

## **Chapter 9. Monitoring, Research, and Adaptive Management Programs**

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## 9. Monitoring, Research, and Adaptive Management Programs

### 9.1 Introduction

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Monitoring, research, and adaptive management measures for the Habitat Conservation Plan (HCP) are described in this chapter. The monitoring measures were designed to document compliance and verify progress toward meeting the goals and objectives defined in Chapter 6. Through research, the City of Portland (City) will collect information about fish population trends in adults and juveniles. The adaptive management program will guide the response if monitoring and research information indicate the need for a modified approach.

The City has identified measurable habitat objectives for each conservation measure. The measurable objectives are more detailed than the goals and objectives described in Chapter 6 and the measure descriptions in Chapter 7. The measurable objectives can be used as benchmarks for the City's progress on the conservation measures.

#### *Annual Reports*

The City will provide a report to describe progress toward implementing the HCP conservation measures. The report will be issued annually, or at a frequency mutually agreeable to the City and NMFS, for the life of the HCP. These annual compliance reports will be submitted within 120 days following the end of the calendar year. The first annual report will cover the period from the effective date of the HCP until the end of the first full calendar year following that date.

HCP compliance reports will contain summaries of all significant HCP-related activities and associated data and information. Anticipated components include planning and implementation of measures, expenditures, compliance and effectiveness monitoring, research, and any plans or actions related to changed circumstances and/or adaptive management.

After NMFS has approved the annual compliance report, the City will make it available on the bureau's web site or by other appropriate means.

#### *Progress Meetings*

The City anticipates convening formal progress meetings approximately every five years, beginning in Year 5 of the HCP. At these meetings, the City will discuss with NMFS and the Oregon Department of Environmental Quality (ODEQ) the progress to date and any new information affecting successful implementation of the HCP. If appropriate, the HCP Implementation Committee will also be invited. Although adaptive management will be discussed at these meetings and minor adaptive management decisions might be made, major adaptive management decisions will be made at Years 20, 30, and 35, as described in later in Chapter 9, and specifically in Table 9-4. If significant changes occur in the Basin or if significant compliance problems arise during the interim between the five-year progress meetings, the City or NMFS can convene a progress meeting at any time.

## **9.2 Monitoring Program**

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The monitoring program includes two components: compliance monitoring and effectiveness monitoring. Compliance monitoring tracks implementation of the HCP measures and documents completion. Compliance monitoring will be done for every measure in the HCP. Effectiveness monitoring is focused on measures for which the habitat outcomes are somewhat uncertain. The effectiveness monitoring data will enable an assessment of whether or not the measurable habitat objectives have been met. Protocols for compliance and effectiveness monitoring are described in Appendix F of this HCP.

### **9.2.1 Compliance Monitoring**

Most of the HCP measures pose very little uncertainty as to whether implementing the measures will meet the objectives. For these, the City will conduct compliance monitoring only (see also Section 9.2.2, Effectiveness Monitoring). Compliance monitoring results will be reported in the annual report.

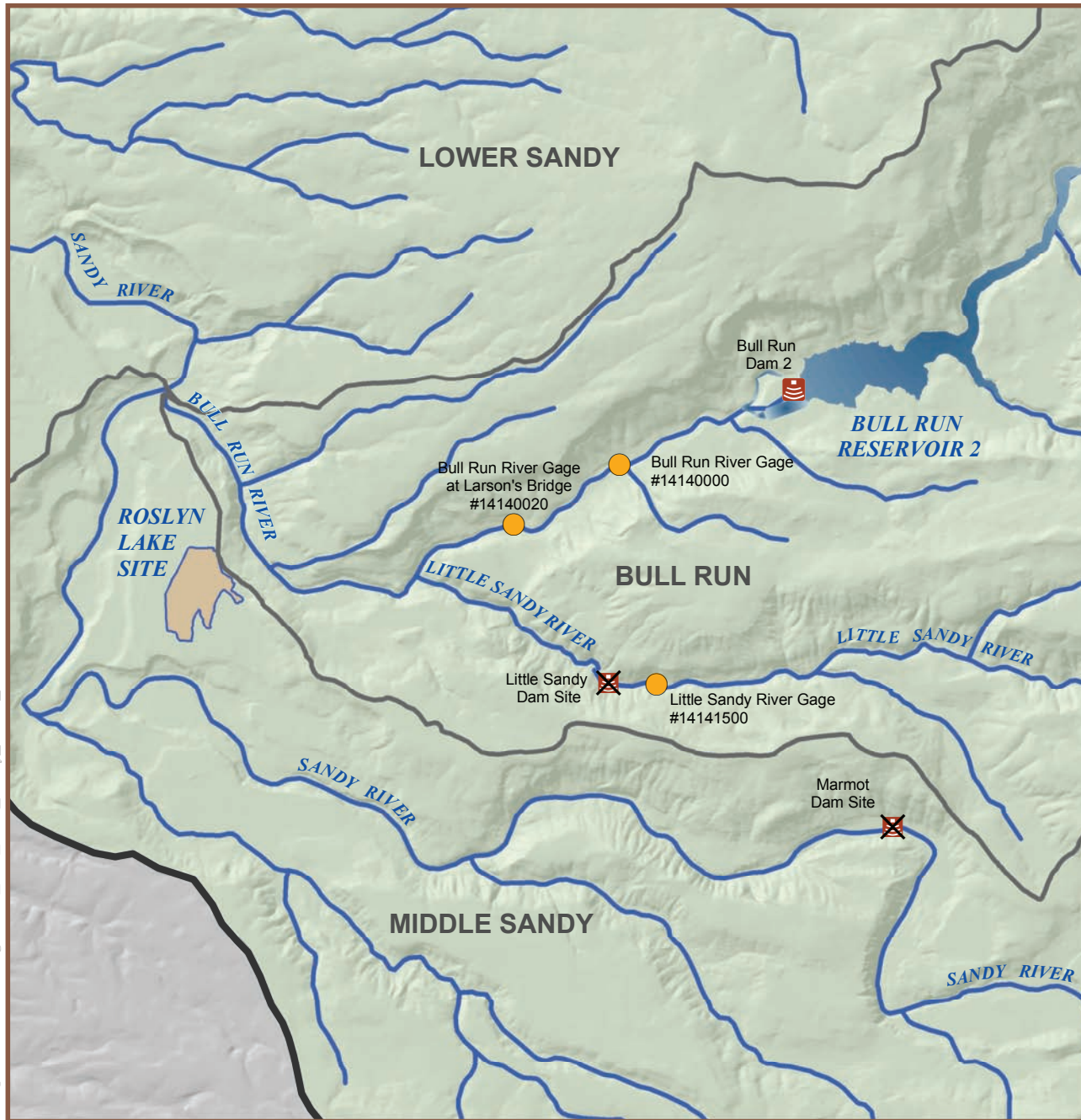
#### **Compliance Monitoring for Bull Run Conservation Measures**

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Compliance monitoring for the Bull Run conservation measures is described in Table 9-1. Almost all of these conservation measures will affect habitat in the lower 5.8 miles of the Bull Run River; a few will improve conditions for fish in the Bull Run reservoirs.

