environmental zone review	✓	✓	✓	✓	✓	✓	
Environmental zone standards check	✓	✓	✓	✓	✓	✓	
Erosion control enforcement	✓	✓	✓	✓	✓	✓	✓
Erosion control plan review	✓	✓	✓	✓	✓	✓	✓
Modified floodplain code				✓			
Foundation and grading plan review	✓	✓	✓	✓	✓	✓	
Greenway Overlay Zone designation			✓				
Integrated Pest Management program implementation	✓	✓	✓	✓	✓	✓	

Process/Activity	Columbia River	Columbia Slough	Willamette River	Johnson Creek	Fanno Creek	Tryon Creek	Bull Run/ Sandy River
Natural Resources Management Plan implementation		✓[a,b]	✓[c]				
NPDES permit implementation	✓[1,2]	✓[1]	✓[1,3]	✓[1]	✓[1]	✓[1]	
Open space conditional use review for Ross Island			✓				
Recreation use authorization in parks	✓	✓	✓	✓	✓	✓	
Sewer construction/connection permit issuance	✓	✓	✓	✓	✓	✓	
Plan District Regulations implementation	✓[d]	✓[d]	✓[e]	✓[f]			
Street grading permit issuance	✓	✓	✓	✓	✓	✓	
Street improvement permit issuance	✓	✓	✓	✓	✓	✓	
Street opening permit issuance	✓	✓	✓	✓	✓	✓	
Tree removal permit issuance	✓	✓	✓	✓	✓	✓	
Urban development planning and facilitation by PDC			✓	✓			
Urban Forestry Management Plan implementation	✓	✓	✓	✓	✓	✓	

[a] Smith-Bybee Lakes Natural Resources Management Plan
[b] Peninsula Drainage District No. 1 Natural Resources Management Plan
[c] Forest Park Natural Resources Management Plan
[d] Columbia South Shore Plan District Regulations
[e] Skyline Plan District Regulations (Balch Creek)
[f] Johnson Creek Basin Plan District Regulations

[1] MS4 Stormwater NPDES permit
[2] Columbia Blvd. TP NPDES permit
[3] Tryon Creek TP NPDES permit

APPENDIX C

Watercourse Matrices

Appendix C-1

Columbia River

COLUMBIA RIVER

Watercourse Fish Use

Species	ESU	Federal Status	Life Stage Presence			Comments
			Spawning	Rearing	Migration	
Steelhead trout	Upper Columbia R.	Endangered			✓	
	Middle Columbia R.	Proposed Threatened			✓	
	Lower Columbia R.	Threatened		✓	✓	
	Snake R.	Threatened			✓	
	Upper Willamette R.	Proposed Threatened		✓	✓	Juvenile rearing is possible
Chinook salmon	Snake R. –spring/summer	Threatened			✓	
	Snake R. - fall	Threatened		✓	✓	
	Upper Columbia R. - spring	Proposed Endangered			✓	
	Lower Columbia R.	Proposed Threatened		✓	✓	
	Upper Willamette R.	Proposed Threatened		✓	✓	Juvenile rearing is possible
Sockeye salmon	Snake R.	Endangered			✓	
Chum salmon	Lower Columbia R.	Proposed Threatened		✓	✓	Juvenile rearing is possible but most chum migrate to saltwater immediately

Pathways and Factors

Pathways:	Storm drain system	Wastewater system	Natural drainage system	River corridor
Influencing Factors:	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• riparian vegetation • predation • disturbance • passage • turbidity/sediment

POTENTIAL TO INFLUENCE (COLUMBIA RIVER)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Toxic materials	LOW	MODERATE	The presence of potentially toxic compounds (e.g., pesticides, oil and grease, heavy metals) can cause adverse acute and/or chronic physiological responses in salmonids. Such compounds are present in the lower Columbia River, but toxicity to salmonids, particularly migratory anadromous salmonids (e.g., steelhead) has not been identified as a significant issue in the river near the Portland area. Nonetheless, urban activities can be an important potential source of such compounds.
Nutrients	LOW	LOW	Nutrient input (e.g., phosphorous, nitrogen) can beneficially affect salmonids (e.g., increased productivity can improve food supply) or adversely affect them (e.g., excessive nutrient input can cause reduced dissolved oxygen). Some nutrient enrichment has occurred in the lower Columbia River from basin development activities (e.g., irrigation return water, treated wastewater effluent), but effects on salmonids have not been identified as a significant issue in the river near the Portland area. Portland-area urban activities are a relatively minor contributor of nutrients to the mainstem river.
Turbidity and fine sediment	LOW	LOW	The presence of excessive turbidity and fine sediment (e.g., from soil erosion) can result in adverse physiological or behavioral responses in salmonids, and affect salmonid spawning redds and food (e.g., invertebrate) supply. Turbidity and fine sediment have not been identified as significant concerns for salmonids in the Columbia River near the Portland area; turbidity and fine sediment concentrations in the Columbia River rarely approach levels harmful to salmonids. Portland-area urban activities are a relatively minor contributor of turbidity and fine sediment to the mainstem river.
Organic material	LOW	LOW	Input of organic material (e.g., leaf litter, woody material) can beneficially affect salmonids (e.g., improve invertebrate production, increase habitat cover) or adversely affect fish (e.g., increased biological oxygen demand). Organic material has not been identified as a significant concern for salmonids in the Columbia River near the Portland area; organic material concentrations in the Columbia River rarely approach levels harmful to salmonids.
Flow	MODERATE	LOW	Increased or decreased flows can result in behavioral changes in migrating salmonids or change the availability and use of fish habitat. The Columbia River basin's storage reservoir/hydropower system in the US and Canada has altered the mainstem river's natural flow regime. This flow modification has affected juvenile survival, water temperature, and adult migration timing. Portland-area urban activities are a relatively minor contributor to the mainstem river's altered flow regime.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

POTENTIAL TO INFLUENCE (COLUMBIA RIVER)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Temperature	MODERATE	LOW	Salmonids require cool water conditions; excessive warm temperatures can result in behavioral changes, reduced growth, stress or injury of salmonids. Basin development activities (e.g., impoundment and altered flows) have modified the Columbia River's thermal regime. This modified thermal regime is considered an important factor that adversely affects salmonids in the river. Because of the river's large thermal capacity, Portland-area urban activities are a relatively minor contributor to the mainstem river's thermal input.
Riparian vegetation	LOW	LOW	Riparian vegetation can be a key contributor to shading and temperature control, and an important source of woody debris that helps maintain channel structure and aquatic habitat diversity. However, because of the Columbia River's large size, riparian vegetation has much less functional influence on shade and channel structure than in smaller rivers or streams. Rather, this vegetation provides more localized streambank functions, such as bank stability and habitat cover. Riparian vegetation is relatively sparse along the Columbia River within the City (i.e., Marine Drive). The levees along the Columbia River are owned by the U.S. Army Corps of Engineers.
Predation	MODERATE	MODERATE	It is possible that instream structures could increase predation by providing habitat, refuge, and cover for fish species that prey upon juvenile steelhead and other salmonids. Predation occurs in the lower Columbia River, particularly predation by smallmouth bass and northern squawfish. However, the extent to which instream structures increase predation is uncertain and debatable.
Passage	LOW	LOW	The presence of instream structures (e.g., culverts, diversions) can restrict or inhibit fish movement or migration, or impede access to suitable habitat. Passage is not a significant issue in the mainstem Columbia River adjacent to the City.
Disturbance	LOW	LOW	Activities (e.g., boat traffic, angling, excessive noise) conducted along or in the river or stream can increase stress, influence behavior, or affect habitat use of salmonids exposed to the disturbance. Although shipping traffic in the Portland area is heavy, disturbance has not been identified as an issue in the mainstem river, since fish can seek refuge in deep water or along the shoreline out of shipping lanes.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

