Examples of Cross-Program Approaches for Sharing Drinking Water Indicators

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William Cooter, RTI International (Presenter)
Kibri Everett, RTI International (Co-Presenter)
David Chrest, RTI International
Jay Rineer, RTI International
Brandon Bergenroth, RTI International
A. Roger Anzzolin, U.S. Environmental Protection Agency, Office of Water, Office of Ground Water and Drinking Water

Abstract

The Drinking Water Mapping Application (DWMA) provides a secure application for EPA staff to obtain reports and maps for managing programs under the Safe Drinking Water Act. The DWMA applies ESRI's enterprise map servers and the EPA's SDE-based enhanced National Hydrography Dataset (the NHDPlus) to locate drinking water surface intake locations within the NHD network and define source water areas relative to the intake facilities. Source protection areas are also provided for buffer areas around wellheads. Examples are provided showing ways that geoprocessing techniques can transform sensitive drinking water information into indicators of great value to a wide range of water quality management issues. The highlighted applications include general indicators based on the Watershed Boundary Dataset HUC12 subwatersheds and ways to identify potential contaminant risks from hazardous waste Large Quantity Generators and hardrock mining activities regulated under EPA's Office of Solid Waste and Emergency Response.

1.0 Introduction

The U.S. Environmental Protection Agency's (EPA's) Office of Ground Water and Drinking Water (OGWDW) Drinking Water Mapping Application (DWMA) is a Web-based geospatial application (Anzollin et al. 2004; Cooter et al. 2006; Cooter et al. 2009) that provides a secure application that EPA staff can easily use to obtain reports and maps that help manage programs under the Safe Drinking Water Act (SDWA). The DWMA takes advantage of content and functionality in the enhanced National Hydrography Dataset, or the NHDPlus (Simley, 2008; U.S. Geological Survey, 2010) to represent locations of surface water-reliant intake facilities and watershed-based analytical Source Protection Areas (SPAs). Upstream navigation features from the NHDPlus are applied to select NHDPlus catchments within 24 hours upstream time of travel (24-hour or 1-Day TOT) from surface intakes to create the surface facility SPAs. Ground water SPAs related to drinking water wells are represented using simple circular buffer areas. Surface and ground water SPAs are illustrated in Figure 1, which shows the user interface of the DWMA that leverages ESRI map servers, ESRI's ArcSDE geodatabase system, and enterprise Oracle database middleware.

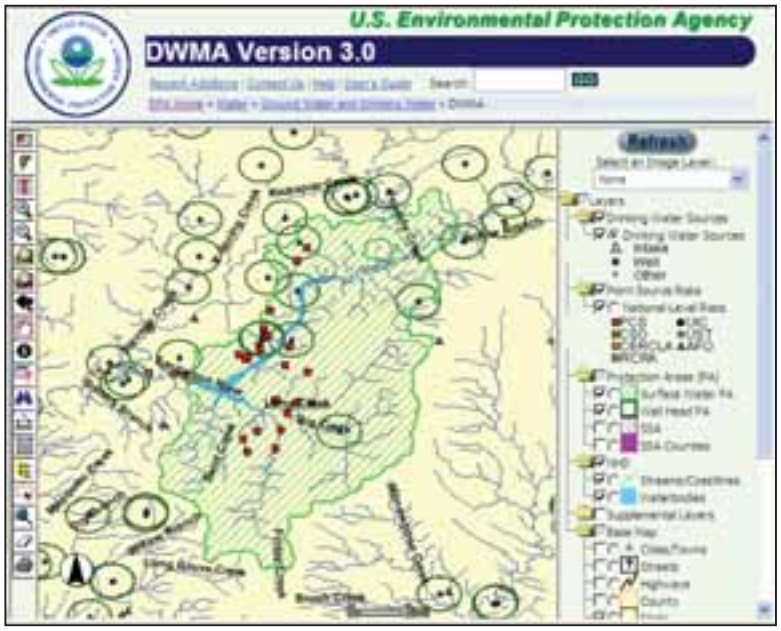

Figure 1: DWMA drinking water facility points and Source Protection Areas (SPAs)

The DWMA provides a secure application that works within EPA restrictions on the display of locational data related to sensitive drinking water facilities or related source protection areas (U.S. EPA 2005; U.S. GAO, 2006). For some time, EPA has evaluated techniques for different types of indicators in order to share drinking water information with wider audiences, at least members of the regulated community outside of EPA itself (state agencies and other federal agencies) and, for some indicators, the ability to share indicators with the general public. Examples are presented of several approaches for developing these special drinking water indicators (a public indicator). For instance, there is now considerable interest in applying the Watershed Boundary Dataset (WBD) subwatershed HUC12 drainage areas (Laitta et al. 2004; Daw and Hanson 2009) for a wide range of water quality issues. WBD drainage areas such the HUC12s show promise as the foundation for presenting non-sensitive drinking water indicators.

