Kunkle, S. (2001). Water Quality Monitoring Trip Notes: 31 p. + 46 p. of literature citations

*Abstract:* Contains three trip memos authored by Sam Kunkle (Watershed Specialist and Affiliate, Dept of Earth Resources, CSU) during water quality information-gathering trips in 2001. The first memo is dated July 1, 2001 and contains his notes about his June 17-22 2001 visits to ZION, PISP, CEBR, BRCA, CARE and other agency offices. The second memo is dated July 18, 2001 and contains his notes about visits to COLM, TICA, and several other agency offices. The third memo is dated August 22, 2001, and contains his notes from trips to CURE, BLCA, and the SEUG during August 5-10, 2001. Kunkle was interviewing water resource specialists and managers at the various parks, and collecting water resource maps, papers, literature, GIS data, project proposals, and management concerns and issues. His memos contain detailed notes about his meetings and the information he had gathered. The project he was involved with included summarizing water quality issues and monitoring needs for Northern Colorado Plateau Network (NCPN) parks, and developing monitoring plans and methods for these parks. Attached is a 46 page list of water resources literature citations, arranged by park unit and interspersed with Kunkle's comments and notes.

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# TRIP MEMO 3

August 22, 2001

To: Lee MacDonald, Melinda Laituri, Freeman Smith, John Stednick, Dept of Earth Resources, CSU, Pete Penoyer, NPS-WRD

cc: Angie Evenden, I&M
cc: Bill Jackson, WRD
cc: Dave Vana-Miller/Mark Flora, WRD
cc: Bruce Rodgers/Charlie Schelz/Gery Wakefield, SEUG
cc: Ken Stahlnecker/Matt Malick, BLCA/CURE
cc: Margaret Beer/Jessica Walker, I&M
cc: Dave Sharrow, ZION
cc: Dean Tucker, NPS-WRD
cc: Gary Rosenlieb, NPS-WRD
cc: Barry Long, NPS-WRD
cc: Rick Inglis, NPS-WRD
cc: Roy Irwin, NPS-WRD

From: Sam Kunkle, Watershed Specialist and Affiliate, Dept of Earth Resources, CSU

Subject: Information gathering trip to Curecanti NRA, Black Canyon NP, and the SE Utah Group, Aug 5-10, 2001.

**Hello CSU team:** Below are summary notes on my recent information-gathering trip to BLCA/CURE, the SEUG, and nearby agencies regarding water quality (WQ) monitoring. When I see all of you next week, I'll bring along copies of the reference materials and maps that I mention and add them to our files. This wraps up my visits to the Northern Colorado Plateau Network parks (except for the three, DINO, FOBU, and GOSP that you plan to visit).

Secondly, attached are bibliographic lists for CURE and CANY parks from Margaret Beer, to which I have appended some new entries that I found in the parks (I also photocopied parts of some reports for our files too). Finally, attached is my updated "working rolodex" of contacts.

**Melinda:** As discussed, I'll stop by your office (Wed. 29th, 9 am), since I need to copy some pages from your questionnaire set plus borrow the boxes of files and maps that I left with you. [I am preparing a working table re: monitoring for our discussion/use].

**Ken, Matt, Charlie, or others visited:** If you'd like to add any comments, corrections, or additions to my notes here, just email me your remarks. Thanks!

## 1. SOME HIGHLIGHTS: VISIT TO CURECANTI NRA/BLACK CANYON NP.

Primarily I visited with Ken Stahlnecker, BLCA/CURE Chief of Resources; Matt Malick, Biologist (principal person on water resource projects); and Jodey Kougioulis, Hydrologic Tech, at the park. I also visited with Lynn Cudlip in Gunnison, local biologist, private consultant, ex-NPS, and principal author of the park's Water Resources Mgmt Plan.

*1.1. GENERAL POINTS AND WQ ISSUES, BLCA/CURE*

- WATER STAFFING AT BLCA/CURE. For water resource work, both parks are covered by the staff located at CURE. Matt Malick, Biologist, spends near full time on the water program, with assistance of a Biotech (Jodey Kougioulis). CURE of course has a river, streams, and reservoirs, so the water resource work load is large. BLCA previously had a person devoted to water rights (Mark Wonzell, now in NPS-WRD); they still plan to fill the old Wonzell post.

- SAMPLING AND MONITORING: BLCA/CANY's monitoring program --which apparently functions very well-- goes back about two decades (see bullets below on this).