COLUMBIA RIVER

Activity	Short Term	Long Term	Influencing Factor/Pathways[2] Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Water Delivery Activities												
Hydrant flushing	✓		a,d		a,d							
Water main installation	✓		a,d,e		a,d,e							e
Water main flushing	✓		a,d		a,d							
Water distribution system cleaning (including chlorination)	✓		a,d		a,d							
Water distribution system repair (e.g., pipeline repairs)	✓		a,d		a,d							
Water distribution system stream crossing construction/maintenance	✓		d,e		d,e							e
Well field maintenance (e.g., discharging water produced from exercising pumps)	✓		d,e		d,e							
Stormwater and Wastewater Management Activities												
Storm drain system discharge		✓	a	a	a	a	a	a				
Stormwater system/drainageway failures	✓		ade		ade				de			e
Wastewater discharge (Columbia Blvd. plant)		✓	b	b	b	b	b	b				
Wastewater outfall extension (e.g., Columbia Blvd. outfall extension)		✓			e					e		e
Root foaming	✓		a,b			a,b						
Structure and Road Construction/Maintenance Activities												
Construction of instream structures	✓		e		e							e

[2] Pathways: a,A = storm drain system b,B = wastewater system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

COLUMBIA RIVER													
			Influencing Factor/Pathways[1]										
Activity	Short Term	Long Term	Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Structure and Road Construction/Maintenance Activities (cont'd)													
Use of instream structures		✓								e		e
Road and bridge construction	✓		a,d,e		a,d,e				d,e			e
Street repair	✓		a,d		a,d							
Street washing		✓	a,d		a,d	a,d						
Street sweeping		✓	A,D		A,D	A,D						
Roadway sand/gravel application	✓				a,d							
Roadway sand/gravel recycling	✓				A,D							
Unimproved rights-of-way		✓			a,d							
Environmental Enhancement Activities													
Vegetation removal (e.g., exotic vegetation control)	✓				d,e				d,e			e
Other Activities													
Vehicle and equipment/facilities cleaning and maintenance		✓	a,d	a,d	a,d							
Fire site runoff (fire-fighting)	✓		a,d,e	a,d,e	a,d,e	a,d,e						e
City-funded vector control		✓	a,b,d,e									

[1] Pathways: a,A = storm drain system b,B = wastewater system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

Appendix C-2

Columbia Slough

COLUMBIA SLOUGH

Watercourse Fish Use

Species	ESU	Federal Status	Life Stage Presence			Comments
			Spawning	Rearing	Migration	
Steelhead trout	Upper Columbia R.	Endangered			✓	Migration is conceivable but unlikely
	Middle Columbia R.	Proposed Threatened			✓	Migration is conceivable but unlikely
	Lower Columbia R.	Threatened		✓	✓	Rearing/migration is possible; local stocks may rear in slough and adults may stray into slough
	Snake R.	Threatened			✓	Migration is conceivable but unlikely
	Upper Willamette R.	Proposed Threatened		✓	✓	Rearing/migration is possible; local stocks may rear in slough and adults may stray into slough
Chinook salmon	Snake R. –spring/summer	Threatened			✓	Migration is conceivable but unlikely
	Snake R. - fall	Threatened			✓	Migration is conceivable but unlikely
	Upper Columbia R. - spring	Proposed Endangered			✓	Migration is conceivable but unlikely
	Lower Columbia R.	Proposed Threatened		✓	✓	Juvenile rearing/migration is unlikely, but local stocks may rear in slough and adults may stray into slough
	Upper Willamette R.	Proposed Threatened		✓	✓	Juvenile rearing/migration is unlikely but local stocks may rear in slough and adults may stray into slough
Sockeye salmon	Snake R.	Endangered			✓	Migration is conceivable but unlikely
Chum salmon	Lower Columbia R.	Proposed Threatened		✓	✓	Migration is conceivable but unlikely. Tributaries upstream from Milton Creek in Oregon are excluded from the ESU but upstream-produced chum from WA may access

Pathways and Factors				
Pathways:	**Storm drain system**	**Combined system**	**Natural drainage system**	**River corridor**
Influencing Factors:	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• riparian vegetation • predation • disturbance • passage • turbidity/sediment

POTENTIAL TO INFLUENCE (COLUMBIA SLOUGH)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Toxic materials	MODERATE	MODERATE	The presence of potentially toxic compounds (e.g., pesticides, oil and grease, heavy metals) can cause adverse acute and/or chronic physiological responses in salmonids. Toxic materials are viewed as a concern in the Columbia Slough due to accumulation of contaminants from both point and non-point sources. However, the temporary use of the slough by migratory anadromous salmonids limits their exposure and risk from these contaminants.
Nutrients	MODERATE	MODERATE	Nutrient input (e.g., phosphorous, nitrogen) can beneficially affect salmonids (e.g., increased productivity can improve food supply) or adversely affect them (e.g., excessive nutrient input can cause reduced dissolved oxygen). Nutrient loading contributes to occasional oxygen depletion in the slough.
Turbidity and fine sediment	LOW	MODERATE	The presence of excessive turbidity and fine sediment (e.g., from soil erosion) can result in adverse physiological or behavioral responses in salmonids, and affect salmonid spawning redds and food (e.g., invertebrate) supply. Sediments are viewed as a concern in the slough due to the slough's slow flushing and accumulation of sediments from erosion and stormwater runoff. However, turbidity and fines are not considered as significant factors affecting salmonids (such as by limiting food production or spawning) particularly since use of the slough is temporary.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

POTENTIAL TO INFLUENCE (COLUMBIA SLOUGH)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Organic material	MODERATE	MODERATE	Input of organic material (e.g., leaf litter, woody material) can beneficially affect salmonids (e.g., improve invertebrate production, increase habitat cover) or adversely affect fish (e.g., increased biological oxygen demand). Organic material, such as from decomposing algae and macrophytes, as well as airport de-icing materials, has been identified as contributing to the oxygen depletion problem in the slough, along with nutrient inputs.
Flow	HIGH	MODERATE	Increased or decreased flows can result in behavioral changes in migrating salmonids or change the availability and use of fish habitat. Slow flushing and control of flows are considered important factors in causing water quality and sediment problems in the slough. The slough has been cut off from the mainstem Columbia River at the head (east) end, and thus does not flush as rapidly as in the past. This slow flushing contributes to certain water quality problems in the slough, and reduces suitability for access and use by salmonids.
Temperature	HIGH	MODERATE	Salmonids require cool water conditions; excessive warm temperatures can result in behavioral changes, reduced growth, stress or injury of salmonids. Slow flushing and limited shading in the slough often cause unsuitable temperatures for salmonids, particularly during summertime low flow periods.
Riparian vegetation	MODERATE	MODERATE	Riparian vegetation can be a key contributor to shading and temperature control, and an important source of woody debris that helps maintain channel structure and aquatic habitat diversity. Riparian vegetation is sparse in the lower slough due to diking and other bank armoring. The resultant lack of shading contributes to the excessive water temperatures that occur during parts of the year.
Predation	MODERATE	MODERATE	Warmwater predatory fish (e.g., bass) are abundant in the slough, and are very active in the warmer waters of the slough. It is possible that instream structures could increase predation by providing habitat, refuge, and cover for fish species that prey upon juvenile steelhead and other salmonids. However, it is debatable as to if and how much such structures would increase predation.
Passage	MODERATE	MODERATE	The presence of instream structures (e.g., culverts, diversions) can restrict or inhibit fish movement or migration, or impede access to suitable habitat. The upper end of the slough is cut off, which prevents access from the Columbia River into the head of the slough, and the middle and upper slough are inaccessible due to a levee near 24th Avenue that blocks upstream passage.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

POTENTIAL TO INFLUENCE (COLUMBIA SLOUGH)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Disturbance	LOW	MODERATE	Activities (e.g., boat traffic, angling, excessive noise) conducted along or in the river or stream can increase stress, influence behavior, or affect habitat use of salmonids exposed to the disturbance. Although some localized disturbance could occur, salmonid use is relatively low in the slough.