Other options are presented that define special geospatial services (that could at least be implemented as extranet indicators) for use with EPA regulated facilities such as RCRA Large Quantity Generators (LQGs) regulated under the Resource Conservation and Recovery Act (RCRA) through EPA's Office of Resource Conservation and Recovery (ORCR) in the Office of Solid Waste and Emergency Response. This type of geospatial service could be extended for a wide range of other EPA-regulated facilities where point locations are available in enterprise data system supported by EPA's Office of Environmental Information (e.g., through OEI's Envirofacts system or Office of Enforcement and Compliance Assurance (OECA) extranet systems such as the Online Tracking Information System (OTIS) or OECA's publicly accessible Enforcement and Compliance History Online (ECHO) Web application (http://www.epa.gov/Compliance/data/systems/multimedia/aboutotis.html).

For focused rule development analyses, NHDPlus catchments can be selected defining downstream time of travel Aquatic Areas of Review (Aq AORs), where spatial overlap with the extents of drinking water SPAs can provide indicators for potential risks related to various waste generating activities. EPA is applying this Aq AOR approach as part of EPA plans to develop a financial responsibility rule for classes of facilities within the hard-rock mining industry covered under Section 108(b) of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA, commonly called Superfund) [further information at this Internet link

http://www.epa.gov/superfund/policy/financialresponsibility/index.html]. The goal is to ensure that facilities involved in any way with these "hardrock mining" activities would remain financially responsible for cleaning up substances that were improperly disposed.

2.0 Indicator Approaches for Providing Sensitive Drinking Information to Wider Audiences

Much of the content of the DWMA, including drinking water facilities and SPAs, fall under EPA's policy on sensitive drinking water information (U.S. GAO, 2006). This policy involves restrictions that apply to displaying the precise locations of drinking water entities or SPAs to a wide non-EPA audience. There are several approaches that can be taken, however, to remove the sensitivity and still provide useful drinking water indicator information products. One approach is to adopt a cross-program perspective, where it is possible to display the locations of entities from other programs that are in proximity to drinking water facilities or located within drinking water SPAs. For instance, EPA has supported pilot projects for underground storage tanks (USTs) for gas stations and other facilities with underground fuel tanks that may leak and which are frequently major state concerns as potential risks for contamination of ground water source waters (Anzzolin 2007; McCormick, 2006).

Figure 2 shows a proximity analysis that highlights (in purple halos) a public water system wellhead that falls within 2,500 feet of a facility with Underground Storage Tanks (USTs). This figure shows a companion presentation where the UST facility is highlighted, but where the sensitive drinking water information is not displayed. Cross-program results on UST facilities meeting proximity tests (e.g., within SPAs or within a certain distance of a wellhead) provide indicator information that could possibly be shared with the public and offered through a web application or in the form of a web service.

Figure 2. Underground Storage Tanks (USTs) within SPAs

In addition to EPA-regulated facility points, other types of GIS features can be selected based on their proximity to sensitive drinking water information. For instance, the Clean Water Act Section 303(d) impaired waters under EPA's Total Maximum Daily Load (TMDL) program can be selected that fall within surface drinking water SPAs. Figure 3 shows this subset of impaired waters (involving over 5,900 individual listings) for the 2002 303(d) baseline (U.S. EPA 2009). Presenting just the TMDL-related materials from Figure 3 would be an indicator approach that avoids the direct display of sensitive drinking water information.