##### *Compliance Locations for Flow and Temperature*

The City will use established United States Geological Survey (USGS) sites on the lower Bull Run and Little Sandy rivers to monitor flow and water temperature. Compliance for flow measures will be based on flows recorded at USGS Gauge No. 14140000 (Bull Run River at RM 4.7). This site will also be used to determine compliance with the downramping rate. Compliance with temperature measures will be based on water temperatures recorded at Larson's Bridge site on the lower Bull Run River (USGS Gauge No. 14140020, RM 3.8), and at the Little Sandy Dam site (USGS Gauge No. 14141500, Little Sandy River at RM 1.95).



### Site Features

- Sandy River Basin Boundary
- Sandy River Basin Watershed Boundary
- Streams
- Dam
- Former Dam Site
- Lakes
- Former Lake Site

### Flow and Temperature Monitoring Gages

- USGS Gage

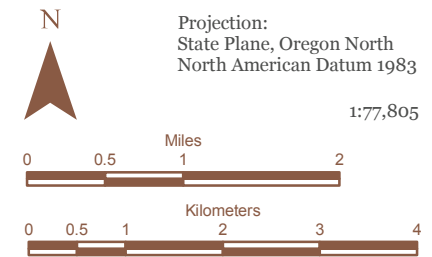


Figure 9-1. Compliance Locations for Flow and Temperature

**Table 9-1. Compliance Monitoring for Bull Run Measures**

#	Measure	Measurable Habitat Objective <sup>a</sup>	Compliance Monitoring <sup>b</sup>
F-1	<b>Minimum Instream Flow, Normal Water Years</b>	Provide instream flows	Record hourly flows at USGS Gauge No. 1414000 <sup>c</sup>
F-2	<b>Minimum Instream Flows, Water Years with Critical Seasons</b>		
F-3	<b>Flow Downramping</b>		
F-4	<b>Little Sandy Flow Agreement</b>	Avoid conflicts with natural instream flows	Document completion of flow agreement
T-1	<b>Pre-infrastructure Temperature Management</b>	<u>Pre-infrastructure objective:</u> Maintain water temperatures at or below 21 °C at Larson's Bridge	Record water temperatures hourly for the lower Bull Run River and Little Sandy River
T-2	<b>Post-infrastructure Temperature Management</b>	<u>Post-infrastructure objective:</u> Maintain water temperatures at their natural thermal potential	Document implementation and completion of Dam 2 tower and spillway rock weir improvements (tower improvements will be complete and operational by 2013)
P-1	<b>Walker Creek Fish Passage</b>	Provide year-round upstream and downstream passage for steelhead and coho	Document passage conditions compared with NMFS design criteria
R-1	<b>Reservoir Operations</b>	Avoid or minimize mortality of cutthroat and rainbow trout	Document reservoir surface elevations
R-2	<b>Cutthroat Trout Rescue</b>	Prevent mortality of cutthroat trout in spillway canal	Document any fish mortality that occurs in the canal and/or during handling (prior to release)
R-3	<b>Reed Canarygrass Removal</b>	Improve one-third acre of habitat for western toad, red-legged frog, and northwestern salamander through annual removal of reed canarygrass	Provide photo documentation of sites after reed canarygrass removal
H-1	<b>Spawning Gravel Placement</b>	Supply spawning gravel in amounts equivalent to natural accumulation	Survey the lower Bull Run River (RM 1.5–RM 6.0) in Years 1, 2, 3, 5, 7, and 10 after initial gravel placement and every five years thereafter  Document the amount of gravel placed, the placement locations, and amount of gravel usable for spawning by fish in annual report as described in Appendix F

Table continued on next page.

**Table 9-1. Compliance Monitoring for Bull Run Measures, continued**

#	Measure	Measurable Habitat Objective <sup>a</sup>	Compliance Monitoring <sup>b</sup>
<b>H-2</b>	<b>Riparian Land Protection</b>	Preserve the riparian forest on City land along the lower Bull Run River	Survey riparian forest condition during annual spawning and gravel surveys; document results in annual report
<b>O&amp;M-1</b>	<b>Bull Run Infrastructure Operations and Maintenance</b>	Avoid or minimize the effects of operations and maintenance activities on covered lands in the Bull Run watershed	Document any releases of sediment or debris to the reservoirs, the lower Bull Run River, or to any tributary streams  Document changes in stormwater facilities at Sandy River Station, if needed  Document tree planting and success of revegetation efforts
<b>O&amp;M-2</b>	<b>Bull Run Spill Prevention</b>	Avoid or minimize effects of spills from water supply operations on covered species in the Bull Run River and the Sandy River below the confluence with the Bull Run	Document any spills to the reservoirs, the lower Bull Run River, or to any tributary streams

<sup>a</sup>The measure descriptions in Chapter 7 provide the definitions and details of the measurable habitat objectives listed in this table.

<sup>b</sup>Compliance monitoring methods are described in Appendix F, Monitoring and Research Protocols.

<sup>c</sup>USGS calibrates and maintains the equipment that records stream flow, publishes provisional flow data in near-real-time on the USGS website, and publishes final flow data annually.

### **Compliance Monitoring for Offsite Conservation Measures**

The City will implement conservation measures on private land in various locations throughout the Sandy River Basin. Compliance monitoring and the measurable habitat objective for each measure are described in Table 9-2. The measures are categorized by type: riparian easements and improvements, acquisition of water rights, fish passage, carcass placement, large wood and log jam placement, channel restoration, and terrestrial wildlife habitat conservation. The measures are organized by type, rather than by watershed, because the objectives and monitoring measures for each type are similar.

When applicable, the measurable habitat objective defines a number of acres for riparian easements. The intent for the easements is to provide 100-foot-wide buffers from the top of the mean high-water level in the reach specified. The total acres per reach may or may not be contiguous depending on the willing-seller opportunities available. Compliance will be determined by the acres specified aggregated into three portions of the Basin: upper Sandy, middle Sandy, and lower Sandy.

**Table 9-2. Compliance Monitoring for Offsite Measures**

#	Measure	Measurable Habitat Objective <sup>a</sup>	Compliance Monitoring <sup>b</sup>
<b><i>Riparian Easements and Improvements</i></b>			
H-11	<b>Sandy 1 Riparian Easement and Improvement</b>	Establish riparian forest of $\geq 70\%$ site potential trees (by canopy cover) for approximately 11 acres (with 100-foot buffer widths) within 15 years	Complete an aerial photograph analysis or site survey to determine whether planting is needed  Repeat the analysis every five years for the term of the HCP to verify that initial planting has succeeded and/or if replanting is warranted  Document date riparian easement is completed and when site potential forest is established
H-12	<b>Sandy 2 Riparian Easement and Improvement</b>	Establish riparian forest of $\geq 70\%$ site potential trees (by canopy cover) for approximately 62 acres (with 100-foot buffer widths) within 15 years	

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**Table 9-2. Compliance Monitoring for Offsite Measures, continued**