- ONRW: CURE will seek Outstanding Natural Resource Waters (ONRW)classification (anti-degradation designation) for selected tributaries in the park. The park needs credible WQ data to characterize "pristine" streams. Since 2000 the park has worked with the USGS National Water Quality Lab in Denver to collect data suitable for the ONRW application. As part of the package, the USGS District Office (Norm Spahr et al) is on tap for sampling questions. CURE also had contact with Roy Irwin, NPS-WRD regarding analyses.

- "RE-CLASSIFICATION" OF WATERS. CURE wants the State to re-classify certain streams from Aquatic Life 2, Recreation 2, Use Protected (based on no data) to the higher level Aquatic Life Cold 1 class, to be based on the high quality data that the park is collecting. [Mark Wonzell, at NPS-WRD in Fort Collins, previously BLCA, has advised the park that they may want to wait on re-classification at some BLCA sites, pending clarification of water rights issues there].

- USGS-NAWQA: The US Geological Survey is active in the area (out of the District Office, Denver; National Lab, Denver; and Grand Junction offices). The USGS has run a National Water Quality Assessment (NAWQA). They collected ten water quality samples above CURE (Gunnison River at Cty Rd 32) and 11 below (Gunnison R below Gunnison Tunnel), in 1995. The analyses included nutrients, major cations, anions, metals, organic carbons, suspended sediment, and field parameters. A summary of this NAWQA work appears in Long et al, 1996. Also, USGS samples were gathered in 1997-98 at these two sites, as summarized in Spahr et al, 2000. [I photocopied excerpts of these references in my box of items for our files). Spahr is at the USGS District Office in Denver at 303 236-2101.

- GIS DATA ON CD: I am bringing Melinda a CD from Malick, with ArcView shp files and other data from the park, plus hydrographic features (about 250 MB of files).

*1.2. THE PARK'S WATER SAMPLING AND ANALYSIS*

- PARK SAMPLING SITES: BLCA/CURE operates a WQ monitoring program to provide baseline information and to track threats to the reservoirs from grazing, mining,

recreation activities, or other land or resource activities. They sample about 21 stream and reservoir sites every other month, collecting 3 bottles at each site, filtering some, with one bottle acidified for metals. They use a "Hydrolab" on-site to measure pH, SpC, DO, and temperature. Flow is measured at some natural cross-sections, and they maintain some gaging stations. At selected reservoir sites they take Secchi dish readings. The park's available staff for water resource work can sample about 3 sites during a day (with travel, sampling, on-site measurements, splitting, in-house analyses of E. coli and chlorophyll, preparation, shipping, etc). About once per year they sample aquatic macroinvertebrates (the macroinvertebrate procedure is detailed in the park's "Protocols for long term monitoring of water quality" (1997) --copy made for our files). [Malick has done some of the macroinvertebrate analyses himself, and contracted out others].

- PROTOCOL BOOK. Until about a half year ago, CURE followed their "Protocols for Long Term Monitoring of Water Quality: BLCA and CURE" by Malick and Cudlip, 1997 (I have a copy in my box of references for CSU). Now the park follows the USGS procedures for most of their work (described in the next bullet). The park's 1997 Protocol contains some historically interesting tables, showing water quality sampling sites in the park during the 1982-85, 1987-92, 1993-94, and 1995-present periods.

- USGS CLEAN PROTOCOLS: CURE's pristine water sampling (also described in proposals below) requires "clean sampling" with rubber gloves, sample splitting, and other precautions specified in the USGS National Field Manual for Collection of WQ Data, Sept 1999, (http://water.usgs.gov.owq/Fieldmanual/). This is now CURE's protocol.

- RECENT SAMPLING EXPENSES: Malick notes that WQ expenses have grown this year since: (1) the local "CSU Mountain Meadows Research Institute" no longer analyzes samples, and they had worked at reasonable expense; (2) the park is working with the USGS, which is much more expensive; and (3) the park is seeking lower detection limits and defensible QA/QC because of their planned ONRW application, and low-level analyses are more expensive. Therefore, WQ analysis costs have increased. [This year, Inventory and Monitoring, Moab contributed some extra funds to the park to help cover the new expenses. The USGS tells me they also contributed a bit of discretionary funds for some of the CURE work (per. comm., Von Guerard)].