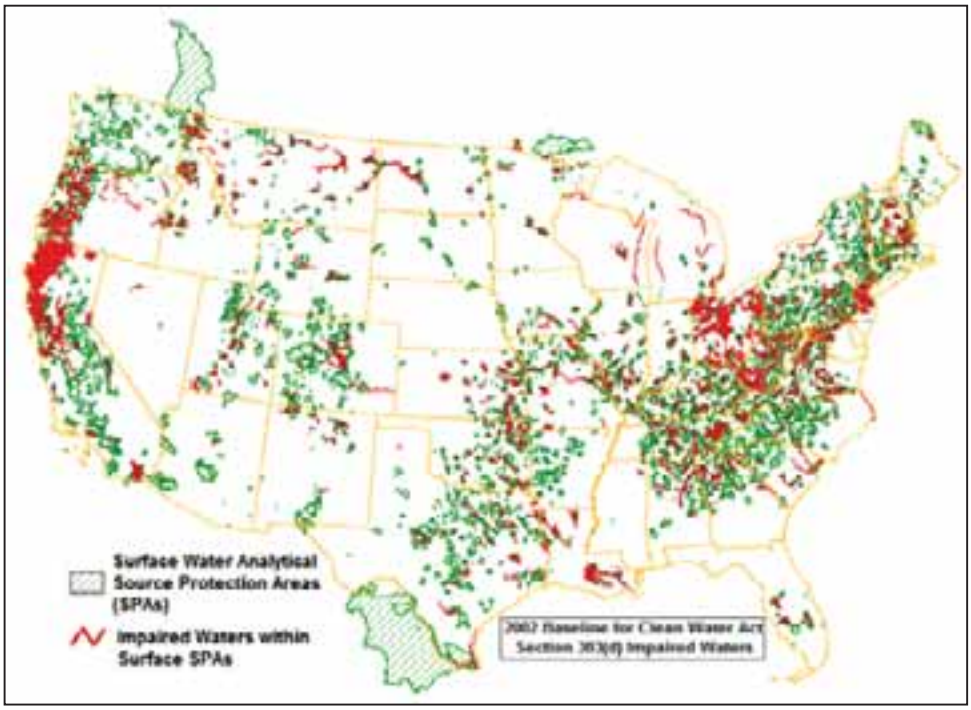

Figure 3. TMDL waters in proximity to surface drinking water SPAs

For established EPA regulatory programs, locations are commonly represented using latitude and longitude points related to plant centroids where there are potential releases to environmental media. Where rules are already in place, facility points are available through EPA systems such as Envirofacts (http://www.epa.gov/enviro) or other related EPA geospatial download services (http://www.epa.gov/enviro/geo_data.html). For new rulemaking, facility points will be taken from existing EPA data systems as well as relevant data from EPA or other federal and state agencies.

NHDPlus-based downstream analyses can generate Aquatic Areas of Review (Aq AORs) showing an NHDPlus catchment for a flowline in immediate proximity to a given facility point as well as other downstream flowlines and catchments for a selected time of travel (e.g., 1 Day TOT). Aq AORs provide an initial screening framework to check for potential contaminant risks at a facility as well as a reasonable downstream area. The Aq AORs provide a more water resource focused framework than alternatives such as simple circular buffer zones around a facility point.

Figure 4 shows an example configuration that could be applied to identify whether the Aq AOR involves downstream surface or ground water SPAs. This sort of indicator information (where the locations of specific drinking water facilities or SPAs would not be included) could then be included in the regulatory process for information released to the public, for instance as part of a Notice of Data Availability. EPA is applying this approach as part of proposed financial responsibilities rules for facilities within the hard-rock mining industry covered under Section 108(b) of CERCLA [http://www.epa.gov/superfund/policy/financialresponsibility/index.html].

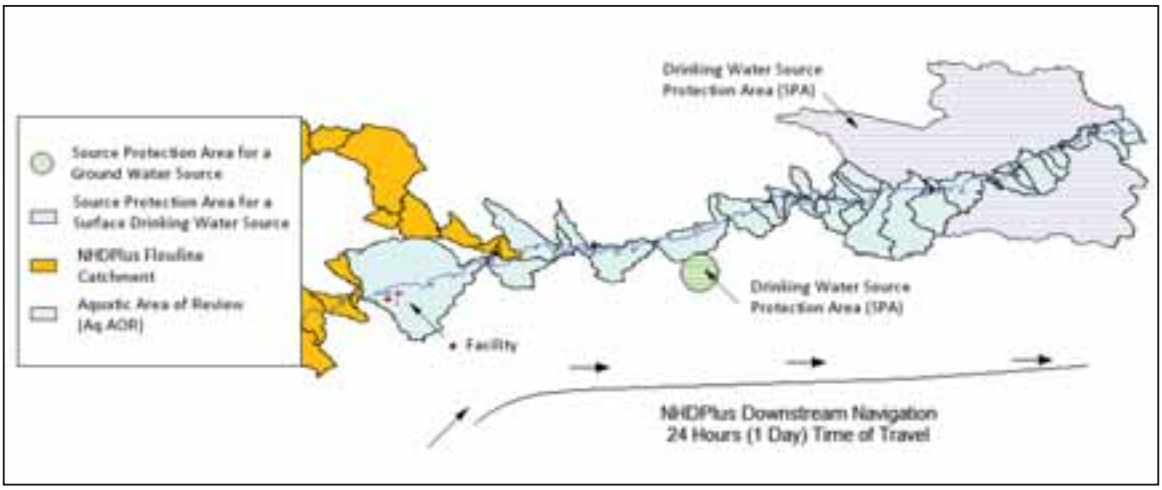

Figure 4. Special Aquatic Areas of Review (Aq AORs)

