TARGET APPLICATION PROCEDURE
3-12-12 Draft

1. Through consensus of the project team, establish criteria for acceptable levels of uncertainty, either blanket provisions for the project or according to guidelines applicable to different situations.

   Proposal: Set confidence level and probability for application of biological-hydrological indicators at 80 percent and for water quality indicators at 95 percent.

2. Select stream reaches at which goals will be investigated.

   Proposal: Emphasize locations having both extensive flow gauge and B-IBI data, but consider adding sites having only B-IBI data and/or locations representing exceptional resource values or having particular interest for some other reason.

   Locations having both extensive flow gauge and B-IBI data—

Stream	Gauge	B-IBI Station
Crisp	40d	09MID1495
Newaukum	12108500	09NEW1657
Big Soos	12112600	09SOO1134
Covington	09a	E3516
Little Soos	54i	09SOO1209
Jenkins	26a	E216
Soosette	54h	09SOO1022
Mill	1211347	09BLA0675
Miller	42a	MI971
Des Moines	11d	DM_Ravine_DS

   Additional locations having B-IBI data—

Stream	No. of Additional B-IBI Stations
Crisp	1
Newaukum	8 including North Fork
Big Soos	3
Covington	5
Little Soos	2
Jenkins	3
Soosette	9
Mill	2
Miller	0
Des Moines	0

   Locations representing exceptional resource values or having particular interest for some other reason—to be determined

3. Using the Existing Data Review[1] and any future report including metals data, characterize existing indicator conditions at the selected reaches: biological (B-IBI), hydrological (high

[1] Knutson, C. 2011. Existing Data Review for Development of a Stormwater Retrofit Plan for the Water Resource Inventory Area (WRIA) 9: Historical Flow, Total Suspended Solids, and Turbidity Data. King County Department of Natural Resources and Parks, Seattle, WA.

pulse count [HPC], high pulse range [HPR], and 2-year peak:mean winter base flow ratio [PEAK:BASE]), and water quality (TSS, turbidity, dissolved copper [DCu], and dissolved zinc [DZn], as available).

Status:

Biology—

Stream	Mean B-IBI	Max. B-IBI	75th P'tile B-IBI
Crisp	24	30	26
Newaukum	29	38	31
Big Soos	37	46	38
Covington	31	34	32
Little Soos	23	28	25
Jenkins	35	40	38
Soosette	34	40	37
Mill	20	24	23
Miller	12	*	*
Des Moines	10	*	*
* Insufficient data available for statistics			

Hydrology—

	Existing:								
	Mean	Min.	25th P'tile	Mean	Min.	25th P'tile	Mean	Min.	25th P'tile
Stream	HPC	HPC	HPC	HPR	HPR	HPR	Peak:Base	Peak:Base	Peak:Base
Crisp	1	0	0	30	0	0	3	2	2
Newaukum	9	4	6	146	71	108	9	6	7
Big Soos	5	0	3	108	0	65	5	3	4
Covington	4	1	2	109	4	69	6	4	5
Little Soos	7	0	5	132	0	101	9	7	8
Jenkins	4	1	2	125	48	84	4	3	3
Soosette	10	6	8	166	119	137	16	9	12
Mill	13	7	11	235	97	185	15	8	11
Miller	18	17	18	311	298	305	10	9	9
Des Moines	11	9	10	261	184	223	21	15	18

Water quality—

Stream	WQ Station	Maximum Turbidity	Minimum Turbidity	Mean Turbidity	Maximum TSS	Minimum TSS	Mean TSS
Crisp	F321	5.2	0.8	2.1	8.2	0.5	1.6
	321	24.9	0.5	2.8	84.8	1.0	7.5
Newaukum							
Big Soos	A320	85.3	0.5	4.4			
Covington	C320				4.3	0.5	1.8
Little Soos	G320	5.2	0.8	2.1	7.4	0.7	3.2
Jenkins							
Soosette	Y320				8.0	1.4	4.3
Mill							
Springbrook	A317	61.1	5.7	20.4	118.0	2.8	27.5
	317				79.8	2.1	8.9
Miller							
Des Moines							

4. For the selected reaches, state candidate biological goals in terms of B-IBI and candidate water quality goals in relation to WDOE water quality criteria. Candidate goals will be evaluated at the end of the analysis and refined and finalized based on the environmental and financial results.

   Proposal:

   Candidate biological goals—

   Goal 1: Maintain existing *mean* B-IBI scores.
   Goal 2: Maintain existing *maximum* B-IBI scores.
   Goal 3: Maintain existing *75th percentile* B-IBI scores.
   Goal 4: Raise B-IBI at any station with *minimum* < 35 to ≥ 35 associated with salmon support (Karr 2003).
   Goal 5: Raise B-IBI at any station with *mean* < 35 to ≥ 35 associated with salmon support (Karr 2003).
   Goal 6: Raise B-IBI at all stations to ≥ 40 associated with strong salmon support (Karr 2003).
   Goal 7: Raise group 4 (B-IBI < 21) and group 3 (B-IBI = 21-28) to a higher group.

