Chapter 19

Environmental Sensor Networks and Continuous Data Quality Assurance to Manage Salinity within a Highly Regulated River Basin

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ABSTRACT

Environmental sensor networks enjoy widespread deployment as monitoring systems have become easier to design and implement in the field and installation costs have fallen. Unfortunately software systems for data quality assurance have not kept pace with the development of these sensor network technologies and risk compromising the potential of these innovative systems by making it difficult to assess the accuracy and consistency of the data. Lingering uncertainty can constrain the willingness of stakeholders to make operational decisions on the basis of the real-time sensor data: a few negative experiences can do irreparable damage to a project which is attempting to change stakeholder behavior. Management of river salt loads in complex and highly regulated river basins such as the Murray Darling Basin in south-east Australia and the San Joaquin Basin in California, USA present significant challenges to Information Technology infrastructure within resource agencies that often have a poor history of coordination and data sharing. In the San Joaquin Basin, web-based environmental data dissemination initiatives to address salinity issues need to overcome a fear of loss of autonomy as well as data quality assurance and data reliability issues. These environmental decision support issues are contrasted with those facing resource managers in the Murray Darling Basin. This paper describes a new approach to environmental decision support for salinity management in the San Joaquin Basin of

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INTRODUCTION

In the past five years there has been a revolution in the way individuals share information. Social networking software applications such as Facebook, MySpace, and YouTube continue to redefine the manner by which knowledge is acquired and shared. The US Environmental Protection Agency Office of Information Technology has suggested that the next five years will witness as significant a technical revolution in data sharing technologies as the past five have provided in the ability to search. As data sharing becomes more widespread a significant constraint to the use of the information acquired is the issue of data quality. Important decisions are often made on current or real-time data: which is why, in the past, agencies preferred to establish and maintain their own monitoring stations. However, scant attention and few resources have been devoted to sharing the data from these stations with others (Maidment, 2008; Tarboton, 2005).

The Consortium for the Advancement of Hydrologic Science (CUAHSI) has developed a Hydrologic Information System architecture in an attempt to address some of the obstacles associated with data sharing on the web (Maidment, 2008). Given the rapid increase in statutory environmental regulation during the past decade and the establishment of pollutant-load regulatory frameworks in many countries such as the TMDL (Total Maximum Daily Load) in the United States (CEPA, 2002), stakeholders are being obligated to support the extensive monitoring networks needed to implement these pollutant control systems. Data sharing technologies and procedures for ensuring continuous data quality assurance are necessary for sustained and cost-effective watershed-based pollutant regulation. This paper describes a prototype data acquisition, sharing and data quality assurance project developed for salinity management within the San Joaquin Basin of California (Figure 1) that takes a first step at overcoming existing impediments. The paper provides detail on wetland salinity management since the 80,000 hectare project area to which these techniques are applied was without any form of continuous environmental monitoring as recently as six years ago. The salinity control strategy taken to manage salt exports from these San Joaquin Basin wetlands is contrasted with the Basin salinity plan adopted for the significantly larger Murray Darling Basin in south-east Australia to contrast and compare the relative merits of each program.
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