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[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

COLUMBIA SLOUGH

Activity	Short Term	Long Term	Influencing Factor/Pathways[2] Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Water Delivery Activities												
Hydrant flushing	✓		a,c,d		a,c,d							
Water main installation	✓		a,c,d,e		a,c,d,e							e
Water main flushing	✓		a,c,d		a,c,d							
Water storage reservoir draining and cleaning	✓		a,c,d		a,c,d							
Water distribution system cleaning (including chlorination)	✓		a,c,d		a,c,d							
Water distribution system repair (e.g., pipeline repairs)	✓		a,c,d		a,c,d							
Water distribution system stream crossing construction/maintenance	✓		d,e		d,e							e
Storage tank maintenance, repair, and improvement	✓		a,c,d		a,c,d							
Well field maintenance (e.g., discharging water produced from exercising pumps)	✓		d,e				d,e					
Stormwater and Wastewater Management Activities												
Storm drain system discharge		✓	a	a	a	a	a	a				
Combined system discharge		✓	c	c	c	c	c	c				
Root foaming	✓		c			c						
Sump operation		✓	A,C		A,C		A,C					
Sewer pipeline construction	✓		a,c,d,e		a,c,d,e				d,e			e
Sewage system failures (e.g., breaks in sewage lines)	✓		a,c,d,e	a,c,d,e	a,c,d,e	a,c,d,e						
Stormwater control structure construction/maintenance	✓		a,d,e		a,d,e							

[2] Pathways: a,A = storm drain system b,B = wastewater system c,C= combined system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

COLUMBIA SLOUGH												
			Influencing Factor/Pathways[2]									
Activity	Short Term	Long Term	Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Stormwater and Wastewater Management Activities (cont'd)												
Stormwater control structure operation		✓	A,D		A,D		A,D					
Stormwater system/drainageway failures	✓		a,c,d		a,c,d							
Structure and Road Construction/Maintenance Activities												
Culvert installation/placement/ maintenance	✓				d,e		e	e	e		e	e
Road and bridge construction	✓		a,c,d,e		a,c,d,e				d,e			e
Street repair	✓		a,c,d		a,c,d							
Bridge repair	✓		d,e		d,e				d,e			e
Street washing		✓	a,c,d		a,c,d	a,c,d						
Street sweeping		✓	A,C,D		A,C,D	A,C,D						
Roadway sand/gravel application	✓				a,c,d							
Roadway sand/gravel recycling	✓				A,C,D							
Unimproved rights-of-way		✓			a,c,d							
Environmental Enhancement Activities												
Streambank armoring installation	✓				e				e	e		e
Streambank armoring		✓			E				e	e		
Streambank improvement installation	✓				d,e			e	d,e			e
Streambank improvements (bioengineering)		✓			D,E			D,E	D,E			
Installation of riparian enhancements	✓				d,e				d,e			e
Riparian enhancement (e.g., tree plantings)		✓			D,E	D,E		D,E	D,E			

[2] Pathways: a,A = storm drain system b,B = wastewater system c,C= combined system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

COLUMBIA SLOUGH												
			Influencing Factor/Pathways[2]									
Activity	Short Term	Long Term	Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Environmental Enhancement Activities (cont'd)												
Wetland construction/maintenance	✓				d,e							
Wetland enhancement		✓	D,E	D,E	D,E							
Vegetation removal (e.g., exotic vegetation control)	✓				d,e							e
Park, Natural Area, and Landscape Activities												
City facilities landscape maintenance		✓	a,c,d,e,	a,c,d,e								
Hillslope slumping/landsliding	✓				a,c,d,e	a,c,d,e			d,e			
Landslide repair	✓				A,C,D,E	A,C,D,E						
Trail construction	✓				d,e				e			e
Trail maintenance and use		✓			D,E							
Natural areas acquisition and management		✓			D,E				D,E			E
Pesticide application	✓		a,c,d,e									
Pest control applicator certification[3]	✓		A,C,D,E									
Turf maintenance (i.e., mowing and fertilization)		✓	a,c,d	a,c,d	a,c,d	a,c,d						
Golf course maintenance		✓	a,c,d	a,c,d	a,c,d	a,c,d						
Other Activities												
Vehicle and equipment/facilities cleaning and maintenance		✓	a,c,d	a,c,d	a,c,d							
Fire site runoff (fire-fighting)	✓		a,c,d,e	a,c,d,e	a,c,d,e	a,c,d,e						e
City-funded vector control		✓	a,c,d,e									
Raceway operation	✓		d	d	d	d						

[2] Pathways: a,A = storm drain system b,B = wastewater system c,C= combined system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

[3] Pest control applicator certification is considered a potential beneficial influence. Its intent, if properly implemented, is to avoid potential adverse effects from pesticide application (as listed above).

Appendix C-3

Willamette River

WILLAMETTE RIVER

Watercourse Fish Use

Species	ESU	Federal Status	Life Stage Presence			Comments
			Spawning	Rearing	Migration	
Steelhead trout	Lower Columbia R.	Threatened		✓	✓	
	Upper Willamette R.	Proposed Threatened		✓	✓	
Chinook salmon	Lower Columbia R.	Proposed Threatened	?	✓	✓	Spawning use by fall-run chinook salmon unknown
	Upper Willamette R.	Proposed Threatened		✓	✓	

Pathways and Factors

Pathways:	Storm drain system	Combined system	Wastewater system	Natural drainage system	River corridor
Influencing Factors:	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• riparian vegetation • predation • disturbance • passage • turbidity/sediment

POTENTIAL TO INFLUENCE (WILLAMETTE RIVER)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Toxic materials	MODERATE	MODERATE	The presence of potentially toxic compounds (e.g., pesticides, oil and grease, heavy metals) can cause adverse acute and/or chronic physiological responses in salmonids. Toxic releases have been identified as an issue in the Willamette River upriver from Portland (particularly in the Newberg Pool reach), but toxicity to salmonids, particularly migratory anadromous salmonids (e.g., steelhead) has not been identified as a significant issue in the river near the Portland area. Nonetheless, urban activities can be an important potential source of such compounds and could potentially affect migrating salmonids.
Nutrients	LOW	LOW	Nutrient input (e.g., phosphorous, nitrogen) can beneficially affect salmonids (e.g., increased productivity can improve food supply) or adversely affect them (e.g., excessive nutrient input can cause reduced dissolved oxygen [DO]). Some nutrient enrichment has occurred in the Willamette River from basin development activities (e.g., irrigation return water, treated wastewater effluent). However, nutrient-related effects on salmonids have not been identified in the river near the Portland area, and Portland-area urban activities are a relatively minor contributor to the river's overall nutrient load.
Turbidity and fine sediment	LOW	LOW	The presence of excessive turbidity and fine sediment (e.g., from soil erosion) can result in adverse physiological or behavioral responses in salmonids, and affect salmonid spawning redds and food (e.g., invertebrate) supply. Turbidity and fine sediment have not been identified as significant concerns for salmonids in the Willamette River near the Portland area; turbidity and fine sediment concentrations in the river rarely approach levels harmful to salmonids.
Organic material	LOW	LOW	Input of organic material (e.g., leaf litter, woody material) can beneficially affect salmonids (e.g., improve invertebrate production, increase habitat cover) or adversely affect fish (e.g., increased biological oxygen demand). Organic material has not been identified as a significant concern for salmonids in the Willamette River near the Portland area; organic material concentrations in the river derive from a variety of sources throughout the river basin, and rarely approach levels harmful to salmonids.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