- USGS CHEMICAL ANALYSIS COSTS: Low level analyses at the USGS in Denver run about $190 per bottle, to analyze for ammonia, nitrate+nitrite, nitrite, Cd, Cu, Pb, Mn, Se, Ag, Zn, Ca, Mg, total P, TKN. Additional costs to the park include the Hydrolab, bottles, "splitter" devices, rubber gloves, plus costs of the in-park analyses (E. coli and chlorophyll).

- DATA BASES AND INTERPRETATIONS: The CURE Water Resources Management Plan by Cudlip et al (1996) and the WQ data report by Long et al (1995) provide good summaries and interpretations of the WQ data at CURE up through about 1995. The "Horizon" report of Dean Tucker et al, NPS-WRD, summarizes the park's water quality data base. At this time, the park understands that the USGS analyses for CURE/BLCA should go into the USGS National Water Information System (and presumably into STORET from the USGS?). The park also has an in-house data base. They do not enter data into STORET at this time at the park level (lacking the staff for that task).

### *1.3. COOPERATION AND OTHER AGENCIES*

- USGS ROLE VS SMALLER STATE ROLE: The BLCA/CURE area is the "reverse" of the SEUG. Namely, at BLCA/CURE, the State plays a minor or little role in WQ monitoring and the USGS is a key player in WQ. Meanwhile at SEUG, the reverse holds true, that is, the State DEQ is the main WQ entity while the USGS's role is minor.

- USGS: Main contacts for the US Geological Survey include Bob Boulger (Hydrologist) and Paul Von Guerard (Sub-District Chief) in Grand Junction and Norm Spahr (Hydrologist handling analyses and monitoring) in Denver. (I haven't talked with Boulger yet, but did compare notes with the other two). Von Guerard also has worked with Gary Rosenlieb and Barry Long on the Park Service-USGS Partnership program (e.g., the work this past spring at COLM by Dave Butler, who is in Von Guerard's shop).

- USGS REPORTS IN THE WORKS: Norm Spahr, USGS Denver, and Paul Von Guerard, USGS Grand Junction told me that the USGS is to produce a "nutrient loading" report for the CURE area, reportedly to be a 30-year summary (Nancy Bauch, main author). Spahr also is to coordinate a report on "retrospective analysis of the Upper Gunnison's long-term WQ data." A third report apparently will be on "pH trends in the Yampa River." These 3 reports are due to be out this fall or early winter according to Von Guerard.

- STATE'S REPORTEDLY ISSUE-DRIVEN APPROACH: Both Matt Malick and Lynn Cudlip describe the State has having no monitoring network in the CURE area per se. They describe the State role in WQ as issue driven, tackling specific problems as they arise. Also, apparently the State of Colorado does not consider monthly sampling necessary, as does Utah. (I still need to check on this with the State; John Almy, FS in Delta recommended I contact Dan Beley (303) 692-3606).

- PREVIOUS CSU HELP AT CURE: Note that the local Colorado State University "Mountain Meadows Research Institute" previously had helped CURE with WQ analyses. However, the person doing the analysis (Ann Gary) retired, so this lab option closed. The Institute normally focuses on pastures and grazing, so WQ work is outside their area of interest.

- FOREST SERVICE: As noted in my last trip report and visit with the Forest Service in Delta, the FS around the CURE/BLCA area has no routine chemical or biological routine monitoring (budget belt-tightening eliminated the earlier routine monitoring). Past work in sediment also generally is discontinued at this time. The State has been "after the Forest Service" to collect credible data on streams suspected as polluted and eligible for 303(d) listing (mainly from abandoned mine impacts). This would relate to metals and sediment impacts on aquatic life in streams and rivers. State monitoring work around the three Forests is tied to State 303(d) listing of waters near abandoned mines.

- BLM: I talked with Dennis Murphy of BLM in Montrose (970) 240-5342, a principal BLM person with water quality involvement in western Colorado. Dennis has had about 20 years of involvement in the BLCA/CURE area and has collected samples for fecal coliforms, macroinvertebrates, metals etc, but basically in the past.

- EPA: As with other parks I have visited in the network, BLCA/CURE has no working relations or routine contact with the U.S. Environmental Protection Agency.

- LYNN CUDLIP: Lynn has been a key water person in the area and SE Utah since the late 80s, writing many documents, including the CURE and SEUG Water Resources Mgt Plans (on CURE, she's principal author, with Matt Malick, CURE; Mark Wondzell, WRD-NPS; and Bill Jackson WRD-NPS). She provided me overviews of local expertise and activities, and summarized the main issues in the area in her experience, including: possible spills by reservoir, second homes/septic tank installations, sediment from roads/construction, other growth (e.g., in Crested Butte).

