



Water Quality Monitoring

Importance

Most Northern Colorado Plateau Network (NCPN) parks are located in semi-arid to arid environments where water is a major factor in determining the distribution of flora, fauna, and historic human habitation. Additionally, the abundance and quality of water resources reflect human activities and land use in and near parks, and are a primary factor influencing park visitation and recreational activities. Water bodies in national parks are protected by the Clean Water Act and other policies that prevent unacceptable levels of pollution and establish acceptable values for other water quality measures. Park managers need information on status and trends in surface-water quality and quantity to comply with the Clean Water Act and to mitigate historic and future impacts to park water resources that may have ecological and social significance.

Long-term Monitoring

Water quality monitoring sites are selected based on historic impacts, perceived threat, current monitoring by others, or to determine baseline status as a starting point for long-term trend detection. As many as 30 water quality parameters are measured at each site visit. At every site, portable sensors are used to measure core parameters (specific conductivity, flow, temperature, pH, and dissolved oxygen) as basic indicators of water quality. Field and laboratory measurements are then compared to state water quality standards to determine if acceptable concentrations are present and if, over time, conditions are changing beyond acceptable normal ranges. NCPN water quality monitoring is a coordinated effort between the network, individual park units, the U.S. Geological Survey, and the State of Utah.



NPS/D. THOMAS

Yampa River, Dinosaur National Monument.

Status and Trends

The year 2012 marked the eighth year of NCPN's water quality monitoring program. In addition to core monthly sampling, we cooperated with Region 8 of the Environmental Protection Agency to test selected locations for contaminants of emerging concern—those that have not traditionally been tested for during water quality sampling and may not be adequately cleansed by current wastewater treatment methods, such as pesticides, personal care products, and pharmaceuticals. The network will publish final results from this work at a later date. NCPN also continued assisting Zion NP with enhanced fecal coliform monitoring on the North Fork of the Virgin River to help resolve chronic exceedances at this popular recreational site. An analysis of historic nutrient concentrations, co-authored by NCPN staff, was published in a U.S. Geological Survey Scientific Investigations Report (see page 2).

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Network park units where the NCPN monitors water quality

Arches NP	Dinosaur NM
Black Canyon of the Gunnison NP	Golden Spike NHS
Bryce Canyon NP	Hovenweep NM
Canyonlands NP	Natural Bridges NM
Capitol Reef NP	Timpanogos Cave NM
Curecanti NRA	Zion NP

NHS = National Historic Site; NP = National Park; NM = National Monument;
NRA = National Recreation Area



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North Fork Virgin River, Zion National Park.

Why Nutrients?

Nutrient impairment, which causes organic enrichment and oxygen depletion, is a primary cause of degradation in streams and lakes nationwide. In response to recent state efforts to develop numeric nutrient water-quality criteria, the U.S. Geological Survey, in cooperation with the National Park Service, assessed total nitrogen (TN) and total phosphorus (TP) concentration data for 93 sites in or near 14 NCPN units for the time period 1972–2007. The data were screened for exceedances of nutrient standards or criteria, and 52 of the 93 sites were analyzed for trends in ambient and flow-adjusted concentrations (flow adjustment accounts for the effect of variation in flow) of TN and TP.

Long-term and Short-term Trends Show Differences

Most of the sites analyzed indicated either no trends or downward trends in nutrient concentrations. The trends that were found tended to vary depending on the time period evaluated, but most of the downward trends occurred during earlier historical periods (generally starting in the 1970s or early 1980s) that followed implementation of the 1972 Clean Water Act, which mandated changes to improve municipal wastewater treatment, address nonpoint-source pollution, enhance management of public land, and guide the implementation of best-management practices, such as improvements in fertilizer or manure application to help minimize erosion and nutrient runoff. Many of these historical, long-term downward trends were identified on larger streams, including the Colorado, Dolores, Fremont, Green, Gunnison, Virgin, and Yampa rivers.

In contrast, the few upward trends in ambient and flow-adjusted TN or TP concentrations occurred during more recent

sampling periods (1990s–2000s and early to mid-2000s). Sites with upward trends were either tributary to or on the Gunnison River (TN and TP) or on the Green or Yampa Rivers (TN only). This finding suggests that more recent changes in these watersheds may be affecting water quality at these sites and justifies continued monitoring.

Future Implications

Although few significant upward trends in TN or TP concentrations were identified, exceedances of standards and criteria may indicate problem areas in surface water that warrant closer evaluation. Results evaluated in this report represent conditions for different periods of record based on sometimes discontinuous data availability and thus may not represent basin conditions through the entire 1972–2007 time period. This highlights the need to maintain continuity in long-term water-quality and streamflow sampling programs at key reference and integrator sites throughout the network. Sites with a high number of exceedances, elevated median concentrations, or upward trends in concentrations merit continued or renewed monitoring and assessment to evaluate future changes in nutrient concentrations that could result in nutrient enrichment and eutrophication.

Brown, J. B., and D. P. Thoma. 2012. Assessment of total nitrogen and total phosphorus in selected surface water of the National Park Service Northern Colorado Plateau Network, Colorado, Utah, and Wyoming, from 1972 through 2007. U.S. Geological Survey Scientific Investigations Report 2012–5043, 112 p.