POTENTIAL TO INFLUENCE (WILLAMETTE RIVER)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Flow	MODERATE	LOW	Increased or decreased flows can result in behavioral changes in migrating salmonids or change the availability and use of fish habitat. The Willamette River basin's storage reservoir/hydropower system has altered the mainstem river's natural flow regime, which has affected juvenile survival, water temperature, and adult migration timing. Portland-area urban activities are a relatively minor contributor to the mainstem river's altered flow regime.
Temperature	MODERATE	LOW	Salmonids require cool water conditions; excessive warm temperatures can result in behavioral changes, reduced growth, stress or injury of salmonids. Temperatures often reach unsuitable levels in the river in midsummer, but it is not well understood how much such temperatures are determined by natural factors vs. basin development activities (e.g., modified flow). Portland-area urban activities are a relatively minor contributor to the river's thermal input.
Riparian vegetation	MODERATE	MODERATE	Riparian vegetation can be a key contributor to shading and temperature control, and an important source of woody debris that helps maintain channel structure and aquatic habitat diversity. However, because of the Willamette River's large size, riparian vegetation has less functional influence on shade and channel structure than in smaller rivers or streams. Rather, this vegetation provides more localized streambank functions, such as bank stability and habitat cover. Riparian vegetation is relatively sparse along the river within the City (i.e. waterfront area).
Predation	MODERATE	MODERATE	It is possible that instream structures could increase predation by providing habitat, refuge, and cover for fish species that prey upon juvenile steelhead and other salmonids. Predation occurs in the lower Willamette River, particularly predation by smallmouth bass and northern squawfish. However, the extent to which instream structures increase predation is uncertain and debatable.
Passage	LOW	LOW	The presence of instream structures (e.g., culverts, diversions) can restrict or inhibit fish movement or migration, or impede access to suitable habitat. Passage is not an issue in the mainstem Willamette River within the City.
Disturbance	LOW	LOW	Activities (e.g., boat traffic, angling, excessive noise) conducted along or in the river or stream can increase stress, influence behavior, or affect habitat use of salmonids exposed to the disturbance. Although shipping traffic and other river activities in the Portland harbor can be intensive at times, disturbance has not been identified as an issue in the mainstem river, since fish can seek refuge in deep water or along the shoreline out of shipping lanes.

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[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

WILLAMETTE RIVER												
			Influencing Factor/Pathways[2]									
Activity	Short Term	Long Term	Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Water Delivery Activities												
Hydrant flushing	✓		a,c,d		a,c,d							
Water main installation	✓		a,c,d,e		a,c,d,e							e
Water main flushing	✓		a,c,d		a,c,d							
Water storage reservoir draining and cleaning	✓		a,c,d		a,c,d							
Water distribution system cleaning (including chlorination)	✓		a,c,d		a,c,d							
Water distribution system repair (e.g., pipeline repairs)	✓		a,c,d		a,c,d							
Water distribution system stream crossing construction/maintenance	✓		d,e		d,e							e
Storage tank maintenance, repair, and improvement	✓		a,d		a,d							
Stormwater and Wastewater Management Activities												
Storm drain system discharge		✓	a	a	a	a	a	a				
Combined system discharge		✓	c	c	c	c	c	c				
Wastewater discharge (Tryon Creek plant)		✓	b	b	b	b	b	b				
Root foaming	✓		a,b,c			a,b,c						
Sump operation		✓	A,C		A,C		A,C					
Stormwater and Wastewater Management Activities (cont'd)												
Sewer pipeline construction	✓		a,c,d,e		a,c,d,e				d,e			e
Sewage system failures (e.g., breaks in sewage lines)	✓		a,c,d,e	a,c,d,e	a,c,d,e	a,c,d,e						
Stormwater system/drainageway failures	✓		a,c,d,e		a,c,d,e				d,e			e

[2] Pathways: a,A = storm drain system b,B = wastewater system c,C= combined system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

WILLAMETTE RIVER												
			Influencing Factor/Pathways[2]									
Activity	**Short Term**	**Long Term**	**Toxics**	**Nutri.**	**Turb./ Sed.**	**Organic**	**Flow**	**Temp.**	**Ripar. Veg.**	**Pred.**	**Passage**	**Disturb.**
Stormwater control structure operation (e.g., Oaks Bottom)		✓	D		D		D					
Structure and Road Construction/Maintenance Activities												
Construction of riverbank features	✓				e				e			e
Use of riverbank features		✓										e
Construction of instream structures	✓		e		e							e
Use of instream structures		✓								e		e
Road and bridge construction	✓		a,c,d,e		a,c,d,e				d,e			e
Street repair	✓		a,c,d		a,c,d							
Street washing		✓	a,c,d		a,c,d	a,c,d						
Street sweeping		✓	A,C,D		A,C,D	A,C,D						
Roadway sand/gravel application	✓				a,c,d							
Roadway sand/gravel recycling	✓				A,C,D							
Unimproved rights-of-way		✓			a,c,d							
Environmental Enhancement Activities												
Installation of riparian enhancements	✓				d,e				d,e			e
Riparian enhancement (e.g., tree plantings)		✓			D,E	D,E		D,E	D,E			

[2] Pathways: a,A = storm drain system b,B = wastewater system c,C= combined system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

WILLAMETTE RIVER												
			Influencing Factor/Pathways[2]									
Activity	Short Term	Long Term	Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Environmental Enhancement Activities (cont'd)												
Vegetation removal (e.g., exotic vegetation control)	✓				d,e				d,e			e
Park, Natural Area, and Landscape Activities												
City facilities landscape maintenance		✓	a,c,d,e,	a,c,d,e								
Greenhouse and plant production facilities operation		✓	a,c,d	a,c,d								
Pesticide application	✓		a,c,d,e									
Pest control applicator certification[3]	✓		A,C,D,E									
Natural areas acquisition and management		✓			D,E				D,E			E
Turf maintenance (i.e., mowing and fertilization)		✓	a,c,d	a,c,d	a,c,d	a,c,d						
Boat launch facilities maintenance			d,e		d,e							e
Other Activities												
Dredging at sea wall	✓		e		e							e
Vehicle and equipment/facilities cleaning and maintenance		✓	a,c,d	a,c,d	a,c,d							
Fire site runoff (fire-fighting)	✓		a,c,d,e	a,c,d,e	a,c,d,e	a,c,d,e						e
City-funded vector control		✓	a,b,c,d,e									

[2] Pathways: a,A = storm drain system b,B = wastewater system c,C= combined system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

[3] Pest control applicator certification is considered a potential beneficial influence. Its intent, if properly implemented, is to avoid potential adverse effects from pesticide application (as listed above).