- UPPER GUNNISON WATER CONSERVATION DISTRICT: Lynn Cudlip pointed out that the District is working on an Upper Gunnison Basin Water Plan, with the State. She suggested they can provide an insight into issues. [Sam, follow-up, I need to talk with Tyler Martineau, a coordinator for the District, in Crested Butte (349-1979), Kathleen (Klein) Curry, Mgr of the District (641-6065), or John Hess, District Board person (349-5338)].

- WATER QUALITY FORUM: A "Water Quality Forum" group is headed by Paul Von Guerard, USGS, Grand Junction and Mike Baker and Steve McCall of the US BuRec [mbaker@uc.usbr.gov, (970) 248-0637].

*1.4. "PROJECT PROPOSALS"*

CURE provided me copies of five proposals ("project statements" or "detail sheets") related to water quality, most developed closely with the park's USGS colleagues in Denver or Grand Junction --in some cases intended to have a USGS lead-- to be considered for cooperative funding. They are abstracted in the following bullets.

- #1.a. "Data collection and analysis of required water quality parameters; outstanding waters designation" The problem: NPS needs to collect samples on pristine streams for data to apply for "Outstanding Waters." The proposal: Submit water-quality samples to the USGS using special clean procedures and laboratory analysis and QA/QC techniques suitable to characterize "Outstanding (pristine) Waters." (#1b effort below is already underway, but no continued funding is available).

- #1b. "Quality assurance and publication of water-quality data collected from streams, rivers, and reservoirs." The problem: As described in #1a above, a need for NPS to collect samples with clean field protocols for analysis at low detection limit analysis by an unbiased laboratory (USGS in Denver). The proposal: Gather data to characterize "Outstanding (pristine) Waters." This proposal #1b, underway, basically kicks off the larger effort on "Outstanding Waters" described in #1a, above (no new funding is available for this at this time).

- #2. "Upper Gunnison River water-quality assessment." The problem: A need to compile and evaluate all the water quality information available to determine the need for further monitoring, and to design and coordinate the monitoring. The proposal: The USGS, in conjunction with NPS and others, proposes to summarize and interpret all available WQ information, then develop a comprehensive monitoring program with data base for everyone's use. [Sam note: This sounds like an opportunity for BLCA/CURE cooperation with the USGS. The effort would be large and comprehensive, so I assume the main financing of $222,000 would have to depend on the USGS. Apparently unfunded at this time].

- #3. "Dispersion and travel time of major stream inputs to CURE." The problem: With a major highway adjacent to the reservoirs, truck contaminant spills have occurred and will continue to pose a risk --possibly also for hazardous materials. Managers need to understand travel time and dispersion rates for spills, in order to track and deal with such problems. The proposal: The USGS proposes to work with the NPS on research to determine travel time and dispersion for major tributaries at CURE and develop methods to predict peak concentrations of spill materials. Budget proposed: $226,300. (Apparently unfunded at this time).

- # 4. "Occurrence and toxicity of polycyclic aromatic hydrocarbons from motorized watercraft to aquatic life." The problem: Motorized watercraft (especially "personal watercraft," PWC) contribute polycyclic aromatic hydrocarbons (PAHs) to reservoir water, with potential toxic effects on aquatic organisms, including the valuable salmonid fishery. The proposal: CURE proposes to evaluate and quantify the potential effects and concentrations of PAH compounds in the reservoir system. The information is essential background for any NPS policy decisions regarding watercraft use on Blue Mesa reservoir. CURE would need to determine levels and sources of PAHs and evaluate effects of the PAHs, with toxicity tests. Determine as far as possible the personal watercraft contribution to the contamination. In cooperation with USGS, some $163,000 of effort is proposed, beginning in 2002. Some people involved: Matt Malick, CURE; Paul Von Guerard, Subdistrict Chief USGS, Grand Junction; Mark VanMouweric, contaminants specialist, CSU research associate for NPS, Fort Collins). (?presumably unfunded).

## 2.. HIGHLIGHTS OF VISIT TO seug OF PARKS

Principal persons met at SE Utah Group of parks and the Inventory and Monitoring office in Moab were: Bruce Rodgers, Chief Resource Mgmt; Charlie Schelz, Biologist (and water program leader); Mary Moran, Biological Tech; Margaret Beer, I&M (data); Jessica Walker (I&M GIS); Gery Wakefield (SEUG GIS). I also stopped by briefly at Hovenweep where Jim Estes, acting ranger, took me to see one of the springs.