#	Measure	Measurable Habitat Objective <sup>a</sup>	Compliance Monitoring <sup>b</sup>
<b><i>Riparian Easements and Improvements</i></b>			
H-13	<b>Gordon 1A and 1B Riparian Easement and Improvement</b>	Establish riparian forest of $\geq 70\%$ site potential trees (by canopy cover) for approximately 78 acres (with 100-foot buffer widths) within 15 years of establishment of easement	<p>Complete an aerial photograph analysis or site survey to determine whether planting is needed</p> <p>Repeat the analysis every five years for the term of the HCP to verify that initial planting has succeeded and/or if replanting is warranted</p> <p>Document date riparian easement is completed and when site potential forest is established</p>
H-14	<b>Sandy 3 Riparian Easement and Improvement</b>	Establish riparian forest of $\geq 70\%$ site potential trees (by canopy cover) for approximately 7 acres (with 100-foot buffer widths) within 15 years of establishment of easement	
H-15	<b>Cedar 2 and 3 Riparian Easement and Improvement</b>	Establish riparian forest of $> 70\%$ site potential trees (by canopy cover) for approximately 49 acres (with 100-foot buffer widths) within 15 years of establishment of easement	
H-16	<b>Alder 1A and 2 Riparian Easement and Improvement</b>	Establish riparian forest of $> 70\%$ site potential trees (by canopy cover) for approximately 43 acres (with 100-foot buffer widths) within 15 years of establishment of easement	
H-18	<b>Sandy 8 Riparian Easement and Improvement</b>	Establish riparian forest of $\geq 70\%$ site potential trees (by canopy cover) for approximately 25 acres (with 100-foot buffer widths) within 15 years of establishment of easement	
H-19	<b>Salmon 1 Riparian Easement and Improvement</b>	Establish riparian forest of $\geq 70\%$ site potential trees (by canopy cover) for approximately 23 acres (with 100-foot buffer widths) within 15 years of establishment of easement	
H-20	<b>Salmon 2 Riparian Easement and Improvement</b>	Establish riparian forest of $\geq 70\%$ site potential trees (by canopy cover) for approximately 36 acres (with 100-foot buffer widths) within 15 years. of establishment of easement	

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**Table 9-2. Compliance Monitoring for Offsite Measures, continued**

#	Measure	Measurable Habitat Objective <sup>a</sup>	Compliance Monitoring <sup>b</sup>
<b><i>Riparian Easements and Improvements</i></b>			
H-21	<b>Salmon 3 Riparian Easement and Improvement</b>	Establish riparian forest of $\geq 70\%$ site potential trees (by canopy cover) for approximately 12 acres (with 100-foot buffer widths) within 15 years of establishment of easement	Complete an aerial photograph analysis or site survey to determine whether planting is needed
H-22	<b>Boulder 1 Riparian Easement and Improvement</b>	Establish riparian forest of $>70\%$ site potential trees (by canopy cover) for approximately 15 acres (with 100-foot buffer widths) within 15 years of establishment of easement	Repeat the analysis every five years for the term of the HCP to verify that initial planting has succeeded and/or if replanting is warranted
H-28	<b>Zigzag 1A/1B Riparian Easement and Improvement</b>	Establish riparian forest of $>70\%$ site potential trees (by canopy cover) for approximately 12 acres (with 100-foot buffer widths) within 15 years of establishment of easement	Document date riparian easement is completed and when site-potential forest is established
H-24	<b>Salmon 2 Miller Quarry Acquisition</b>	Establish riparian forest of $>70\%$ site potential trees (by canopy cover) for approximately 40 acres (with 100-foot buffer widths) within 15 years of acquisition	<p>Document purchase of the site in annual report</p> <p>Complete an aerial photograph analysis or site survey to determine whether planting is needed</p> <p>Repeat the analysis every five years for the term of the HCP to verify that initial planting has succeeded and/or if replanting is warranted</p> <p>Document date riparian easement is completed and when site potential forest is established</p>
<b><i>Water Rights Acquisition</i></b>			
F-5	<b>Cedar Creek Purchase Water Rights</b>	During HCP Years 6-10, purchase approximately 50% of the current surface water rights that currently decrease June-September flows to increase June-September flows	Document the rights purchased and the estimated amount of additional flow for fish

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**Table 9-2. Compliance Monitoring for Offsite Measures, continued**

#	Measure	Measurable Habitat Objective <sup>a</sup>	Compliance Monitoring <sup>b</sup>
<b><i>Fish Passage</i></b>			
P-2	<b>Alder 1 Fish Passage</b>	Provide year-round upstream and downstream passage for steelhead and coho	Document passage conditions compared with NMFS design criteria once every three years after project implementation
P-3	<b>Alder 1A Fish Passage</b>		
P-4	<b>Cedar Creek 1 Fish Passage</b>	Provide year-round upstream and downstream passage for steelhead, coho salmon, cutthroat trout	
<b><i>Carcass Placement</i></b>			
H-25	<b>Salmon 2 Carcass Placement</b>	Place 1,800 salmon carcasses in one season	Document number of carcasses, release sites, and year of implementation
H-29	<b>Zigzag 1A, 1B, and 1C Carcass Placement</b>	Place 1,800 salmon carcasses in one season	

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**Table 9-2. Compliance Monitoring for Offsite Measures, continued**

#	Measure	Measurable Habitat Objective <sup>a</sup>	Compliance Monitoring <sup>b</sup>
<b><i>Large Wood and Log Jam Placement</i></b>			
H-3	<b>Little Sandy 1 and 2 LW Placement</b>	Place 50 key pieces of LW and achieve 80% of predicted woody debris levels within 15 years of placement	Tag all pieces of LW at the time of placement for later identification
H-4	<b>Sandy 1 and 2 Log Jams</b>	Place 10 engineered log jams in reaches Sandy 1 and 2	Monitor number of pieces of wood in the stream as described in Appendix F
H-5	<b>Gordon 1A and 1B LW Placement</b>	Place 300 key pieces of LW in reaches Gordon 1A and 1B and achieve 80% of predicted woody debris levels within 15 years of placement	
H-6	<b>Trout 1A LW Placement</b>	Place 25 key pieces of LW and achieve 80% of predicted woody debris levels within 15 years of placement	
H-7	<b>Trout 2A LW Placement</b>	Place 20 key pieces of LW in reach Trout 2A and achieve 80% of predicted woody debris levels within 15 years of placement	
H-17	<b>Cedar 2 and 3 LW Placement</b>	Place 600 key pieces of LW in reaches Cedar 2 and 3 and achieve 80% of predicted woody debris levels within 15 years of placement	
H-26	<b>Boulder 0 and 1 LW Placement</b>	Place 65 key pieces of LW in reaches Boulder 0 and 1 and achieve 80% of predicted woody debris levels within 15 years of placement	
<b><i>Channel Restoration</i></b>			
H-8	<b>Sandy 1 Reestablishment of River Mouth</b>	Create one additional mile of stream by reconnecting with original river mouth	Document reestablishment of the historic Sandy River mouth

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**Table 9-2. Compliance Monitoring for Offsite Measures, continued**

