10-23-2015

Practitioner Interview

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Notes from interview with Ron Anderson (Oct. 23, 2015)

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As part of an effort to better understand how water resources systems knowledge is used in practice and how to improve water resources systems curricula, Ron Anderson, chief engineer at Lower Colorado River Authority, was interviewed by Paul Block and Ali Mirchi on October 23rd, 2015. The interview started at 2:00 PM EDT and took about an hour.

BACKGROUND QUESTIONS

1. **What is your current job title?**
   Chief Engineer at Lower Colorado River Authority

2. **For how many years have you worked in your job?**
   5 years in this position; 15 years for LCRA; 30 years in field

3. **What formal training have you had in systems analysis?**
   Civil engineering undergrad with an emphasis on water resources; Grad school in civil engineering and mechanical engineering; classical operations research approach under Dr. Paul A. Jensen; then went to MBA school and studied linear programming, etc.

4. **If your professional activities have included systems analysis, for how many years have you performed these activities?**
   The use of systems approach is usually it is fairly mandated; we think of river systems holistically, hydrological cycle is a system; for permitting, environmental impacts are studied as a system; system perspective is pretty common in the planning side of things; I am not in the daily operations side of LCRA; they may have specific aspects of gate operations and maybe more narrowly focused.

QUESTIONS ABOUT USE OF SYSTEMS ANALYSIS ON THE JOB

5. **Describe your job. What is/are your roles/activities in your job?**
   I evaluate the reliability of current supply; project availability of short- and long-term supply; seek out and evaluate new sources of supply; have eyes and ears on technology development especially from academic world to serve customers.

6. **What work projects have used systems analysis techniques to identify/evaluate/select a design or decision alternative?**

   Two come to mind:

   1. LCRA's SAWS project, which was an 8-year long study; the question was can we have sufficient water in the basin to meet the demands of the city of San Antonio and meet environmental requirements like water quality problems; it was a multi-disciplinary project with studies of in-stream flow, climate change, agricultural activities, reservoir construction, estuary; each component of the study would get updated with the results of

the other analysis components; quite rigorous program overseen by a science review panel who imparted a lot of systems analysis techniques like sensitivity analysis to examine what kinds of failures could happen that might have been overlooked; the sensitivity analysis was new to many participants involved in the study; "people had to be taught and required"; (All of this was for San Antonio Water Project which was eventually not constructed);

2. LCRA- Add 100,000 AF of firm storage; 3 years ago we started looking into adding 100,000 AF of water supply storage; evaluated many different supply alternatives on feasibility and cost alternatives; selected a suite of alternatives to reach goal; ended up with a mix of projects (90,000 AF of surface water storage and10,000 AF of groundwater); optimization was done to see how to affordably bring on sources within 5 years; optimization boiled down to what can happen within this time-frame; sources were readily available GW and very clean reservoir; looked at combination of reservoirs; one large reservoir was found more cost-effective than multiple small ones; then the analysis focused on specific sites, this project was built; GW wells were installed and operation is expected by 2018.

7. **What systems analysis techniques, software, and/or tools were used?**
   1. Academic review panel – very systems oriented. Software was used.
   2. CH2 developed a model (meta-model) for the design of pump station. The meta-model took LCRA RiverWare outputs to determine design flows for reservoir system and pump station. Meta-model was ANN linked with optimization.

8. **Have any projects coupled optimization algorithms with external simulation models, simulated system equations within the optimization framework, or used an optimization algorithm available within a simulation model? If yes, what kinds of simplifications were required in the solution approach?**

   We simplify things all the time – otherwise would never a finish a design. Full robust approach doesn't always add significant value; the preferred way for reservoir project was to develop stochastic model but for ease of use and explanation we simplified the modeling to a nonparametric approach more accessible to the public; for ease of explanation, sometimes it's worth simplifying. So there's a trade-off between understandability and rigor; now that the model is accepted maybe we can go back and do a parametric model; we also developed an optimization model for sizing reservoirs for agricultural water use; the problem was non-linear and too complex for excel to do the job; we ended up buying a high-end tool to solve it; Cost was justified for in time savings.; even with the work today we can use dynamical models and that's a specialty we don't currently have and so we are using statistical models. These are good enough. So, we simplify based on problem complexity and expertise of personnel.

9. **What uncertainty analyses have been used to evaluate designs or decision alternatives? If yes, what assumptions were required? What difficulties (if any) were there in communicating results of the uncertainty analysis to decision-makers?**
   As the chief engineer I am the enforcer of inclusion and communication of uncertainty; it tends to be overlooked routinely by practitioner; and it's my job as a quality control; example is a gain-loss study of the river where uncertainly wasn't analyzed; all the analyses were done using measured values of gains and loss, measurement methods have accuracy problems; an example where uncertainty analysis was done was a study by TX water development board; project focused on evaporation and surface tension. Published a range of possible evaporation rates. Validated that method tested was effective; the range was 0-24% evaporation with expected value of 10-12 %; because 0 was included, there was some ridicule and people exploited the range; communication staff don't like uncertainty, it "can confuse the reader."

10. **Have projects applied multi-objective decision methods to select a final design or decision alternative? If yes, how was a preferred alternative selected from a set of tradeoffs?**
    Development of new 100,000AF source is an example. Fixed amount of water, fixed time-frame, limited amount of money; for example, there limited time to acquire a site, so willing sellers were a priority and the site was clean of environmental issues. Choices were limited relatively quickly.

USE OF SYSTEMS ANALYSIS IN THE PROFESSION

11. **What role should systems analysis play in professional practice? How can the profession more effectively use systems analysis in the future?**

    a. What encourages or limits the use of systems analysis in the water resources engineering profession?

    In locations or organization that are "data rich," systems analysis is pretty well facilitated, in "data poor" cases there's just not enough to work with; at LCRA we have a large monitoring network (Hydromet) which shows the state of the system or environment and allows for such analysis, it's a huge investment; It's the same with south Florida; others may be more resource limited, so little data is collected there and the approaches are more ad hoc and systems analysis is a bit of luxury; Similarly, less of this is applied in developing countries.

12. **What systems analysis skills and techniques should universities teach to prepare new practitioners to successfully join the profession?**

    Observed that students with more traditional or practical educational experiences (than Ron) could contribute at the entry level better (e.g. pump design). But as career

progressed, he was able to advance with systems type thinking. Like the difference between undergrad and graduate education.

New grads have a lot of great skills (stats, modeling) that are not in the professional work force. Good opportunity for continuing education for these skills/tool, especially for older engineers.

REFERRAL

13. **Can you recommend a colleague we should also interview? What is their contact info? Would you be willing to put us in contact with them?**

Tarrant County Regional Water District (Ft. Worth)