I also met with the Forest Service (Katherine Foster), BLM (Ann Marie Aubry), and USGS (Rod Tibbets) while in Moab. [Angie Evenden was not in town].

### *2.1. GENERAL POINTS AND WQ ISSUES, SEUG*

- WATER RESOURCES MGMT PLAN: The 1999 report by Lynn Cudlip (Gunnison consultant), Keven Berghoff (now Weather Service, Portland), and Dave Vana-Miller (WRD-NPS) for Arches National Park and Canyonlands National Park is an excellent summary of water resource issues and water program goals. The report lists conditions of the surface waters and water quality and presents details on each of 11 issues related to water --including mining impacts, water quality problems at springs, and other topics (copy at WRD, Fort Collins). These three people are available for questions, so contacts for our follow-up on ideas. Other important reports are listed in the bibliography, attached separately.

- ISSUES IN GENERAL: As described in Cudlip et al. (1999) WQ issues include: 1. impacts on most springs by visitors and cattle; 2. in some areas, possible landfill effects on WQ; off-road vehicle impacts on certain streams' WQ (sediment mainly); 3. effects of old mines (mainly decommissioned uranium, copper and potash mines) that yield

ammonia, metals, radioactive materials, and salinity; 4. impacts of present mines and oil/gas wells, with yields of salts or other contaminants. [NPS-WRD has been involved in some of the mine issues in the park area, including Roy Irwin, NPS-WRD, reportedly involved].

- VISITATION: Most interviewees pointed out concern over growing visitation in the area, including camping and other recreational activities, plus second homes in the area --all posing risk of contamination from human wastes, trampling, erosion, sedimentation, and other effects.

- SPRINGS AND GROUND WATER: Only indirectly related to our interests, at Arches, NPR-WRD has been involved in issues of possible spring flow depletion, due to ground-water withdrawals in the area (Jim Harte and Rick Inglis of WRD apparently have played a role in this issue).

## 2.2. *PARK WATER SAMPLING AND ANALYSIS*

- WATER STAFFING AND HELP: Charlie Schelz is the principal person for I&M work for SEUG, water being one part of I&M. He dedicates about 15-20% of his time to the water resource work. Mary Moran, his Biotech, can focus about 30-40% of her time on water. Charlie has support available from other SEUG or I&M people in the building, for example, on GIS maps (e.g., J. Walker, I&M and G. Wakefield, SEUG, who work closely together) or data base development (M. Beer, I&M). Seasonals help on some field aspects. In all, it appears to be a very well-run water resource program.

- SAMPLING SITES/FREQUENCY: Charlie Schelz, SEUG Biologist, has necessarily cut back his sampling site numbers now that Utah DEQ wants monthly sampling of a site (i.e., at least ~10 samples/year/site), at washes, springs, canyons, and rivers. So SEUG now samples 8-9 sites/year, hitting the sites monthly, rotating the sampling sites on a 3-year basis (sampling 1/3 of his ~27 sites each year). The 21 "long-term monitoring" water sites appear on the "Water Sampling Sites" sheet copied for CSU use (ARCH = 6; CANY = 9; NABR = 3; HOVE = 3). [I have just emailed you shape files of all the WQ sites, from SEUG].

- EARLY 80s TO PRESENT SAMPLING SITES: In addition to the current "Water Sampling Sites" sheet, water sampling sites used from 1983-1997 are shown in two tables in the "Water quality inventory and monitoring annual report" (unpublished draft) from Aug 1997 (16 pp --copy made for CSU use). The sites used over the years have been: ARCH = 9 sites; NABR = 5; CANY = the largest number at about 36 sites; HOVE = 3 sites. As described in the preceding bullet, only selected sites are used, and then rotated.