<b>#</b>	<b>Measure</b>	<b>Measurable Habitat Objective<sup>a</sup></b>	<b>Compliance Monitoring<sup>b</sup></b>
<b><i>Channel Restoration</i></b>			
<b>H-9</b>	<b>Sandy 1 Channel Reconstruction</b>	Open one-third river miles of side-channel habitat  Place 25 logs in side channel	Tag all side-channel logs at the time of placement for later identification  Once every three years, resurvey the stream to document seasonal flooding of the side-channel habitat and determine how many pieces of LW are still within the side-channel
<b>H-10</b>	<b>Sandy 1 Turtle Survey and Relocation</b>	Avoid direct impacts to western painted turtles and northwestern pond turtles	Document surveys of potential turtle habitat. Document all turtle relocations (species, number, locations, and dates)  Note: Measure H-10 is only necessary for projects conducted in the Sandy River delta
<b>H-27</b>	<b>Zigzag 1A Channel Redesign</b>	Maintain one-third mile of floodplain habitat for steelhead, coho, and spring Chinook  Place 25 pieces of LW in reaches Zigzag 1A and 1B	Tag all pieces of LW at the time of placement for later identification  Once every three years, resurvey the stream to determine how many pieces of LW are still within the side channel
<b><i>Terrestrial Wildlife Habitat Conservation</i></b>			
<b>W-1</b>	<b>Minimize Impacts to Spotted Owls</b>	Avoid disturbance of active nesting habitat	Survey protocols for owls, eagles, and fishers have not yet been determined  Protocols will be available within six months of the start of the HCP term
<b>W-2</b>	<b>Minimize Impacts to Bald Eagles</b>	Avoid disturbance of active winter night roosts or nests	
<b>W-3</b>	<b>Minimize Impacts to Fishers</b>	Avoid disturbance of fisher habitat	

<sup>a</sup>The measure descriptions in Chapter 7 provide additional definitions and details.

<sup>b</sup>Compliance monitoring methods are described in Appendix F, Monitoring and Research Protocols.

## 9.2.2 Effectiveness Monitoring

The City will conduct effectiveness monitoring for some of the HCP conservation measures. The effort will focus on measures for which there is some degree of uncertainty about the biological effectiveness. In some cases, the City does not plan to do effectiveness monitoring because the outcomes are already known and well supported by the available scientific literature. The rationale for those decisions is described in this section.

The effectiveness monitoring measures were developed to respond to the following guidance from NMFS:

- Provide detail about anticipated physical “endpoints”
- Collect data at stream sites where field work is done
- Conduct more robust analysis of physical habitat changes over time for instream projects (e.g., channel design or large wood placements) compared with other types of projects
- Gather pre-project habitat condition data to aid in determining project effectiveness
- Compare post-project field data with the habitat changes expected to result from the project (i.e., estimated habitat changes documented in the Ecosystem Diagnosis and Treatment (EDT) database )

### Measures for Which Effectiveness Monitoring is Not Necessary

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Four categories of Sandy offsite projects involve minimal uncertainty about biological effectiveness. The categories are fish passage improvements, carcass placements, riparian improvements, and a water rights purchase. The City believes only compliance monitoring is needed. The rationale for this conclusion is discussed by category below. Hypotheses for the expected results are provided.

#### *Fish Passage Improvements*

Four fish passage measures will be implemented in the first 15 years of the HCP. One project is on Walker Creek, a tributary to the lower Bull Run River. Two projects are on Alder Creek, where passage is restricted by a Highway 26 crossing (RM 0.1) and obstructed upstream near a diversion dam (RM 1.7). The fourth project is at the Sandy Fish Hatchery on Cedar Creek at RM 0.5.

**Working Hypothesis:** Fish passage improvements in Walker, Alder, and Cedar creeks will increase the available space for upstream distribution of listed and unlisted native salmonid fish stocks in the Sandy River Basin.

This hypothesis is supported by an extremely large body of scientific literature (Roni et al. 2002) for streams in the Pacific Northwest. The evidence indicates salmonid fish colonization of new habitat can be fairly rapid (Pess 2005; Iversen et al. 1993; Bryant et al. 1999; Glen 2002), and a similar result is expected for Alder Creek, Walker Creek and Cedar Creek. Source populations are present immediately downstream of these sites. Effectiveness monitoring is not necessary.

### *Carcass Placements*

The City will place carcasses along five reaches in the Salmon and Zigzag Rivers. These measures are one-time treatments and depend upon carcass availability. The intent is to make a contribution to planned efforts by other Sandy River Basin Partners.

**Working Hypothesis:** Carcass placements will increase nutrient levels; increase primary and secondary aquatic productivity; and, subsequently, increase the survival, growth, and abundance of listed and unlisted salmonid fish stocks in the Sandy River Basin.

Scientific literature and available research clearly document that carcass introductions have a direct positive influence on nutrient levels, aquatic productivity, and fish species response (Bilby et al. 1998 and 2001; Cedarholm et al. 1999; Washington Department of Fish and Wildlife [WDFW] 2001; Wipfli et al. 1999 and 2001; Shively 2001; Ashley and Slaney 1997; Reimchen et al. 2003; Johnston et al. 2004). Carcass placement programs are a key strategy under the Oregon Plan for Salmon and Watersheds (Oregon Department of Fish and Wildlife [ODFW] 2000) and are also supported by the State of Washington and the Canadian province of British Columbia (BC Ministry of Fisheries 2000).

Effectiveness monitoring is not necessary, based on the literature cited above, and because the measures are one-time treatments, monitoring would have no effect on later HCP implementation decisions.

### *Riparian Improvements*

Riparian improvement measures are planned in 12 stream reaches. The measures include riparian easements and silvicultural enhancements. Habitat conditions are expected to improve in 16 Sandy River Basin reaches.

**Working Hypothesis:** Protecting and enhancing riparian zones will increase wood recruitment, shade, bank stabilization, and runoff filtration capacity over time that will increase the survival, abundance, and productivity of covered species in the Sandy River Basin.

This hypothesis is supported by an extensive scientific record. The benefits of improving and protecting riparian areas for enhanced biological productivity are well established in the literature (Platts et al. 1987; Murphy and Koski 1998; McDade et al. 1990; Sullivan et al. 1990; VanSickle and Gregory 1990) and are key components of other approved HCPs across the region. All of the riparian measures in this HCP include replanting as necessary. With the establishment of the coniferous vegetation in the riparian zones, the multiple fish benefits enumerated in the hypothesis will begin to accrue. Effectiveness monitoring is not necessary.

### *Water Rights Purchase*

The City will purchase water rights in Cedar Creek to increase flows for fish. This measure will affect three reaches, and will be done only after the weir at the Sandy Fish Hatchery is modified to allow fish passage.

**Working hypothesis:** Purchasing surface water rights in Cedar Creek will increase streamflow and habitat for covered species.

The value of streamflow to fish and amphibians has been thoroughly documented in the scientific literature (Stoker 1950; Bovee et al. 1985; Kelley et al. 1987; California Department of Fish and Game 1987 and 1993; Electric Power Research Institute 2000). Most western states, including Oregon, recognize that streamflow is important for aquatic species conservation and have promulgated instream flow regulations (ORS 537.330).

Compliance monitoring will document the estimated change in flows. Effectiveness monitoring is not necessary.

### **Effectiveness Monitoring for Offsite Measures**

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As discussed above, in-channel improvements pose some biological uncertainty. The City will monitor the effectiveness of these in-channel measures.

The City has defined specific improvements in habitat conditions anticipated for each in-channel measure. For example, reaches Sandy 1 and 2 log jams are expected to improve pool and off-channel habitat, in addition to increasing the amount of large wood. Improvements in the actual stream conditions (pool and off-channel habitat) are variables that will be monitored. The same working hypothesis applies for all of the offsite projects:

**Working hypothesis:** At least 80 percent of the projected changes in the key habitat variables (pre-project versus post-project conditions) will occur in each affected stream reach.