   Candidate water quality goals—

   Comply with water quality criteria for turbidity, copper, and zinc.

5. Set hydrologic indicator targets that must be met for potential biological goal achievement. Apply methods in the Target Development Report[1], considering both the estimates given by the respective equations and the confidence limits or probability associated with those estimates, according to the established criteria for acceptable uncertainty, as follows:

   HPC, HPR—Use tabulated values[2] derived from linear regressions and confidence limits on regression coefficients and constants to set HPC and HPR targets consistent with the candidate B-IBI goals and acceptable level of uncertainty.

   PEAK:BASE—Use tabulated values[3] derived from logistic regressions and probabilities to set PEAK:BASE targets consistent with the candidate B-IBI goals and acceptable level of uncertainty.

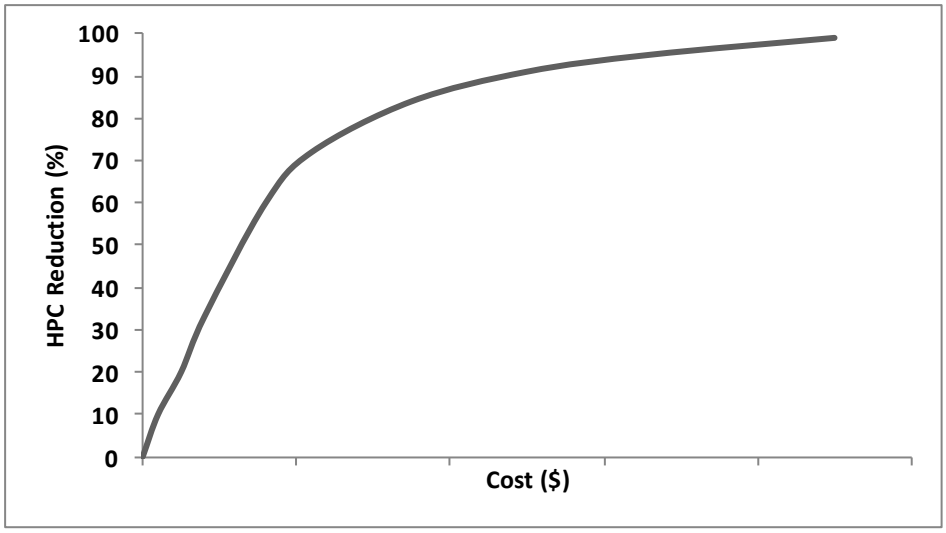
   Proposal: See the Goal worksheets in the Attachment for hydrologic targets associated with the seven candidate B-IBI goals.

6. Set turbidity, copper, and zinc targets to pursue the goal of complying with WDOE water quality criteria, with copper, and zinc targets based on the measured or estimated water hardness for the stream.

7. Devise BMP strategies to attempt to meet hydrologic targets and achieve candidate biological goals.

8. Run BMP strategies through SUSTAIN and obtain hydrologic outputs translatable to indicator values, as well as TSS output. It is expected that the most helpful SUSTAIN output to accomplish this task will be in the form of:

[1] Horner, R. 2012. Development of Flow and Water Quality Targets. King County Department of Natural Resources and Parks, Seattle, WA.
[2] See Hydrologic Targets spreadsheet.



From the output graph the cost of any target HPC reduction (e.g., from 10 to 7, 30%; or 10 to 4, 60%) can easily be determined, allowing the investigation of many candidate goals based first on HPC. At this time it appears that values of the other hydrologic indicators (HPR and PEAK:BASE) must be determined by post-processing calculations, information that will be used to assess candidate goals further and refine them.

9. Compare outputs to hydrologic targets. Make a judgment on the likelihood of B-IBI goal achievement based on the weight of the different pieces of evidence provided by the predicted HPC, HPR, and PEAK:BASE values.

10. Use SUSTAIN TSS output and equations from the Target Development Report to estimate turbidity, copper, and zinc resulting from the BMP strategies. Select equations based on all data or storm flow data depending on the objectives of the analysis.[1] Make best estimates of turbidity, DCu, and DZn based on the regression equation and highest estimates based on the 95 percent confidence limits of the regression equation coefficients and constants.