Appendix C-4

Johnson Creek

JOHNSON CREEK

Watercourse Fish Use

Species	ESU	Federal Status	Life Stage Presence			Comments
			Spawning	Rearing	Migration	
Steelhead trout	Lower Columbia R.	Threatened	✓	✓	✓	Observed upstream to Gresham and in Kelley Creek
Chinook salmon	Lower Columbia R.	Proposed Threatened	✓	✓	✓	Probably mostly stray hatchery spring stock or fall chinook from Willamette

Pathways and Factors

Pathways:	Storm drain system	Natural drainage system	River corridor
Influencing Factors:	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• riparian vegetation • predation • disturbance • passage • turbidity/sediment

POTENTIAL TO INFLUENCE (JOHNSON CREEK)

Factor	Existing Potential of Factor to Affect Fish[1]	City's Capacity to Influence Factor[2]	Explanation of Influencing Factor/Potential to Influence
Toxic materials	MODERATE	MODERATE	The presence of potentially toxic compounds (e.g., pesticides, oil and grease, heavy metals) can cause adverse acute and/or chronic physiological responses in salmonids. Excessive concentrations of certain heavy metals and synthetic organic chemicals have been detected in Johnson Creek, and are mainly bound to particulates washed into the creek from agricultural and industrial areas. Past accidental industrial chemical spills have occurred in Johnson Creek and caused fish kills, including salmonids.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

POTENTIAL TO INFLUENCE (JOHNSON CREEK)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Nutrients	LOW	MODERATE	Nutrient input (e.g., phosphorous, nitrogen) can beneficially affect salmonids (e.g., increased productivity can improve food supply) or adversely affect them (e.g., excessive nutrient input can cause reduced dissolved oxygen [DO]). High nutrient concentrations often occur in Johnson Creek (including from urban activities). However, because of relatively rapid flow conditions in the creek for salmonids, DO content is suitable, and algal growth is not excessive, under most conditions.
Turbidity & fine sediment/	MODERATE	MODERATE	The presence of excessive turbidity and fine sediment (e.g., from soil erosion) can result in adverse physiological or behavioral responses in salmonids, and effect salmonid spawning redds and food (e.g., invertebrate) supply. Watershed development has increased flooding magnitude and frequency and soil erosion, resulting in increased sediments from stream channel and land erosion. Fines in Johnson Creek are presently not at levels that seriously limit fish food production or embed spawning areas.
Organic material	MODERATE	MODERATE	Input of organic material (e.g., leaf litter, woody material) can beneficially affect salmonids (e.g., improve invertebrate production, increase habitat cover) or adversely affect fish (e.g., increased biological oxygen demand). Organic material input in Johnson Creek has not been identified as a significant fish habitat issue or concern, except that lack of woody material has resulted in reduced habitat structure and cover at some locations (see Riparian vegetation below).
Flow	HIGH	MODERATE	Increased or decreased flows can result in behavioral changes in migrating salmonids or change the availability and use of fish habitat. Watershed development, particularly urban development, has affected the flow regime of Johnson Creek, significantly increasing the magnitude and frequency of flooding and reducing summer baseflows. These flow changes have caused stream channel instability and erosion, and resulting effects on fish habitat structure and function.
Temperature	HIGH	MODERATE	Salmonids require cool water conditions; excessive warm temperatures can result in behavioral changes, reduced growth, stress or injury of salmonids. Temperatures in Johnson Creek are often unsuitable during parts of the year due to reduced stream flows and reduced riparian shading conditions that have occurred with watershed and streamside development.
Riparian vegetation	HIGH	MODERATE	Riparian vegetation can be a key contributor to shading and temperature control, and an important source of woody debris that helps maintain channel structure and aquatic habitat diversity. Watershed development and streamside disturbance has reduced riparian vegetation along many sections of Johnson Creek. Such reduction is likely a key factor contributing to lack of instream cover, increased water temperature, and streambank erosion in the creek.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

POTENTIAL TO INFLUENCE (JOHNSON CREEK)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Predation	LOW	LOW	Instream structures can increase predation by providing habitat, refuge, and cover for fish species that prey upon juvenile steelhead and other salmonids. Fish predators such as northern squawfish are virtually absent from Johnson Creek; herons and raccoons are probably common in the stream but have not been identified as having a significant predation impact on salmonids.
Passage	MODERATE	MODERATE	The presence of instream structures (e.g., culverts, diversions) can restrict or inhibit fish movement or migration, or impede access to suitable habitat. Passage has been identified as an issue for chinook salmon at a partial barrier near Crystal Springs Creek.
Disturbance	LOW	MODERATE	Activities (e.g., angling, excessive noise) conducted along or in the river or stream can increase stress, influence behavior, or affect habitat use of salmonids exposed to the disturbance. Disturbance does not seem to be an issue in Johnson Creek although some localized disturbance of adult spawners and juveniles likely takes place.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

JOHNSON CREEK												
			Influencing Factor/Pathways[2]									
Activity	Short Term	Long Term	Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Water Delivery Activities												
Hydrant flushing	✓		a,d		a,d							
Water main installation	✓		a,d,e		a,d,e							d,e
Water main flushing	✓		a,d		a,d							
Water storage reservoir draining and cleaning	✓		a,d		a,d							
Water distribution system cleaning (including chlorination)	✓		a,d		a,d							
Water distribution system repair (e.g., pipeline repairs)	✓		a,d		a,d							
Reservoir construction	✓		a,d		a,d							
Storage tank maintenance, repair, and improvement	✓		a,d		a,d							
Stormwater and Wastewater Management Activities												
Storm drain system discharge		✓	a	a	a	a	a	a				
Root foaming	✓		a			a						
Sump operation		✓	A		A		A					
Streambed pipeline maintenance and repair	✓		d,e		d,e							d,e
Sewer pipeline construction	✓		a,d		a,d				d			d
Sewage system failures (e.g., breaks in sewage lines)	✓		a,d	a,d	a,d	a,d						
Stormwater system/drainageway failures	✓		a,d		a,d							

[2] Pathways: a,A = storm drain system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

JOHNSON CREEK

Activity	Short Term	Long Term	Influencing Factor/Pathways[2] Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Stormwater and Wastewater Management Activities (cont'd)												
Stormwater control structure construction/maintenance	✓		d,e		d,e							
Stormwater control structure operation		✓	D,E		D,E		D,E					
Structure and Road Construction/Maintenance Activities												
Culvert installation/placement/ maintenance	✓				d,e				d,e		d,e	d,e
Road and bridge construction	✓		a,d,e		a,d,e				d,e			d,e
Street repair	✓		a,d		a,d							
Bridge repair	✓		d,e		d,e				d,e			d,e
Street washing		✓	a,d		a,d	a,d						
Street sweeping		✓	A,D		A,D	A,D						
Roadway sand/gravel application	✓				a,d							
Roadway sand/gravel recycling	✓				A,D							
Unimproved rights-of-way		✓	a,d		a,d							
Environmental Enhancement Activities												
Streambank armoring installation	✓				d,e				d,e	d,e		d,e
Streambank armoring		✓			D,E				d,e	d,e		
Installation of instream habitat enhancements (e.g., boulder wing deflectors)	✓		d,e		d,e							d,e
Instream habitat enhancement operation					D,E				D,E			
Installation of riparian enhancements	✓				d,e				d,e			d,e

[2] Pathways: a,A = storm drain system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

Activity	Short Term	Long Term	Influencing Factor/Pathways[2] Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Environmental Enhancement Activities (cont'd)												
Riparian enhancement (e.g., tree plantings)		✓			D,E	D,E		D,E	D,E			
Floodplain land acquisition		✓			E		E		E			
Wetland construction/maintenance	✓				d,e							
Wetland enhancement		✓	D,E	D,E	D,E		D,E					
Stream downcutting control feature installation	✓		d,e		d,e							d,e
Stream downcutting control feature operation		✓			D,E				D,E			
Vegetation removal (e.g., exotic vegetation control)	✓				d,e				d,e			d,e
Park, Natural Area, and Landscape Activities												
City facilities landscape maintenance		✓	a,d,e,	a,d,e								
Hillslope slumping/landsliding	✓				a,d,e	a,d,e			d,e			
Pesticide application	✓		a,d,e									
Pest control applicator certification[3]	✓		A,D,E									
Natural areas acquisition and management		✓			D,E				D,E			E
Turf maintenance (i.e., mowing and fertilization)		✓	a,d	a,d	a,d	a,d						
Golf course maintenance		✓	a,d	a,d	a,d	a,d						

[2] Pathways: a,A = storm drain system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

[3] Pest control applicator certification is considered a potential beneficial influence. Its intent, if properly implemented, is to avoid potential adverse effects from pesticide application (as listed above).