To test this hypothesis, two key questions are relevant:

- Are the habitat variable ratings in the current EDT database representative of pre-project habitat conditions?
- Are the projected increases in habitat ratings (as described in Appendix E) an accurate representation of post-project habitat conditions?

To answer these questions, the City will implement the following protocol:

- Gather baseline habitat surveys (pre-project information)
- Conduct project effectiveness evaluation (post-project surveys)
- Compare results with measurable habitat objectives (as described in Table 9-3)

Each of the three elements of the protocol is described in more detail below.

#### ***Baseline Habitat Surveys***

Although a thorough reach-specific habitat database already exists, the City will verify baseline pre-project conditions for each reach where in-channel measures are planned. A standardized ODFW Aquatic Inventory Project protocol will be used to assess existing habitat conditions (Moore et al. 2002) The habitat parameters proposed for measurement during the stream channel surveys are EDT Level 2 environmental attributes (see Appendix D, EDT Limiting Factor and Habitat Attribute Definitions and Relationships). The City will collect two years of pre-project stream habitat survey data and average them to establish the



baseline for comparing the post-project treatment results. The City will also use the pre-project information to determine variance estimates around the habitat parameters to be analyzed as part of the effectiveness monitoring. A more detailed description of the protocol is provided in Appendix F, Monitoring and Research Protocols.

### *Project Effectiveness Evaluation*

The study design for the in-channel projects is anticipated to include habitat surveys in the form of a Before/After with Controls Included (BACI) assessment (Roni et al. 2005). The City will use upstream reach controls (either upstream of the treated portion of the reach or in the immediate upstream EDT reach) to minimize the influence of external factors, channel disturbance regimes, and weather on the outcomes of the before and after project comparisons. The controls will be chosen to include habitat representative of current conditions in untreated sections of the reaches. A more detailed description is provided in Appendix F, Monitoring and Research Protocols.

### *Comparison with Measurable Objectives*

In-channel mitigation measures will influence habitat variables and environmental attributes in 13 reaches encompassing approximately 51 lineal miles of stream habitat. Professional biologists familiar with the Sandy Basin rated habitat variables for each EDT reach and estimated the change in the rating that would occur after HCP measure implementation. The ability to accurately measure each habitat attribute and the expected change depends on many factors, including the following:

- Characteristics of the attribute
- Natural variability
- Sampling methodology
- Observer error

Because variance terms are not currently available for each of these four factors, it is not possible to clearly define the level of precision achievable with a monitoring program.

The City will statistically evaluate key EDT habitat attributes for each of the in-channel treatment reaches because these factors offer the greatest projected magnitude of change attributable to the in-channel treatment measures, and the variance concerning their estimates and operator errors are anticipated to be sufficiently small. The key habitat attributes include the following:

- Woody debris
- Backwater pool percentage
- Off-channel habitat factor
- Beaver pond percentage
- Pool percentage
- Large cobble riffle percentage
- Pool tail percentage
- Small cobble riffle percentage

The HCP conservation measures are also expected to provide beneficial changes in additional habitat variables, including the following:

- Fine sediment
- Bed scour
- Confinement-hydrmodifications
- Riparian function

The City believes, however, that these variables exhibit either a high variance or a relatively low anticipated magnitude of change (i.e., less than 10 percent post-treatment change), which will make statistical assessment difficult. The City does not plan to collect or evaluate effectiveness data on these variables and will instead focus on the key attributes listed that are associated with the greatest predicted benefits to fish. The predicted habitat changes for each of the primary covered species are discussed in more detail in Chapter 8 and in Appendix E.

The monitoring measures, measurable habitat objectives, and monitoring methods are described in Table 9-3. Additional details of the protocols are provided in Appendix F.

**Table 9-3. Effectiveness Monitoring for Offsite Measures**

#	Measure	Measurable Habitat Objective <sup>a</sup>	Effectiveness Monitoring <sup>b</sup>
<b><i>Large Wood and Log Jam Placement</i></b>			
<b>H-12</b>	<b>Trout 1A LW Placement</b>	Achieve 80% of predicted increase in pieces of LW within 15 years of implementation	Conduct habitat surveys per monitoring protocol
<b>H-13</b>	<b>Trout 2A LW Placement</b>		

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**Table 9-3. Effectiveness Monitoring for Offsite Measures, continued**

#	Measure	Measurable Habitat Objective <sup>a</sup>	Effectiveness Monitoring <sup>b</sup>
<b><i>Large Wood and Log Jam Placement</i></b>			
H-3	<b>Little Sandy 1 and 2 LW Placement</b>	Achieve 80% of predicted increase in pieces of LW within 15 years of implementation	Conduct habitat surveys per monitoring protocol
H-5	<b>Gordon 1A and 1B LW Placement</b>	Achieve 80% of predicted increase in backwater pools, pools, and pool-tail habitat within 15 years of implementation  Achieve 80% of predicted increase in percentage of total habitat that is large-cobble riffles, within 15 years of implementation	
H-26	<b>Boulder 0 and 1 LW Placement</b>	Achieve 80% of predicted increase in pieces of LW within 15 years of implementation.	
H-4	<b>Sandy 1 and 2 Log Jam Placements</b>	Achieve 80% of predicted increase in pieces of LW within 15 years of implementation	Conduct habitat surveys per monitoring protocol
H-17	<b>Cedar 2 and 3 LW Placement</b>	Achieve 80% of predicted increase in pieces of LW within 15 years of implementation  Achieve 80% of predicted increase in percentage of off-channel, beaver pond and pool habitat within 15 years of implementation	

Table continued on next page

<b>Table 9-3. Effectiveness Monitoring for Offsite Measures, continued</b>			
<b>#</b>	<b>Measure</b>	<b>Measurable Habitat Objective<sup>a</sup></b>	<b>Effectiveness Monitoring<sup>b</sup></b>
<b><i>Channel Restoration</i></b>			
<b>H-9</b>	<b>Sandy 1 Channel Reconstruction</b>	Achieve 80% of predicted increase in percentage of off-channel habitat within 15 years of implementation	Every three years, resurvey the site to determine whether the gradient control structure is maintaining flow in the side channel and the river
<b>H-24</b> <b>H-24</b>	<b>Salmon 2 Miller Quarry Acquisition and Restoration</b>	Achieve 80% of predicted improvements in off-channel habitat within 15 years of implementation	Once every three years after measure implementation, survey opened floodplain area and side channels
<b>H-27</b>	<b>Zigzag 1A Channel Design</b>	Achieve 80% of predicted habitat improvements within 15 years of implementation	Conduct habitat surveys per monitoring protocol

<sup>a</sup>Monitoring protocols are described in detail in Appendix F, Monitoring Plans and Protocols.

<sup>b</sup> Predicted habitat changes for each reach are defined in Chapter 8.

<sup>a</sup>Predicted habitat changes for each reach are defined in Chapter 8 and in Appendix E.

## 9.3 Research Program

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The City's research program has four components in the Bull Run River watershed, and one component in the larger Sandy River Basin. In the Bull Run watershed, the City will study placement of spawning gravel, degree of Chinook spawning gravel scour, concentrations of total dissolved gases (TDG), and abundance of spawning Chinook adults. For the Sandy River Basin, the City will collaborate with ODFW, Mt. Hood National Forest, Bureau of Land Management (BLM), and ODEQ to measure the number of juvenile salmonids outmigrants (JOMs) in the Sandy River Basin.