Estimate	All Data		Storm Flow Data	
Best estimate	Turbidity = 0.46*TSS + 3.26		Turbidity = 0.46*TSS + 4.02	
Highest estimate at 95% confidence	Turbidity = 0.47*TSS + 3.74		Turbidity = 0.47*TSS + 4.78	
Best estimate	TCu = 0.050*TSS + 2.70	DCu = 0.36*TCu + 0.93	TCu = 0.048*TSS + 3.15	DCu = 0.31*TCu + 1.21
Highest estimate at 95% confidence	TCu = 0.054*TSS + 2.89	DCu = 0.38*TCu + 1.07	TCu = 0.052*TSS + 3.37	DCu = 0.35*TCu + 1.39
Best estimate	TZn = 0.43*TSS + 8.76	DZn = 0.71*TZn – 2.56	TZn = 0.18*TSS + 12.3	DZn = 0.72*TZn – 3.20
Highest estimate at 95% confidence	TZn = 0.51*TSS + 10.9	DZn = 0.73*TZn - 1.81	TZn = 0.23*TSS + 14.9	DZn = 0.74*TZn – 2.24

[1] The selection of the equation is most important at relatively low TSS concentrations, which is the case in most WRIA 9 streams (see Existing Data Report). The results vary by 10-17 percent for turbidity with TSS < 7 mg/L, by 10-16 percent for DCu with TSS < 25 mg/L, and by as much as 53 percent for DZn. The relatively large deviation for DZn accentuates the importance of estimating uncertainty and taking particular care in interpreting results. Used in this way they can still be useful to make judgments on whether or not the estimated DZn concentration would meet the WDOE criterion.

Units: Turbidity—NTU; TSS—mg/L; total copper (TCu), dissolved copper (DCu), total zinc (TZn), dissolved zinc (DZn)—µg/L

11. Assess the frequency of target exceedance by running extreme meteorological event cases through SUSTAIN.

12. For any candidate biological or water quality goal not expected to be achieved, or for any candidate goal greatly exceeded but at high cost, decide if the BMP strategy and modeling should be reiterated, or if the candidate goal should be modified or discarded.

13. Finalize goals for each stream reach at the completion of model runs.

ATTACHMENT

Hydrologic Targets for Candidate Goals

Goal 1: Maintain existing mean B-IBI scores at gauge stations

Stream	Mean B-IBI	Best Est. HPC	Low Est. HPC 80% Prob.	Best Est. HPR	Low Est. HPR 80% Prob.	Notes
Crisp	24	10	6	170	110	Low B-IBI not consistent with hydrology
Newaukum	29	6	3	130	80	Some hydrology control needed
Big Soos	37	3	0	80	40	Some hydrology control needed
Covington	31	5	2	120	70	Maintenance possible with existing hydrology
Little Soos	23	10	6	160	100	Maintenance possible with existing hydrology
Jenkins	35	4	1	100	50	Some hydrology control needed
Soosette	34	4	1	100	50	Some hydrology control needed
Mill	20	12	8	210	140	Some hydrology control needed
Miller	12	20	15	310	230	Maintenance possible with existing hydrology
Des Moines	10	23	17	350	260	Already at min. B-IBI

Goal 2: Maintain existing maximum B-IBI scores at gauge stations

Stream	Max. B-IBI	Best Est. HPC	Low Est. HPC 80% Prob.	Best Est. HPR	Low Est. HPR 80% Prob.	Notes
Crisp	30	6	3	130	80	Low B-IBI not consistent with hydrology
Newaukum	38	2	0	80	40	Substantial hydrology control needed
Big Soos	46	0	0	0	0	Need return to fully forested hydrologic condition
Covington	34	4	1	100	50	Maintenance possible with existing hydrology
Little Soos	28	7	4	140	90	Maintenance possible with existing hydrology
Jenkins	40	1	0	70	0	Need return close to fully forested hyd. condition
Soosette	40	1	0	70	0	Need return close to fully forested hyd. condition
Mill	24	10	6	170	110	Some hydrology control needed
Miller	Insufficient data available					
Des Moines	Insufficient data available					

Note: Miller and Des Moines are based on one B-IBI data point and hydrology for that and preceding year; otherwise B-IBI statistics are based on the period of data availability during 2000-2010 with hydrologic calculations for that period and the preceding year.

Goal 3: Maintain existing 75th percentile B-IBI scores at gauge stations

Stream	75th Per. B-IBI	Best Est. HPC	Low Est. HPC 80% Prob.	Best Est. HPR	Low Est. HPR 80% Prob.	Notes
Crisp	26	8	5	160	100	Low B-IBI not consistent with hydrology
Newaukum	31	5	2	120	70	Maintenance possible with existing hydrology
Big Soos	38	2	0	80	40	Some hydrology control needed
Covington	32	5	2	110	60	Maintenance possible with existing hydrology
Little Soos	25	9	5	160	110	Maintenance possible with existing hydrology
Jenkins	38	2	0	80	40	Some hydrology control needed
Soosette	37	3	0	80	40	Some hydrology control needed
Mill	23	10	6	160	100	Maintenance possible with existing hydrology
Miller	Insufficient data available					
Des Moines	Insufficient data available					