JOHNSON CREEK												
			Influencing Factor/Pathways[2]									
Activity	Short Term	Long Term	Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Other Activities												
Fire site runoff (fire-fighting)	✓		a,d,e	a,d,e	a,d,e	a,d,e						d,e
Existing structure decommissioning in floodplain		✓					D,E		D,E			
City-funded vector control		✓	a,d,e									

[2] Pathways: a,A = storm drain system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

Appendix C-5

Fanno Creek

FANNO CREEK

Watercourse Fish Use

Species	ESU	Federal Status	Life Stage Presence			Comments
			Spawning	Rearing	Migration	
Steelhead trout	Upper Willamette R.	Proposed Threatened	✓	✓	✓	Use not documented but accessible; cutthroat trout present

Pathways and Factors

Pathways:	Storm drain system	Natural drainage system	River corridor
Influencing Factors:	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• riparian vegetation • predation • disturbance • passage • turbidity/sediment

POTENTIAL TO INFLUENCE (FANNO CREEK)

Factor	Existing Potential of Factor to Affect Fish[1]	City's Capacity to Influence Factor[2]	Explanation of Influencing Factor/Potential to Influence
Toxic materials	LOW	MODERATE	The presence of potentially toxic compounds (e.g., pesticides, oil and grease, heavy metals) can cause adverse acute and/or chronic physiological responses in salmonids. Concentrations of such contaminants in Fanno Creek have not been observed in levels high enough to pose a significant risk to salmonids. However, urban activities can be an important potential source of such compounds.
Nutrients	MODERATE	MODERATE	Nutrient input (e.g., phosphorous, nitrogen) can beneficially affect salmonids (e.g., increased productivity can improve food supply) or adversely affect them (e.g., excessive nutrient input can cause reduced dissolved oxygen [DO]). High nutrient concentrations often occur in Fanno Creek (including from urban activities); this nutrient enrichment sometimes causes increased algal growth and reduced DO content in the creek.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

POTENTIAL TO INFLUENCE (FANNO CREEK)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Turbidity and fine sediment	HIGH	HIGH	The presence of excessive turbidity and fine sediment (e.g., from soil erosion) can result in adverse physiological or behavioral responses in salmonids, and affect salmonid spawning redds and food (e.g., invertebrate) supply. Development in the Fanno Creek watershed has increased flooding magnitude and frequency and soil erosion, and the watershed contains certain soils that are particularly susceptible to erosion. The extent to which fines adversely affect steelhead in Fanno Creek is unknown, but possible use by spawning steelhead justifies concern with potential intrusion of fines into spawning gravels.
Organic material	LOW	MODERATE	Input of organic material (e.g., leaf litter, woody material) can beneficially affect salmonids (e.g., improve invertebrate production, increase habitat cover) or adversely affect fish (e.g., increased biological oxygen demand). Organic material input in Fanno Creek has not been identified as a significant fish habitat issue or concern.
Flow	MODERATE	MODERATE	Increased or decreased flows can result in behavioral changes in migrating salmonids or change the availability and use of fish habitat. Watershed development, particularly urban development, may affect the flow regime of Fanno Creek, increasing peak flows and reducing summer baseflows. These flow changes may cause localized stream channel instability and erosion, and resulting effects on fish habitat structure and function.
Temperature	HIGH	MODERATE	Salmonids require cool water conditions; excessive warm temperatures can result in behavioral changes, reduced growth, stress or injury of salmonids. Temperatures in Fanno Creek are often unsuitable for salmonids during parts of the year due to reduced stream flows and riparian shading conditions that have occurred with watershed development.
Riparian vegetation	HIGH	MODERATE	Riparian vegetation can be a key contributor to shading and temperature control, and an important source of woody debris that helps maintain channel structure and aquatic habitat diversity. Watershed development and streamside disturbance has reduced riparian vegetation along many sections of Fanno Creek. Such reduction contributes to increased water temperature and streambank erosion in the creek.
Predation	LOW	LOW	Instream structures can increase predation by providing habitat, refuge, and cover for fish species that prey upon juvenile steelhead and other salmonids. Few if any predatory fish occur in Fanno Creek. Predation on salmonids by other animals (e.g., herons, raccoons) is not a significant concern.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

POTENTIAL TO INFLUENCE (FANNO CREEK)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Passage	MODERATE	MODERATE	The presence of instream structures (e.g., culverts, diversions) can restrict or inhibit fish movement or migration, or impede access to suitable habitat. Passage at culverts has not been evaluated but may be an issue since culvert designs on streams not known to contain migratory salmonids are often impassable to adults.
Disturbance	LOW	LOW	Activities (e.g., angling, excessive noise) conducted along or in the river or stream can increase stress, influence behavior, or affect habitat use of salmonids exposed to the disturbance. Disturbance is not considered an issue in Fanno Creek; although some localized disturbance of adult spawners or juveniles could occur.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

FANNO CREEK

Activity	Short Term	Long Term	Influencing Factor/Pathways[2] Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Water Delivery Activities												
Hydrant flushing	✓		a,d		a,d							
Water main installation	✓		a,d,e		a,d,e							d,e
Water main flushing	✓		a,d		a,d							
Water storage reservoir draining and cleaning	✓		a,d		a,d							
Water distribution system cleaning (including chlorination)	✓		a,d		a,d							
Water distribution system repair (e.g., pipeline repairs)	✓		a,d		a,d							
Storage tank maintenance, repair, and improvement	✓		a,d		a,d							
Stormwater and Wastewater Management Activities												
Storm drain system discharge		✓	a	a	a	a	a	a				
Root foaming	✓		a			a						
Streambed pipeline maintenance and repair	✓		d,e		d,e							d,e
Sewer pipeline construction	✓		a,d		a,d				d			d
Sewage system failures (e.g., breaks in sewage lines)	✓		a,d	a,d	a,d	a,d						
Stormwater system/drainageway failures	✓		a,d		a,d							
Stormwater control structure construction and maintenance	✓		d,e		d,e							
Stormwater control structure operation		✓	D,E	D,E	D,E		D,E					

[2] Pathways: a,A = storm drain system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

FANNO CREEK

Activity	Short Term	Long Term	Influencing Factor/Pathways[2] Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Structure and Road Construction/Maintenance Activities												
Culvert installation/placement/ maintenance	✓				d,e				d,e		d,e	d,e
Road and bridge construction	✓		a,d,e		a,d,e				d,e			d,e
Street repair	✓		a,d		a,d							
Bridge repair	✓		d,e		d,e				d,e			d,e
Structure and Road Construction/Maintenance Activities (cont'd)												
Street washing		✓	a,d		a,d	a,d						
Street sweeping		✓	A,D		A,D	A,D						
Roadway sand/gravel application	✓				a,d							
Roadway sand/gravel recycling	✓				A,D							
Unimproved rights-of-way		✓	a,d		a,d							
Environmental Enhancement Activities												
Streambank armoring installation	✓				d,e				d,e	d,e		d,e
Streambank armoring		✓			D,E				d,e	d,e		
Installation of instream habitat enhancements (e.g., boulder wing deflectors)	✓		d,e		d,e							d,e
Instream habitat enhancement operation		✓			D,E				D,E			
Installation of riparian enhancements	✓				d,e				d,e			d,e
Riparian enhancement (e.g., tree plantings)		✓		D,E	D,E	D,E		D,E	D,E			
Wetland construction/maintenance	✓				d,e							
Wetland enhancement		✓	D,E	D,E	D,E		D,E					
Stream downcutting control feature installation	✓		d,e		d,e							d,e

[2] Pathways: a,A = storm drain system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

FANNO CREEK												
			Influencing Factor/Pathways[2]									
Activity	Short Term	Long Term	Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Environmental Enhancement Activities												
Stream downcutting control feature operation		✓			D,E				D,E			
Vegetation removal (e.g., exotic vegetation control)	✓				d,e				d,e			d,e
Park, Natural Area, and Landscape Activities												
City facilities landscape maintenance		✓	a,d,e,	a,d,e								
Hillslope slumping/landsliding	✓				a,d,e	a,d,e			d,e			
Landslide repair	✓				A,D,E	A,D,E						
Natrual areas acquisition and management		✓			D,E				D,E			E
Pesticide application	✓		a,d,e									
Pest control applicator certification[3]	✓		A,D,E									
Turf maintenance (i.e., mowing and fertilization)		✓	a,d	a,d	a,d	a,d						
Golf course maintenance		✓	a,d	a,d	a,d	a,d						
Other Activities												
Fire site runoff (fire-fighting)	✓		a,d,e	a,d,e	a,d,e	a,d,e						d,e
City-funded vector control		✓	a,d,e									

[2] Pathways: a,A = storm drain system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

[3] Pest control applicator certification is considered a potential beneficial influence. Its intent, if properly implemented, is to avoid potential adverse effects from pesticide application (as listed above).

