King County Normative Flows Project
Science Review Team meeting
Saturday, May 4, 2002
Notes by Chase Barton, report compiled by Derek Booth, both of the University of Washington Center for Urban Water Resources Management

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This report summarizes the discussions and recommendations of the Science Review Team (SRT) for the meeting May 4, 2002, at the offices of King County Water and Land Resources Division. This and any subsequent documents from the SRT are intended as consensus reports of the team and represent its collective judgment and conclusions.

The discussions of the day had three major themes: team and meeting logistics, scope of the Normative Flow project, and specific issues and recommendations arising from the day's presentations and discussions. They are addressed below in turn:

- **Team and meeting logistics**

Future meetings of the SRT should be driven by the pace and need of the county's technical team; "3 meetings per year" is not necessarily "one meeting every four months." That said, a mid-summer 2002 meeting will be difficult to schedule; depending on the progress of the technical team, a working session in June or early September are the most likely options.

Derek Booth is the "coordinator" of the SRT and the liaison with King County; the other four members of the team agreed that he should also act as a full technical member of the SRT. Current budgeting for the SRT may or may not support both roles for the full 2-year period, but he agreed to participate in a substantive role for now and anticipates no problems, financial or otherwise, for at least the next 12 months and possibly for the duration of the existing contract (through December 2003).

Reports will be issued by the SRT for each meeting and/or for each major topic addressed. Individual members will be technical or "focal" leads for particular issues within their respective expertise, and each report will have an overall coordinator Derek Booth is acting in that role for this report). The reports will be jointly authored and reviewed, and they will be consensus documents. When consensus cannot be accomplished, minority reports may be appended to the main report. Individual team members are free to respond to individual inquiries or to defer them to the designated coordinator for that meeting/issue, but individual responses by team members will reflect individual opinions. Only the consensus report, or its explicit discussion/representation by the report coordinator, will be offered as the "SRT position."

Generically, future meetings should be as topical and specific as possible. The SRT will be responsible for setting the final agenda, but the need for meetings and the topics of meetings will

be established by King County. Meetings should be conducted to allow fixed times for presentations, adequate time for SRT discussion, and solicitations of follow-up questions and information to the SRT from both King County and non-King County attendees. We propose, for example, that fixed blocks of time be specified for each topic and that presentations should be limited to one-half that period, thus allowing for substantial discussion before moving to the next topic on the agenda. SRT members will only rarely interrupt presentations when critical points of clarification require such interruptions.

- **Scope of the Normative Flow project**

Discussion of the SRT on the overall scope of the project, and of the initial presentations, yielded the following comments:

  - Work on a "conceptual framework" is valuable up to a point, but it can reach a point of diminishing returns rapidly. Focus on technical issues will be more productive. Theory and prior experience can be brought to bear most productively when there is a specific empirical situation to anchor it.
  - Deterministic diagram linking "flows" to "fish" is simplistic. However, the recognition of "flow" as a critical parameter in maintaining healthy ecosystems is entirely appropriate. At the same time, analytical processes designed to diagnose and treat the major causes of river degradation should not be limited to flow considerations. As an example, channel and floodplain modification, groundwater processes, sediment dynamics, chemical factors, and others must be considered to ensure that crucial limiting factors are not overlooked with a overly narrow, exclusive focus on flow considerations.
  - The focus of project—lowland streams or mainstem rivers—was ambiguously presented. Scope *should* include mainstem rivers, regardless of jurisdictional authority. Attention to the management of large systems is critical to achieving project goals, independent of jurisdiction or whether Habitat Conservation Plans or Federal Energy Regulatory Commission agreements are already in place.
  - Focus on Endangered Species Act issues and/or "salmon" is too limited; must include broader Clean Water Act goals of ecological integrity.

- **Specific recommendations**

  - Regarding the RVA/IHA (Range of Variability Approach/Indicators of Hydrologic Alteration) approach, its conceptual framework needs to be broadened beyond a sole consideration of hydrologic alterations *per se*, although these are clearly of great importance. Because alterations in channel and floodplain morphology, vegetation, and hydrology have also occurred, restoration of "natural flows" may result in unexpected ecological responses due to human-modified sediment, hydraulic, and channel settings. Thus, the linked conceptual-analytical framework should explicitly include two levels. First, a watershed-scale focus on hydrograph generation and time-series analysis of hydrologic alteration is entirely appropriate. An approach such as IHA or a physical habitat time series analysis that includes the floodplain habitat as

well as main-channel habitat is defensible here, although much additional thought needs to be given to which specific parameters are of most direct habitat or biological relevance in King County watersheds. Second, a reach-scale focus on time-varying hydraulic characteristics that capture contemporary site-specific channel and valley (floodplain) setting is critical. Here, hydraulic modeling of channel reaches within watersheds is needed. This modeling should account for processes of floodplain storage and vertical flow exchange (i.e. hyporehic flow).