### 9.3.1 Research in the Bull Run Watershed

#### Spawning Gravel Placement and Bed Scour Research

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Most of the City's conservation measures in the Bull Run River watershed are associated with a high degree of biological certainty that the actions will provide the habitat improvements necessary to meet the HCP's goals and objectives. The benefits of placing spawning gravel are not as well known. The City will evaluate the effectiveness of gravel placements by conducting research on gravel placement and gravel scour.

##### *Gravel Placement Research*

The City will place spawning gravel in the lower Bull Run River to increase spawning habitat, primarily for Chinook salmon and steelhead. The gravel placement rate will be higher than the estimated natural range of gravel accumulation in the lower Bull Run River. The estimated historic gravel supply rate was roughly 30–1,000 cubic yards per year (CH2M HILL 2003); the City will place approximately 1,200 cubic yards per year for the first 5 years and 600 cubic yards per year thereafter. The City will evaluate the gravel placements annually to determine the resulting surface area covered by spawning gravels of suitable size for Chinook salmon and steelhead. A more detailed version of the gravel placement research protocol is provided in Appendix F, Monitoring and Research Protocols.

##### *Chinook Spawning Gravel Scour Research*

The City recently completed an analysis of gravel (or potential redd) scour in the Bull Run River based on existing streamflow and scour velocity information (CH2M HILL 2003b). The study indicated that the flows sufficient to mobilize gravels will occur less frequently and for fewer days under the HCP flow regime than with natural flows, and will therefore reduce the risk of redd scour caused by peak flows. The CH2M HILL study relied on existing information; no new field data were incorporated. The City will augment this information by completing a Chinook redd scour study.

The City will study redd scour in the lower Bull Run River using sliding bead-type scour measuring devices. The lower river, RM 1.5–RM 4.7, will be stratified into stream reaches based on channel and geomorphic characteristics. The City has surveyed this section of the river in the past for spring and fall Chinook spawning. The City will sample a total of 10 Chinook redds a year in the lower river, distributed as evenly as possible among the reaches. Ten redds represent approximately 33 percent of the total redds observed in previous years.

The redd scour study will take place after 5 years of gravel placement, and in each of 3 years between Year 5 and Year 10 of the HCP. The study years might not be consecutive because high flows are needed to generate useful data, and those flows do not occur every year.

A more detailed version of the Chinook spawning gravel scour research protocol is provided in Appendix F, Monitoring and Research Protocols.

### **Total Dissolved Gas Research**

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Oregon's Water Quality Standards state that TDG levels should not exceed 110 percent of saturation unless flows exceed the ten-year, seven day average flood (7Q10) flow for the site [OAR 340-041-0031]. The City has evaluated all water system structures, valves, or turbines that could elevate TDG levels since 2005. There are two structures where the City has found that high levels of TDG can occur, the Dam 2 spillway stilling pool and the Dam 1 spillway. Elevated TDG levels, however, rapidly dissipate at both locations. TDG levels immediately downstream of the Dam 2 stilling pool, for instance, have not exceeded the 110% standard unless the 7Q10 flow for the lower Bull Run River was also exceeded. Similarly, high TDG levels measured in the Dam 1 spillway dissipate to below 110% by the downstream end of the spillway pool. It is not yet known to what extent the short-term elevated TDG levels at these two locations affect fish habitat in the Bull Run River, so additional study is needed.

The City will continue to study TDG levels in the Bull Run River to determine the extent and duration of TDG concentrations. If TDG levels exceed water quality standards, the City will work with ODEQ to develop a water quality management plan. A more detailed version of the TDG research protocol is provided in Appendix F, Monitoring and Research Protocols.

### **Bull Run River Chinook Population Research**

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The City understands the importance of tracking the status of the ESA-listed fish populations in the Sandy River Basin. A variety of partner organizations in the Sandy River Basin need fish population information to evaluate population trends and track recovery of the Endangered Species Act (ESA)-listed fish populations. Although this HCP is habitat based and not focused on the specific population responses of the species, the City will partially fund research on the status of the species in conjunction with other partners.<sup>1</sup> The results of the City's research will be evaluated with monitoring results to determine the City's adaptive management response over time.

The City will collect adult Chinook salmon information for the lower Bull Run River. The City will conduct an annual survey of the lower river from RM 0—RM 5.8 to count adult spring and fall Chinook salmon from August through November. This time period covers the spawning period of spring Chinook and Late River Wild fall Chinook. The reach can be safely surveyed because the City can somewhat control (i.e., reduce) flow levels. A portion of this reach, from the Little Sandy River (RM 2.8) to Larson's Bridge (RM 3.7), corresponds to one of ODFW's probabilistic, randomly selected reaches for the Sandy River Basin snorkel surveys (see Section 9.3.2).

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<sup>1</sup> Chapter 2 describes the City's habitat-based approach and rationale in greater detail.



Photo courtesy of Bonneville Power Administration.

The City will provide \$600,000 for the term of the HCP and will coordinate its monitoring efforts with ODFW. If ODFW can complete Bull Run River population surveys early in the term of the City's HCP, the City will postpone its surveys to a later date and thereby leverage the available funding to greater effect. Overall, the City will fund 20 years of adult Chinook salmon surveys over the 50-year term of the HCP. A more detailed description of the protocol is provided in Appendix F, Monitoring and Research Protocols.

### **9.3.2 Research in the Sandy River Basin**

The population research done by the City will be part of a coordinated basin-wide effort. ODFW, U.S. Forest Service (USFS, Mt. Hood National Forest), BLM, ODEQ, and the City are currently coordinating efforts to monitor population trends for adult Chinook, coho, and steelhead; juvenile salmonids; and freshwater habitat conditions in the Basin. Currently, ODFW is monitoring adult fall and spring Chinook, coho, and steelhead. The fall and spring Chinook counts are index surveys which account for most of the known spawning areas for the species. For coho and steelhead, the adult spawner population estimates are expected to have a precision of  $\pm 35$  percent. ODFW is also starting probabilistic snorkel surveys for juvenile coho, Age-1+ steelhead, and Age-1+ cutthroat. The surveys are designed to provide status and trend information at the Lower Columbia Evolutionarily Significant Unit (ESU) scale. The program includes approximately 50 sites in the ESU and 7 sites in the Sandy River Basin. The surveys began in August 2006. ODFW also started habitat surveys in the Sandy Basin in July 2006; the information will provide habitat status and trend information over time.

### **Juvenile Salmonid Outmigrant Research**

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The City understands the importance of tracking the status of the ESA-listed fish populations in the Sandy River Basin. The City has discussed the need for Juvenile Outmigrant (JOM) data in the Sandy River Basin with other agencies (Phil Roni, NMFS, pers. comm., October 2006) and will participate in funding JOM research. Although this HCP is habitat-based and not focused on the specific population responses of the species, information about juvenile outmigrants is needed to obtain a complete picture of the condition and change in freshwater productivity through time, which is important for determining the overall status of the fish populations. The results of the City's research will be evaluated with monitoring results to determine the City's adaptive management response over time.