Appendix C-6

Tryon Creek

TRYON CREEK

Watercourse Fish Use

Species	ESU	Federal Status	Life Stage Presence			Comments
			Spawning	Rearing	Migration	
Steelhead trout	Lower Columbia R.	Threatened	✓	✓	✓	Access and use mostly in lower 2 miles.

Pathways and Factors

Pathways:	Storm drain system	Natural drainage system	River corridor
Influencing Factors:	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• riparian vegetation • predation • disturbance • passage • turbidity/sediment

POTENTIAL TO INFLUENCE (TRYON CREEK)

Factor	Existing Potential of Factor to Affect Fish[1]	City's Capacity to Influence Factor[2]	Explanation of Influencing Factor/Potential to Influence
Toxic materials	LOW	MODERATE	The presence of potentially toxic compounds (e.g., pesticides, oil and grease, heavy metals) can cause adverse acute and/or chronic physiological responses in salmonids. Excessive concentrations of toxic chemicals have not been detected in Tryon Creek. However, urban activities can be an important potential source of such compounds.
Nutrients	LOW	MODERATE	Nutrient input (e.g., phosphorous, nitrogen) can beneficially affect salmonids (e.g., increased productivity can improve food supply) or adversely affect them (e.g., excessive nutrient input can cause reduced dissolved oxygen [DO]). High nutrient concentrations occasionally occur in Tryon Creek; however, because of fairly rapid flow conditions in the creek, DO content is suitable, and algal growth is not excessive, under most conditions.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

POTENTIAL TO INFLUENCE (TRYON CREEK)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Turbidity and fine sediment	MODERATE	HIGH	The presence of excessive turbidity and fine sediment (e.g., from soil erosion) can result in adverse physiological or behavioral responses in salmonids, and affect salmonid spawning redds and food (e.g., invertebrate) supply. Watershed development may have increased flooding magnitude and frequency and soil erosion, resulting in increased sediments from stream channel and land erosion. The extent to which fines adversely affect steelhead in Tryon Creek is unknown, but possible use by spawning steelhead justifies concern with potential intrusion of fines into spawning gravels.
Organic material	LOW	MODERATE	Input of organic material (e.g., leaf litter, woody material) can beneficially affect salmonids (e.g., improve invertebrate production, increase habitat cover) or adversely affect fish (e.g., increased biological oxygen demand). Organic material input in Tryon Creek has not been identified as a significant fish habitat issue or concern.
Flow	MODERATE	MODERATE	Increased or decreased flows can result in behavioral changes in migrating salmonids or change the availability and use of fish habitat. Watershed development, particularly urban development, may have affected the flow regime of Tryon Creek, increasing peak flows and reducing summer baseflows. These flow changes may cause localized stream channel instability and erosion, and resulting effects on fish habitat structure and function.
Temperature	HIGH	MODERATE	Salmonids require cool water conditions; excessive warm temperatures can result in behavioral changes, reduced growth, stress or injury of salmonids. Temperatures in Tryon Creek are often unsuitable for salmonids during parts of the year due to reduced baseflows and riparian shading conditions that have occurred with watershed development.
Riparian vegetation	MODERATE	MODERATE	Riparian vegetation can be a key contributor to shading and temperature control, and an important source of woody debris that helps maintain channel structure and aquatic habitat diversity. Watershed development and streamside disturbance may have reduced riparian vegetation along some sections of Tryon Creek. Such reduction may contribute to increased water temperature and streambank erosion in these sections of the creek.
Predation	LOW	LOW	Instream structures can increase predation by providing habitat, refuge, and cover for fish species that prey upon juvenile steelhead and other salmonids. Few predatory fish occur in Tryon Creek (e.g., northern squawfish). Predation on salmonids by other animals (e.g., herons, raccoons) is not a significant concern.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

POTENTIAL TO INFLUENCE (TRYON CREEK)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Passage	MODERATE	HIGH	The presence of instream structures (e.g., culverts, diversions) can restrict or inhibit fish movement or migration, or impede access to suitable habitat. Passage at culverts has not been evaluated but may be an issue since culvert designs on streams not known to contain migratory salmonids are often impassable to adults. For example, the Boone's Ferry Road crossing is thought to impede upstream fish passage.
Disturbance	LOW	LOW	Activities (e.g., excessive noise) conducted along or in the river or stream can increase stress, influence behavior, or affect habitat use of salmonids exposed to the disturbance. Disturbance is not considered an issue in Tryon Creek; although some localized disturbance of adult spawners or juveniles could occur.

[1] The "existing potential of factor to affect fish" refers to the potential of a given factor to affect steelhead in the watercourse, taking into account the existing conditions of the watercourse (in the Portland area) as they relate to the influencing factors and the manner in which steelhead use or could use the watercourse.

[2] The "City's capacity to influence factor" refers to the City's capacity to influence the factors in the watercourse from various City activities and planning/permitting processes. The City's capacity to influence factors does not directly translate to impacts to steelhead. Identification of the City's relative capacity to influence factors (i.e., low, moderate, high) is intended to help focus and direct resources where the greatest benefit to steelhead would likely be achieved.

TRYON CREEK

Activity	Short Term	Long Term	Influencing Factor/Pathways[2] Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Water Delivery Activities												
Hydrant flushing	✓		a,d		a,d							
Water main installation	✓		a,d,e		a,d,e							d,e
Water main flushing	✓		a,d		a,d							
Water storage reservoir draining and cleaning	✓		a,d		a,d							
Water distribution system cleaning (including chlorination)	✓		a,d		a,d							
Water distribution system repair (e.g., pipeline repairs)	✓		a,d		a,d							
Storage tank maintenance, repair, and improvement	✓		a,d		a,d							
Stormwater and Wastewater Management Activities												
Storm drain system discharge		✓	a	a	a	a	a	a				
Root foaming	✓		a			a						
Streambed pipeline maintenance and repair	✓		d,e		d,e							d,e
Sewer pipeline construction	✓		a,d		a,d				d			d
Sewage system failures (e.g., breaks in sewage lines)	✓		a,d	a,d	a,d	a,d						
Stormwater system/drainageway failures	✓		a,d,e		a,d,e				d,e			e
Stormwater control structure construction/maintenance	✓		d,e		d,e							
Stormwater control structure operation		✓	D,E	D,E	D,E		D,E					

[2] Pathways: a,A = storm drain system d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