	Min.	B-IBI	Best Est.	HPC	Best Est.	HPR				
Stream	B-IBI	Goal	HPC	80% Prob.	HPR	80% Prob.		Notes		
Crisp	18	35	4	1	100	50	Low B-IBI not consistent with hydrology			
Newaukum	20	35	4	1	100	50	Substantial hydrology control needed			
Big Soos	30	35	4	1	100	50	Some hydrology control needed			
Covington	24	35	4	1	100	50	Some hydrology control needed			
Little Soos	18	35	4	1	100	50	Substantial hydrology control needed			
Jenkins	26	35	4	1	100	50	Some hydrology control needed			
Soosette	28	35	4	1	100	50	Substantial hydrology control needed			
Mill	14	35	4	1	100	50	Very substantial hydrology control needed			
Miller	12	35	4	1	100	50	Very substantial hydrology control needed			
Des Moines	10	35	4	1	100	50	Very substantial hydrology control needed			
	Existing:									
	Mean	Min.	25th Per.	Mean	Min.	25th Per.	Mean	Min.	25th Per.	

Goal 5: Raise B-IBI at any gauge station with mean <35 to ≥35 associated with salmon support (Karr 2003)

				Low Est.		Low Est.		
	Mean	B-IBI	Best Est.	HPC	Best Est.	HPR		
Stream	B-IBI	Goal	HPC	80% Prob.	HPR	80% Prob.	Notes	
Crisp	24	35	4	1	100	50	Low B-IBI not consistent with hydrology	
Newaukum	29	35	4	1	100	50	Substantial hydrology control needed	
Big Soos	37	35	4	1	100	50	Maintenance possible with existing hydrology	
Covington	31	35	4	1	100	50	Some hydrology control needed	
Little Soos	23	35	4	1	100	50	Substantial hydrology control needed	
Jenkins	35	35	4	1	100	50	Maintenance possible with existing hydrology	
Soosette	34	35	4	1	100	50	Substantial hydrology control needed	
Mill	20	35	4	1	100	50	Very substantial hydrology control needed	
Miller	12	35	4	1	100	50	Very substantial hydrology control needed	
Des Moines	10	35	4	1	100	50	Very substantial hydrology control needed	

Goal 6: Raise B-IBI at all gauge stations to ≥40 associated with strong salmon support (Karr 2003)

			Low Est.		Low Est.		
	B-IBI	Best Est.	HPC	Best Est.	HPR		
Stream	Goal	HPC	80% Prob.	HPR	80% Prob.	Notes	
Crisp	40	1	0	70	0	Low B-IBI not consistent with hydrology	
Newaukum	40	1	0	70	0	Very substantial hydrology control needed	
Big Soos	40	1	0	70	0	Very substantial hydrology control needed	
Covington	40	1	0	70	0	Very substantial hydrology control needed	
Little Soos	40	1	0	70	0	Very substantial hydrology control needed	
Jenkins	40	1	0	70	0	Very substantial hydrology control needed	
Soosette	40	1	0	70	0	Very substantial hydrology control needed	
Mill	40	1	0	70	0	Heroic hydrology control needed	
Miller	40	1	0	70	0	Beyond heroic hydrology control needed	
Des Moines	40	1	0	70	0	Beyond heroic hydrology control needed	

Goal 7: Raise group 4 (B-IBI < 21) and group 3 (B-IBI =21-28) to higher group												
								Low Est.				
							Best Est.	Peak:Base				
							Peak:Base	3-4 to 1-2				
			Low Est.		Low Est.		3-4 to 1-2	or 4 to 1-3				
	B-IBI	Best Est.	HPC	Best Est.	HPR		or 4 to 1-3	80% Prob.				
Stream	Goal	HPC	80% Prob.	HPR	80% Prob.		80% Prob.	80% Conf.			Notes	
Crisp	≥ 29	6	3	130	80		5	3	Low B-IBI not consistent with hydrology			
Newaukum	Already in higher group											
Big Soos	Already in higher group											
Covington	Already in higher group											
Little Soos	≥ 29	6	3	130	80		5	3	Some hydrology control needed			
Jenkins	Already in higher group											
Soosette	Already in higher group											
Mill	≥ 29	6	3	130	80		5	3	Substantial hydrology control needed			
	≥ 21	11	7	200	140		20	7	Maintenance possible with existing hydrology			
Miller	≥ 29	6	3	130	80		5	3	Very substantial hydrology control needed			
	≥ 21	11	7	200	140		20	7	Very substantial hydrology control needed			
Des Moines	≥ 29	6	3	130	80		5	3	Very substantial hydrology control needed			
	≥ 21	11	7	200	140		20	7	Very substantial hydrology control needed			