The City will provide \$100,000 per year for the term of the HCP for collecting juvenile salmonid information for the Sandy River Basin. This money will be used in cooperation with the Sandy River Basin Partners (Partners) to leverage additional funds and to create a coordinated JOM monitoring program for the Basin. The City's share amounts to 43 percent of the JOM monitoring effort.

The City will conduct its research on juvenile outmigrants using seven rotary smolt traps. The Sandy River Monitoring Group has identified 12 sites in the Sandy River Basin where operating a smolt trap is feasible. Those sites are Beaver, Gordon, Cedar, Still, Camp, Clear, and Lost creeks, and the Bull Run, Little Sandy, Salmon, Clear Fork Sandy, and Zigzag rivers. These streams will collectively serve as an index for the entire Sandy River Basin.

Use of the juvenile salmonid outmigrant research budget will be reviewed by NMFS and the City as needed and can be reallocated, if necessary, to address other higher priority population research needs in the Sandy River Basin. The City's will commit no more than \$100,000 per year for the term of the HCP.

More detail about the protocol is provided in Appendix F, Monitoring and Research Protocols.

### **9.4 Adaptive Management Program**

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Adaptive management is an important aspect of successfully implementing a habitat conservation program over a 50-year period. The City anticipates that scientific understanding will improve during the term of the HCP, and that conditions will change to the degree that some reconsideration and adaptation will be appropriate.

The City's approach to adaptive management incorporates the following components:

1. Sandy River Basin Restoration Strategy
2. HCP Implementation Committee
3. Adaptive Management Response Framework



#### **9.4.1 Sandy River Basin Restoration Strategy**

As described in Chapter 2, the City's HCP was developed in the context of a partnership effort to restore aquatic and riparian habitat throughout the Sandy River Basin. The Partners have developed a Sandy River Basin Restoration Strategy (Sandy River Basin Partners 2006) and have committed to work together to implement the strategy over time. The Partners recognize the key role the HCP plays in complementing and leveraging restoration work throughout the Basin. Contributing to a coordinated basin-wide restoration effort is fundamental to the rationale for the offsite conservation measures and Habitat Fund included in the HCP.

The Partner's Restoration Strategy is built on geographic and project-type priorities. The geographic prioritization is based on anchor habitats, defined as those reaches currently most productive for fall and spring Chinook salmon, steelhead, and coho salmon. Habitat improvement project priorities are based on a hierarchical framework developed from the most recent literature and consistent with the Oregon Plan for Salmon and Watersheds (Oregon Watershed Enhancement Board 2005).

The City will continue to actively participate in the Partner's ongoing work. While the City's legal obligation is to meet the requirements of federal law, the City's intent is to do so in manner consistent with the Sandy River Basin Partner's Restoration Strategy as that strategy matures and evolves into the future.

#### **9.4.2 HCP Implementation Committee**

For both the HCP and the Sandy River Basin Restoration Strategy to be successful in the long term, the City will need to continue to work in collaboration with the partner organizations. The City recognizes the value of the effort that the Partners have already dedicated to assisting in the definition of measures for the HCP. Similar communication and coordination will be needed during the term of the HCP.

To this end, the City will establish an HCP Implementation Committee. Assuming the Sandy River Basin Partners continue to exist in a similar form, the members will constitute this committee. During the 50-year term of the HCP, the Implementation Committee will assist in making adaptive management decisions. The role of the Implementation Committee will be advisory only. NMFS and the City will retain final authority to make changes to the HCP.

#### **9.4.3 Framework for Adaptive Response**

The design of the HCP creates a variety of adaptive management needs over time. The adaptive management framework includes two major components:

- Adaptive Responses for Individual Measures
- Decision Milestones for Addressing Effectiveness of HCP as a Whole

(See also Chapter 10 for a description of adaptive responses to Changed Circumstances. See Chapter 11 for the estimated costs and funding allocations.)

### **Adaptive Responses for Individual Measures**

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The City will implement adaptive management for individual measures if any of the following circumstances occurs during the term of the HCP:

1. A habitat conservation measure cannot be implemented
2. Effectiveness monitoring indicates that an instream habitat conservation measure has not met the applicable measurable objective
3. Due to factors outside the control of the City (e.g., flood, wildfire, insects and disease, landslide, permanent change in land use, or unauthorized logging), more than 20 percent of the anticipated riparian or instream habitat benefit of an offsite habitat conservation measure, within the reach it is implemented, is lost prior to the end of the 50-year HCP term<sup>2</sup>

If appropriate, given new information, the City and NMFS, with the input of the Implementation Committee, will also reconsider specific offsite measures that have not yet been implemented. In those cases, the merits and feasibility of substituting a new measure for an original measure will be discussed. (See also the contingency provisions in Chapter 11 for situations in which a measure is expected to cost more than the amount estimated and allocated.)

The necessary adaptive response in these situations will be discussed by the City and NMFS on a case-by-case basis. As a starting point, the City will, when appropriate, conduct site surveys (see Appendix F for protocols) and run the EDT model with updated habitat ratings to characterize baseline watershed conditions.

If implementation of an additional or substitute measure is necessary, the City and NMFS will use the following guidelines in the order of priority listed or as applicable to the circumstances:

1. Repeat the original approach in the same location
2. Define a new approach to achieve the same habitat benefit for the same primary covered species in the same reach
3. Define a different but equivalent habitat benefit (and an approach to achieve that benefit) for same primary covered species in the same reach; determine if the new habitat benefit targets a limiting factor for that species in that reach
4. Define an equivalent habitat benefit in a different reach (and an approach to achieve that benefit) that will benefit the same primary covered species; determine if the new habitat benefit targets a limiting factor for that species in that reach
5. Define an equivalent habitat benefit (and an approach to achieve that benefit) that will benefit another of the four primary covered species; determine if the new habitat benefit targets a limiting factor for that species in that reach

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<sup>2</sup>Habitat loss, in this context, is defined as the destruction or degradation of 20 percent of the riparian zone acreages indicated for riparian zone easement and improvement measures in Table 9-2. Habitat loss is also defined as a 20 percent reduction in the aquatic habitat as defined by the measurable habitat objectives associated with the large wood/log placements and the channel redesign and reconnection projects in Table 9-3. The loss would be anticipated to last for 10 years or longer.

Once a measure—or set of alternative measures—has been selected, the City will rerun the EDT model to assist in evaluating the equivalence of the habitat benefit as compared to the benefit predicted for the original measure.

For measures that require effectiveness monitoring, the equivalent habitat benefits described above will be defined based on the specific EDT rating changes predicted to occur for the original measure (see Appendix E).

Decisions applying these guidelines will be made by the City and NMFS, working collaboratively and with input from the HCP Implementation Committee. Monitoring information and scientific literature available at the time will be used.

Costs for implementing the adaptive response, when the original measure was not implemented, will be paid with the funding allocated for the original measure. Costs for implementing additional measures, after the original measures have been implemented, will be paid from the adaptive management portion of the Habitat Fund. (See Chapter 11 for more information on the Habitat Fund.)

### **Decision Milestones for Addressing Effectiveness of the HCP as a Whole**

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The City and NMFS have established key milestones when effectiveness of the HCP, as a whole, will be evaluated and decisions will be made as to whether or not additional habitat measures are needed. These milestones will occur at Years 20, 30, and 35. Year 20 was selected as the first milestone because it would occur after the City has implemented most of the offsite conservation measures described in Chapter 7 and because it will take approximately that long to collect adequate and meaningful data about the Sandy River fish populations. Years 30 and 35 were selected to allow adequate time for implementing measures, accruing biological benefits, and assessing effectiveness before the next milestone and before the end of the HCP term.

