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# An ecological function and services approach to total maximum daily load (TMDL) prioritization

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**Abstract** Prioritizing total maximum daily load (TMDL) development starts by considering the scope and severity of water pollution and risks to public health and aquatic life. Methodology using quantitative assessments of in-stream water quality is appropriate and effective for point source (PS) dominated discharge, but less so in watersheds with mostly nonpoint source (NPS) related impairments. For NPSs, prioritization in TMDL development and implementation of associated best management practices should focus on restoration of ecosystem physical functions, including how restoration effectiveness depends on design, maintenance and placement within the watershed. To refine the approach to TMDL development, regulators and stakeholders must first ask if the watershed, or ecosystem, is at risk of losing riparian or other ecologically based physical attributes and processes. If so, the next step is an assessment of the spatial arrangement of functionality with a focus on the at-risk areas that could be lost, or could, with some help, regain functions. Evaluating stream and wetland riparian function has advantages over the traditional means of water quality and biological assessments for NPS TMDL development. Understanding how an ecosystem functions enables stakeholders and regulators to determine the severity of problem(s), identify source(s) of impairment, and predict and avoid a decline in water quality. The Upper Reese River, Nevada, provides an example of water quality impairment caused by NPS pollution. In this river basin, stream and wetland riparian proper functioning condition (PFC) protocol, water quality data, and remote sensing imagery were used to identify sediment sources, transport, distribution, and its impact on water quality and aquatic resources. This study found that assessments of ecological function could be used to generate leading (early) indicators of water quality degradation for targeting pollution control measures, while traditional in-stream water quality monitoring lagged in response to the deterioration in ecological functions.

**Keywords** Ecosystem function · Water quality · TMDL · Non-point source · Riparian PFC

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