- PARAMETERS: I copied several items for our CSU use that show SEUG WQ parameters sampled or analyzed. The field measurements are temperature, pH, DO, Spc (on the Hydrolab). They gather three samples for DEQ for a). chemicals, b). nutrients, c). metals. Fecal coliforms are gathered and analyzed in house. Procedures for collecting the macroinvertebrates appear in their "WQ inventory and monitoring (draft) annual report" by Schelz & Whitham, 1997 (copy made for us). Charlie Schelz would like to prepare such a summary report each year, using the 1997 draft model. The Utah DEQ lab analyzes the samples sent to them for: sediment, ammonia, Ba, Ca, Cu, Pb, Mn, Se, Na, bicarbonate, carbonate, OH, total P, hardness, SpC, Al, Hg, TKN, As, Cd, Cr, Fe, Mg, K, Ag, Zn, $CO_2$, Cl, $SO_4$, alkalinity, turbidity, TDS, nitrate+nitrite, and $CO_3$ solids

- MONITORING FUNDING: A small amount of park base funding supports the WQ monitoring, to cover bottles/field supplies, macroinvertebrate analyses, and upkeep of the Hydrolab. Then State of Utah DEQ provides the basic chemical analyses gratis at this time --which naturally is valuable to the park (the DEQ needs stream and river samples for their 303(d) work but has accepted some spring samples; pers. comm., Hultquist). Special request for some SEUG funds apparently were necessary to purchase the Hydrolab (~$3-4K). So in all, the WQ program depends on a relatively limited budget and the staffing described above.

- WQ SAMPLES HOVE: The springs at Hovenweep seep out of a Dakota Sandstone layer at the base of cliffs at the head of arroyos in the park. SEUG takes samples from Cajon, Hackberry, Cutthroat, and Square Tower springs (4 samples per year).

- SPECIAL STUDY, SALT CREEK. Charlie Schelz et al at SEUG recently (Feb, 2001) produced an interesting, apparently well-done report entitled "Long-term riparian monitoring, Salt Creek, Needles District" (136 pp, draft, reviewed by NPS-WRD). The study evaluated the effects of a 4-wheel-drive road along the channel of Salt Creek, "the most important riparian area" at CANY. The creek was evaluated for proper functioning condition, erosion, vegetation, and birds, but also monitored for water quality (using macroinvertebrates and the Utah DEQ chemistry parameters described in the "parameters" bullet above). The study illustrates how "water quality monitoring" may need to include some special studies as well (?).

*2.3. COOPERATION, OTHER ORGANIZATIONS, OTHER AGENCIES (plus some notes on follow up I need to do)*

- COOPERATION WITH DEQ ON THE SAMPLING: Parks (or BLM, or FS) can enter into cooperative work with DEQ and in cases DEQ provides free analyses (where the samples complement their ongoing 303(d) observations or other necessary work, pers. comm. T. Toole & A. Hultquist). The BLM and FS people I have met indicated DEQ can be flexible. DEQ's real interest is in continued monitoring of streams. DEQ must have at least 10 samples yearly from a site, preferably monthly, and ideally twice per month in the spring runoff time (with normally no sample in December). DEQ provides sampling/sample handling training for all cooperators (a few times a year).

- BLM MOAB OFFICE: I visited with Ann Marie Aubry, BLM Hydrologist. She described BLM's WQ work in the area, including sites by the Newspaper Rock area, on North Cottonwood Cr, and Indian Cr (marked on the maps I collected for CSU use). Most of the BLM WQ sites are near CANY. Ann Marie samples 11 sites per year, but now she will have to shift to a three-year rotating schedule of perhaps 4 sites/year (as SEUG is doing) to be able to meet Utah DEQ's new demand for monthly sampling. She notes that the State DEQ is still loading the year 2000 data into STORET, so there is a lag of perhaps a year for the DEQ data to reach STORET (handled by Arne Hultquist, DEQ). DEQ analyzes for the same parameters as described above for SEUG's samples. She collects 10 macroinvertebrate samples/year, which go to the BLM/U of UT lab in Logan (Mark Vinson). Other BLM offices around the state also work with Utah DEQ on samples. Ann Marie trades data and ideas with her Forest Service counterpart in the area, Katherine Foster.

- USGS MOAB OFFICE: I visited with Rod Tibbets, Supervisory Hydrologic Tech with USGS in Moab. He lamented that the 1972-2000 National Stream Quality Accounting Network (NASQAN) program (http://water.usgs.gov/nasquan) had been suspended, and expects a lapse of 3-4 years before NASQAN returns to activity in the general area. Sediment work also has been cut at this time. Specific conductance and temperature are still monitored on the Green and San Juan Rivers, and 9 samples per year are analyzed for major ions (at the Denver lab). These sites appear in the USGS's annual release "Water Resources Data, Utah, Water Year 2000" (380 pp) (Rod gave us a copy of the 1999 and 2000 books). Rod notes that the USGS has little cooperation with the State or the US EPA. He summarized the main WQ issues, from his perspective as: salinity, selenium, oil (potentially), coal (also only potentially), abandoned uranium mines from the 1950-80 vintage, and tourism/second homes (probably the big concern being this latter point). He has no cooperative work with the US Forest Service at this time.