- In general, parameters that link physical conditions with biological health are missing from the existing conceptual model and likely from any operational model as well. More effort is needed to articulate hypothesized, mechanistic linkages between hydrologic and hydraulic drivers and ecological response variables, both in-channel and riparian. The SRT can offer feedback on this more detailed conceptual model. This is a critical need. Identifying a suite of ecological response variables that can serve as indicators of desired ecosystem conditions (i.e., "health") or valued performances is an immediate next step.
- Progress will be most rapid by selecting one or more location-specific case studies soon, and by recognizing that the available time in the project may be adequate for demonstrating "proof of principle" but probably *not* for "assuring results" because the time scale for some biological responses is greater than the time frame of the project. If the objective of the Normative Flow Project is to develop an analytical approach for the establishment of desirable flows in a stream, then any analytical approach should be tested on two or more specific King County streams (at least one with considerable modification and the second with little modification from 'natural') but developed to be applicable to all appropriate King County streams. The case-study approach tends to focus attention of the analytical tool developers on "real" problems and to reduce the probability of becoming too concerned with ecological theory that is of little importance to the decisions at hand. Although the objective of a case study is to test analytical approaches developed as part of the program, the study itself can become the objective—and so the primary goal lost—unless considerable vigilance is used to make sure this does not happen.

  The SRT thus believes that establishing two ~~one~~ or more useful case studies is critical, but that their definition will be challenging. The conceptual utility of any such case study is limited if the design and outcome is strongly dictated by unique intersections of geographical and historical conditions. The definition of two or more study locations is a specific task for which the team could provide guidance, particularly in conjunction with the County's broad knowledge and expertise with the local systems. Most likely, a useful set of case studies will include both an urban stream and a reach of a mainstem river, and it should include both habitat and biological response factors.

**Suggested references from SRT members:**


Baron, J.S., N.L. Poff, P.L. Angermeier, C.N. Dahm, P.H. Gleick, N.G. Hairston, Jr., R.B. Jackson, C.A. Johnston, B.D. Richter, and A.D. Steinman. Meeting ecological and societal needs for freshwater. ***Ecological Applications*** (In Press)

Booth, D. B., J. R. Karr, S. Schauman, C. P. Konrad, S. A. Morley, M. G. Larson, and S. J. Burges. ms. Urban stream rehabilitation in the Pacific Northwest. Ecological Applications, in review.

Ebersole, J.L., W.J. Liss, and C. A. Frissell. 2001. Relationship between stream temperature, thermal refugia, and rainbow trout *Oncorhynchus mykiss* abundance in arid-land streams in the northwestern United States. *Ecology of Freshwater Fish* 10:1-10.

Frissell, C.A. 1997. Ecological principles. Pages 96-115 in J.E. Williams, M.P. Dombeck, and C.A. Wood (eds.) *Watershed Restoration: Principles and Practices.* The American Fisheries Society, Bethesda, MD.

Hammer, T.R. 1972. Stream Channel Enlargement Due to Urbanization. Water Resources Research. Vol. 8, December 1972. pp 1530 – 1540.

Karr, J. R. and E. M. Rossano. 2001. Applying public health lessons to protect river health. *Ecology and Civil Engineering* 4: 3-18.

Karr, J. R. and E. W. Chu. 2000. Sustaining living rivers. *Hydrobiologia* 422/423: 1-14.

Morley, S. A. and J. R. Karr. 2002. Assessing and restoring the health of urban streams in the Puget Sound Basin. *Conservation Biology*, in press.

Naiman, R. and R. Bilby. (editors) 1998. River Ecology and Management: Lessons from the Pacific Coastal Ecosystem. Springer.

Olden, J.D., and N.L. Poff. 2002. Redundancy and the choice of hydrologic indices for characterizing streamflow regimes. ***River Research and Applications*** (In Press) *[NOTE: This paper has MANY relevant references: a pdf version of this MS is available from LeRoy Poff upon request]*

Poff, NL, Allan, JD, Bain, MB, Karr, JR, Prestegaard, KL, Richter, BD, Sparks, RE, Stromberg, JC. 1997. The natural flow regime: a paradigm for river conservation and restoration. BioScience 47: 769-784.

Poole, G. C. , J. A. Stanford, S. W. Running, and C. A. Frissell. In review. Morphologic Determinants of Floodplain Hydrogeology: 2) Local Dynamics, Preferential Flow, and River Regulation. Submitted to *Ecological Applications.* Available as a chapter in: Poole, G.C. 2001. Analysis and Dynamic Simulation of Morphologic Controls on Surface- and Ground-water Flux in a Large Alluvial Flood Plain. Ph.D. Dissertation. School of Forestry. The University of Montana, Missoula. 154 pp. Full dissertation posted at: <http://www.eco-metrics.com/BasePages/Publications/Poole2000.pdf>

Poole, G. C. and C. H. Berman. An ecological perspective on in-stream temperature: natural heat dynamics and mechanisms of human-caused thermal degradation. *Environmental Management* 27: 787-802. 2001.

Richter BD, Baumgartner JV, Braun DP, Powell J. 1998. A spatial assessment of hydrologic alteration within a river network. *Regulated Rivers: Research and Management* **14:** 329-340.

Richter BD, Baumgartner JV, Powell J, Braun DP. 1996. A method for assessing hydrologic alteration within ecosystems. *Conservation Biology* **10:** 1163-1174.

Stanford JA, Ward JV, Liss WJ, Frissell CA, Williams RN, Lichatowich JA, Coutant CC. 1996. A general protocol for restoration of regulated rivers. Regulated Rivers: Research and Management 12: 391-413.

Toth, L. A. 1993. The ecological basis of the Kissimmee River restoration plan. Florida Scientist 56:25-51.

Toth, L. A. et al. 1995. Conceptual evaluation of factors affecting restoration of habitat structure within the channelized Kissimmee River ecosystem. Restoration Ecology 3: 160-180.

Williams, J. E., C. A. Wood., and M. P. Dombeck. (editors) 1997. Watershed Restoration: Principles and Practice. American Fisheries Society, Washington, DC.