3.0 Presentation of Sensitive Drinking Water Information

DWMA content such as drinking water facilities and SPAs falls under EPA's policy on sensitive drinking water information (U.S. EAP 2005; U.S. GAO, 2006). Sharing information products related to the DWMA's sensitive drinking water information with a wide public audience must be approached carefully. At the present time, two approaches are being considered by EPA that could significantly widen the audience for drinking water indicator information products.

Basic information products are under analysis as a way to provide destiny indicators for the occurrence of surface water or groundwater source facilities within HUC12 subwatersheds. The HUC12 subwatershed polygons in the Watershed Boundary Dataset (Daw and Hanson 2009) reflect a coordinated effort between the United States Department of Agriculture-Natural Resources Conservation Service (USDA-NRCS), the United States Geological Survey (USGS), and the Environmental Protection Agency (EPA). The spatial scale for the HUC12s is ideal to support small watershed management and planning, while at the same time being large enough for the implementation of indicators for sensitive drinking water information that can potentially be shared with a wide audience. Figure 5 illustrates how such HUC12 indicators could be implemented for the area covering the Chesapeake Bay watershed.

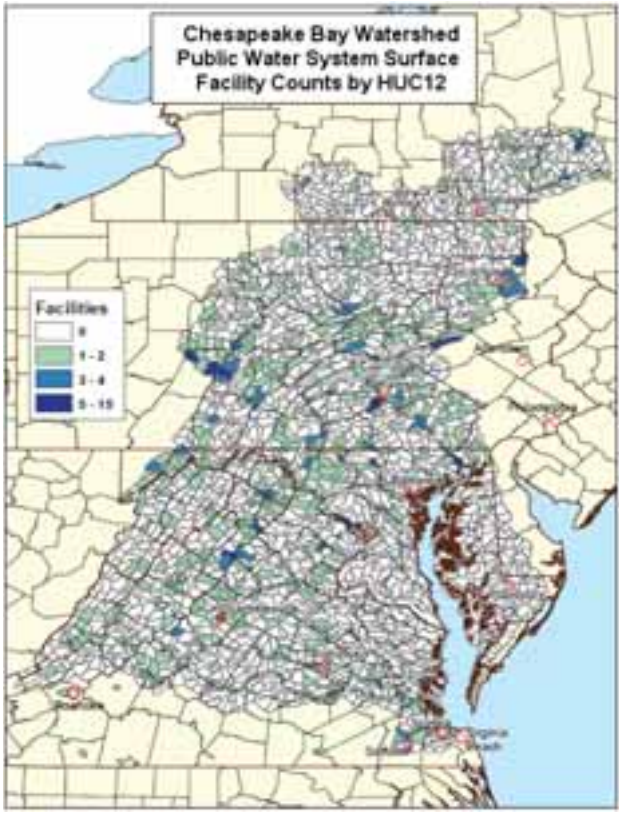

Figure 5. Indicators based on HUC12s for the Chesapeake Bay watershed for drinking water surface source facilities

Eventually, more complex information could be captured in the indicators. For instance, cross-program indicators could give the numbers of drinking water facilities per HUC12 where NPDES facilities are within 24 hours time of travel upstream. Other cross-program indicators related to the proximity to drinking water facilities of Animal Feeding Operations (AFOs) or indicators showing the frequency of drinking water facilities by HUC12 located within karst typography are also possible. In this way, queries related to the actual sensitive drinking water information available through the DWMA could be transferred in a series of indicators that could be shared with other agencies or the general public.