- FOREST SERVICE, MOAB: I met with Katherine Foster, Forest Hydrologist, Manti La Sal NF (has a district office in Moab; her regular office is in Price). Katherine mostly is doing cooperative WQ sampling with the Utah DEQ (7-10 samples per year) for chemicals and with the Logan lab for macroinvertebrates (i.e., the same DEQ parameters as described above for SEUG). She has sampling sites on Beaver Cr, La Sal Cr, and Indian Cr adjacent to CANY, so relevant, as are the BLM sites of Ann Marie Aubry (map I have shows the sites). She is "maxed out" on sampling at this level. Like BLM, she also described Utah DEQ as flexible in allowing sampling sites to be selected. The Forest has some concerns about abandoned (uranium) mines, but has no significant project of reclamation (as we saw is the case in the Uinta NF, above Timpanogos Cave). She noted that Mark Vinson, the "bug lab" in Logan provides all types of indices and spp lists in his reports. Katherine uses a Hydrolab for temp, DO, pH, and SpC. She has no lab. She views WQ issues as spills, salinity, ATVs, second-home developments, and uncontrolled camping (logging is normally controlled, so not such a WQ issue in her impression). The second homes growth impacts springs significantly.

- UTAH STATE U "BUG LAB:" Mark Vinson at the U of UT/BLM macroinvertebrate lab analyses macroinvertebrate samples, working for the State, BLM (Grand Staircase), Forest Service and others (not NPS). He told me that he charges about $150 per sample (?not sure how this compares to other institutes or individuals for cost at this time).

- (Sam): I will contact Robert Hart 520 556-7137 with the USGS in Flagstaff, who until a short time ago coordinated the Colorado Basin investigative work for USGS (according to the USGS in Moab he reportedly is an expert on the issues of the basin).

- Sam: I will contact State of Colorado water quality specialist Dan Beley (303) 692-3606 or others with the State.

- Sam: Some Forest Service follow up. 1. Talk with Louise O'Deen at the Forest Service Rocky Mt Forest & Range Exp Station in Ft Collins re: any possible analysis cooperation, costs, or other details.

- Sam: Follow up with Dave Butler, USGS, at Grand Junction again. See how his 2001 spring work at COLM might be relevant to the springs in the SEUG. Note, Butler is the

only USGS person inside the Northern Colorado Plateau network active in park WQ work emphasizing springs (he is in Von Guerard's shop).

- Sam: At some point we need to talk further with the Utah DEQ regarding possible cooperative monitoring (only SEUG is using their cooperative service at this time; whereas, many Forests and BLM people are working with DEQ). Arne Hultquist (works for Richard Denton) is the main technical person and key data handling person involved in all field sampling on the ground, training, etc. He sounds cooperative, and I get good feedback about him from his "customers." I gather that Denton would make the larger decisions on any cooperative activities.

*3. REFERENCES AND BIBLIOGRAPHIES (collected for CSU)*

Using Margaret Beer's bibliographic list for each park and added in a few references that I found. The symbol ### on those lists indicates a new entry that I brought in. These lists are in separate attachments.

Maps collected include:

- Printout, ArcView hydrologic features at CURE.
- Map: Forest Service: Manti-La Sal National Forest (1989 Moab and Monticello Ranger Districts at 1:126,720 and 1989 Sanpete, Rerron, and Price Ranger Districts at 126,720).
- Map: Bureau of Land Mgt: 1989 Blanding Utah at 1:100,000 and 1995 Navajo Mt Utah at 1:100,000.
- Map: Grand Mesa National Forest, 1995, Scale: 0.5" = 1 mile (Forest closest to COLM).
- Map: Uncompahgre NF. 1993. Scale: 0.5" = 1 mile (near BLCA; also area where FS has done the color, TOC, and other studies recently).
- Map: Gunnison Basin Area. 1984. Scale: 0.5" = 1 mile (headwaters of CURE to the north largely in this Forest).
- Small Map: Grand Mesa, Uncompahgre, and Gunnison National Forests. Small overview map of all three Forests, illustrating locations of BLCA, CURE, and COLM in relation to the Forests.