TRYON CREEK

Activity	Short Term	Long Term	Influencing Factor/Pathways[2] Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Structure and Road Construction/Maintenance Activities												
Culvert installation/placement/ maintenance	✓				d,e				d,e		d,e	d,e
Road and bridge construction	✓		a,d,e		a,d,e				d,e			d,e
Street repair	✓		a,d		a,d							
Bridge repair	✓		d,e		d,e				d,e			d,e
Street washing		✓	a,d		a,d	a,d						
Street sweeping		✓	A,D		A,D	A,D						
Roadway sand/gravel application	✓				a,d							
Roadway sand/gravel recycling	✓				A,D							
Unimproved rights-of-way		✓	a,d		a,d							
Environmental Enhancement Activities												
Streambank armoring installation	✓				d,e				d,e	d,e		d,e
Streambank armoring		✓			D,E				d,e	d,e		
Installation of instream habitat enhancement (e.g., boulder wing deflectors)	✓		d,e		d,e							d,e
Instream habitat enhancement operation		✓			D,E				D,E			
Installation of riparian enhancements	✓				d,e				d,e			d,e
Riparian enhancement (e.g., tree plantings)		✓		D,E	D,E	D,E		D,E	D,E			
Stream downcutting control feature installation	✓		d,e		d,e							d,e
Stream downcutting control feature operation		✓			D,E				D,E			
Vegetation removal (e.g., exotic vegetation control)	✓				d,e				d,e			e

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Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.

TRYON CREEK												
			Influencing Factor/Pathways[2]									
Activity	Short Term	Long Term	Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Park, Natural Area, and Landscape Activities												
City facilities landscape maintenance		✓	a,d,e,	a,d,e								
Hillslope slumping/landsliding	✓				a,d,e	a,d,e			d,e			
Pesticide application	✓		a,d,e									
Pest control applicator certification[3]	✓		A,D,E									
Natural areas acquisition and management		✓			D,E				D,E			E
Turf maintenance (i.e., mowing and fertilization)		✓	a,d	a,d	a,d	a,d						
Golf course maintenance		✓	a,d	a,d	a,d	a,d						
Other Activities												
Fire site runoff (fire-fighting)	✓		a,d,e	a,d,e	a,d,e	a,d,e						d,e
City-funded vector control		✓	a,d,e									

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[3] Pest control applicator certification is considered a potential beneficial influence. Its intent, if properly implemented, is to avoid potential adverse effects from pesticide application (as listed above).

Appendix C-7

Bull Run/Sandy River

BULL RUN/SANDY RIVER

Watercourse Fish Use

Species	ESU	Federal Status	Life Stage Presence			Comments
			Spawning	Rearing	Migration	
Steelhead trout	Lower Columbia R.	Threatened	✓	✓	✓	
Chinook salmon	Lower Columbia R.	Proposed Threatened	✓	✓	✓	
Bull trout	Columbia R.	Threatened	?	?	?	No records of presence in Bull Run, but within species range, i.e., present in Hood and Clackamas rivers.

Pathways and Factors

Pathways:	Natural drainage system	River corridor
Influencing Factors:	• toxic materials • nutrients • fine sediment • organic material • flow • water temperature	• riparian vegetation • predation • disturbance • passage • turbidity/sediment

POTENTIAL TO INFLUENCE (BULL RUN/SANDY RIVER)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Toxic materials	LOW	MODERATE	The presence of potentially toxic compounds (e.g., pesticides, oil and grease, heavy metals) can cause adverse acute and/or chronic physiological responses in salmonids. Since the Bull Run is a closed watershed and no significant industrial activities take place in the drainage, toxics are not a concern in the system.
Nutrients	LOW	LOW	Nutrient input (e.g., phosphorous, nitrogen) can beneficially affect salmonids (e.g., increased productivity can improve food supply) or adversely affect them (e.g., excessive nutrient input can cause reduced dissolved oxygen [DO]). Nutrient enrichment has not been identified as an issue in the drainage.
Turbidity and fine sediment	LOW	MODERATE	The presence of excessive turbidity and fine sediment (e.g., from soil erosion) can result in adverse physiological or behavioral responses in salmonids, and effect salmonid spawning redds and food (e.g., invertebrate) supply. Incidence of hillslope and channel erosion is low in the lower Bull Run River. Turbidity and fine sediment are not a significant concern to salmonids in the river.
Organic material	LOW	LOW	Input of organic material (e.g., leaf litter, woody material) can beneficially affect salmonids (e.g., improve invertebrate production, increase habitat cover) or adversely affect fish (e.g., increased biological oxygen demand). Organic input has not been identified as an issue in the watershed.
Flow	HIGH	HIGH	Increased or decreased flows can result in behavioral changes in migrating salmonids or change the availability and use of fish habitat. Diversion of flow at Headworks (for municipal water supply) significantly decreases flow in the lower Bull Run River, particularly from late spring through early fall.
Temperature	HIGH	HIGH	Salmonids require cool water conditions; excessive warm temperatures can result in behavioral changes, reduced growth, stress or injury of salmonids. Temperature has been identified as an issue in the lower Bull Run River; summertime maximum temperatures are often unsuitable for salmonids. Although such warm temperatures would be expected even under natural conditions, incidence may be increased by flow diversion from the river.
Riparian vegetation	HIGH	LOW	Riparian vegetation can be a key contributor to shading and temperature control, and an important source of woody debris that helps maintain channel structure and aquatic habitat diversity. Riparian vegetation along the lower Bull Run River is mature and fully developed. Protection of this riparian vegetation is considered significant to maintaining suitable salmonid habitat.

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POTENTIAL TO INFLUENCE (BULL RUN/SANDY RIVER)			
Factor	**Existing Potential of Factor to Affect Fish[1]**	**City's Capacity to Influence Factor[2]**	**Explanation of Influencing Factor/Potential to Influence**
Predation	LOW	LOW	Instream structures can increase predation by providing habitat, refuge, and cover for fish species that prey upon juvenile steelhead and other salmonids. Few if any predatory fish occur in the lower Bull Run River. Predation on salmonids by other animals (e.g., kingfishers, otters, and mergansers) is not a significant concern.
Passage	HIGH	MODERATE	The presence of instream structures (e.g., culverts, diversions) can restrict or inhibit fish movement or migration, or impede access to suitable habitat. Passage has been cut off at Headworks since the early 1900s, preventing access to habitat used historically above Headworks. Low flows in summer may impede use of part of reach below Headworks by chinook salmon.
Disturbance	LOW	MODERATE	Activities (e.g., excessive noise) conducted along or in the river or stream can increase stress, influence behavior, or affect habitat use of salmonids exposed to the disturbance. Because the watershed is closed, disturbance is not a significant concern.

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BULL RUN/SANDY RIVER

Activity	Short Term	Long Term	Influencing Factor/Pathways[2] Toxics	Nutri.	Turb./ Sed.	Organic	Flow	Temp.	Ripar. Veg.	Pred.	Passage	Disturb.
Water Delivery Activities												
Water distribution system cleaning (including chlorination)	✓		d		d							
Water distribution system repair (e.g., pipeline repairs)	✓		d		d							
Water distribution system stream crossing construction/maintenance	✓		d,e		d,e							e
Bull Run water diversion		✓					e	e			e	
Bull Run conveyance conduit maintenance (e.g., blowoff and dechlorination)	✓		d,e		d,e							
Bull Run Reservoir 2 outlet works repair	✓		e		e							e
Bull Run watershed road system maintenance (including road decommissioning)		✓			D,E							
Bull Run bridge maintenance	✓		e		e							
Bull Run diversion dam rehabilitation	✓		e		e							
Park, Natural Area, and Landscape Activities												
Natural areas acquisition and management		✓			D,E				D,E			E
Hillslope slumping/landsliding					d,e				d,e			
Landslide repair					D,E				D,E			

[2] Pathways: d,D = natural drainage system e,E = river corridor
Lower case letters denote potential negative influence; capital letters denote a potential beneficial influence.