As a first step at each of these milestones, the City will have a Progress Report meeting with NMFS and the HCP Implementation Committee. The purpose of this meeting will be to reach a common understanding of the

- population trends for the covered species
- City's compliance record to date
- effectiveness of City measures implemented to date
- need (if any) for adaptive management to meet HCP obligations
- opportunities available to improve habitat in accordance with the Sandy River Basin Restoration Strategy
- opportunities for partnership efforts (e.g., to use City funds to leverage additional resources from other sources)
- project preferences of the committee participants

Following the Progress Report meeting, the City and NMFS will have one or more additional meetings to define the adaptive management actions necessary (if any) to maintain

compliance with the HCP. The focus of these meetings will be to decide whether new measures should be selected and implemented, and if so to determine the specific measures.

The City and NMFS will also consider changes in the science underlying the offsite conservation measures. The focus will be on whether or not the preponderance of the available scientific literature indicates that the original hypotheses (for one or more of the offsite conservation measures) have become faulty enough to warrant an adaptive response.

Final decisions will be made by NMFS and will be determined based on what is required to maintain compliance with the HCP. The magnitude of the effort will be constrained by the funding allocated to adaptive management (see Chapter 11).

Decisions at each milestone are described in Table 9-4, and shown in Figure 9-2. The Habitat Fund and Insurance Fund mentioned in Table 9-4 and Figure 9-2 are described in the next section.

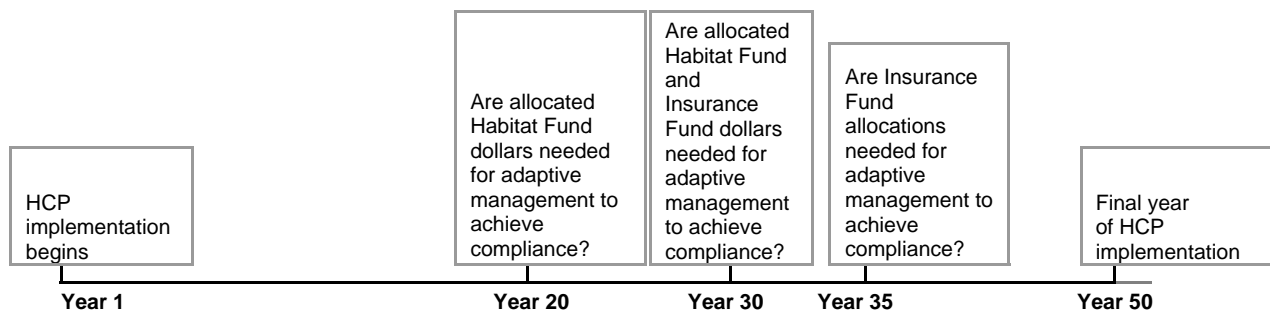
**Table 9-4. Milestones and Related Decisions**

<b>Decision at Year 20</b>	Are Habitat Fund dollars allocated to Years 21–30 needed for adaptive management actions to achieve HCP compliance?	
	If yes, the City and NMFS will select the necessary projects and define implementation schedules during the Year 21–30 time window. Final decision is by NMFS.	If no, the City will dedicate those funds to projects identified with input from the Partners (based on the Sandy River Basin Restoration Strategy). Preference will be given to projects with characteristics necessary to leverage additional funds through partnerships.
<b>Decisions at Year 30</b>	Are Habitat Fund dollars allocated to Years 31–35 needed for adaptive management actions to achieve HCP compliance?	
	If yes, the City and NMFS will select the necessary projects and define implementation schedules during the Year 31–35 time window. Final decision is by NMFS.	If no, the City will dedicate those funds to projects identified with input from the Partners (based on the Sandy River Basin Restoration Strategy). Preference will be given to projects with characteristics necessary to leverage additional funds through partnerships.
	Is the Insurance Fund allocation for Years 31–35 needed, in addition to the Habitat Fund dollars, for adaptive management actions to achieve HCP compliance?	
	If yes, the City and NMFS will select the necessary projects and define implementation schedules during the Years 31–35 time window. Final decision is by NMFS.	If no, the funding allocation for Years 31–35 will revert to the City and will not be retained until the Year 35 milestone.

Table continued on next page.

**Table 9-4. Milestones and Related Decisions, continued**

<b>Decision at Year 35</b>	Are the Insurance Fund allocations for Years 36–40 and Years 41–45 needed for adaptive management actions to achieve HCP compliance?	
	If yes, the City and NMFS will select the necessary projects and define implementation schedules during the Year 36–45 time window. Final decision is by NMFS.	If no, the funding allocation for Years 36–45 will revert to the City and will no longer be available for adaptive management.



**Figure 9-2. Milestones for Adaptive Management Decisions**

**Resources for Addressing Effectiveness of the HCP as a Whole**

The City has designated two funds to be used to implement decisions at the milestones described above: a \$4-million portion of the Habitat Fund and a \$ 3-million Insurance Fund.

**Habitat Fund**

As described in Chapter 7, the \$9-million Habitat Fund has two functions. One function is to provide funds to implement additional projects to address impacts not fully addressed by the other specific projects described in Chapter 7, especially for contributing to larger scale partnership projects. The habitat benefits that will accrue from the City’s portion of these projects will add to total benefit provided by the City’s HCP. A \$5-million portion of the fund is designated solely for that first function. The second function is to provide resources to implement additional habitat projects, in the form of adaptive management, as necessary to ensure effectiveness of the HCP as a whole (per decisions at designated milestones described in Table 9-4). The remaining \$4-million portion of the \$9-million fund will be used for this second function to the extent it is needed. The \$4-million is allocated in three increments: \$2 million for Years 21-25, \$1 million for Years 26-30, and \$ 1 million for Years 31-35. If these increments are not needed for adaptive management, they will be reallocated to partnership projects as described in Table 9-4. (Note: Appendix I shows approximately \$2 million of the \$ 4 million total as being available prior to Year 20 if monitoring of projects implemented early in the term of the HCP shows those projects are not achieving the habitat

objectives defined in this chapter and additional projects are required. Although this funding will be available earlier if needed, the City's intent is to follow the schedule shown in Table 9-4, Figure 9-2 and Figure 11-1 to the greatest extent possible. Decisions on how and when the adaptive management funding will be spent will be made by NMFS in consultation with the City and consistent with constraints defined in Chapter 11.)

### *Insurance Fund*

The City will provide an Insurance Fund to provide resources late in the 50-year term of the HCP. The purpose of the \$3-million Insurance Fund is to fund additional habitat projects, if necessary, based on decisions at the relevant milestones in Table 9-4 and shown in Figure 9-2. The fund is divided into three increments: \$1 million for Years 31-35, \$1.5 million for Years 36-40, and \$0.5 million for Years 41-45 (see also Figure 11-1 in Chapter 11). If decided at the defined milestone that the Insurance Fund amount is not needed to ensure effectiveness of the HCP as a whole, the funding will be retained by the City and will no longer be available for the HCP. (See also Chapter 11, Costs and Funding, for additional information.)