The DWMA contains information for a wide range of point representations of EPA-regulated facilities. As noted above, these include facilities such as waste water treatment plants with discharges to surface waterbodies. The DWMA also contains information on many other regulated facilities where releases to the environment could pose potential contaminant risks to both surface water and ground water drinking water sources. The DWMA's SPAs provide a convenient geospatial foundation to develop web services to document whether regulated facility points fall within a SPA. Under the Resource Recovery and Conservation Act (RCRA), EPA regulates a wide range of hazardous waste disposal sites and hazardous waste generators. A hazardous waste generator is any person or site whose processes and actions create hazardous waste. Generators are divided into categories (large and two categories of small generators) based upon the quantity of waste they produce. Large Quantity Generators (LQGs) generate 1,000 kilograms per month or more of hazardous waste, more than 1 kilogram per month of

acutely hazardous waste, or more than 100 kilograms per month of acute spill residue or soil. With certain exemptions (http://www.epa.gov/osw/hazard/generation/index.htm), LQGs may only accumulate waste on-site for up to 90 days, after which time wastes must be transferred to final disposal facilities There are over 22,000 LQGs, where locations can be readily obtained through EPA's Geospatial Data Access Project (http://www.epa.gov/enviro/geo_data.html). Figure 6 shows the results of a geospatial analysis that identifies over 10,000 LQGs with drinking water SPAs. This LQG information can be viewed as a cross-program drinking water indicator. This approach could be applied to a wide range of regulated facility points in the form of a web service. This type of indicator information could then be shared through EPA enterprise data systems with a wider audience, perhaps using passworded EPA Extranet systems such as OECA's Online Tracking Information System (OTIS).

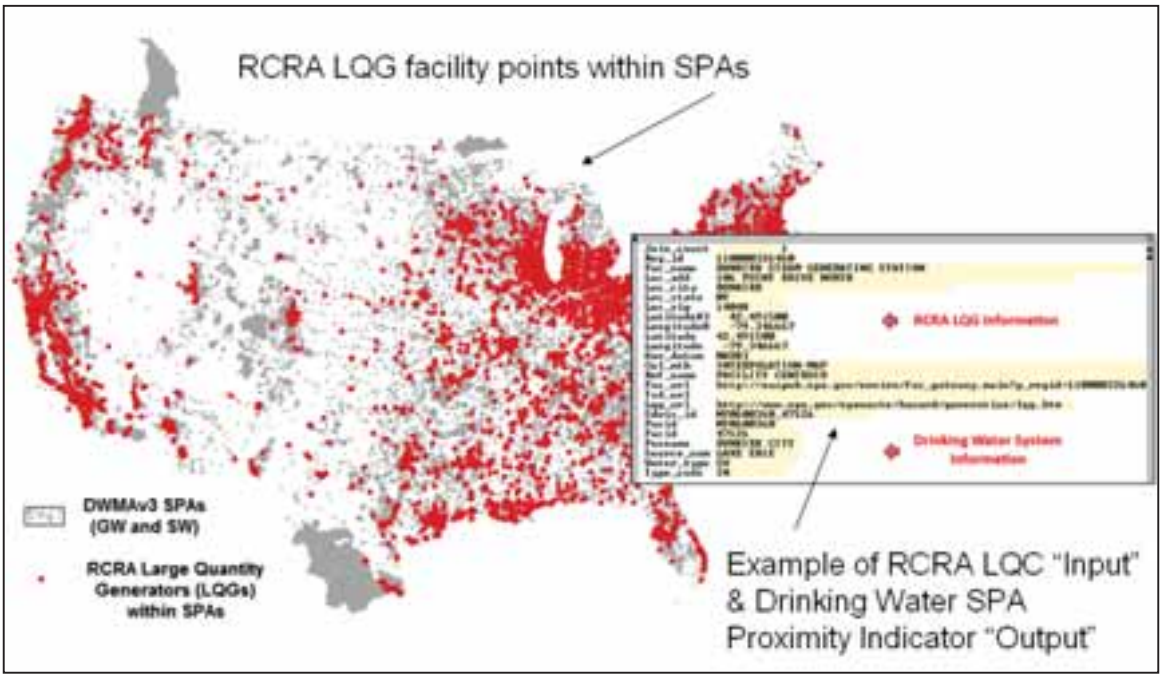

Figure 6. RCRA LQG indicators applying SPAs

4.0 Conclusions

EPA has evaluated techniques for a wide range of indicators so that drinking water information, originally developed for the DWMA, can be shared with wider audiences. This would at the very least include members of the regulated community outside of EPA itself (state agencies and other federal agencies) and, for some indicators, the ability to share information with the general public. For HUC12-based indicators that present the density of source water facilities within subwatershed drainage areas, the EPA Office of Water is providing drinking water indicator features in their new MyWATERS Mapper web-based system. MyWATERS Mapper makes use of cutting edge ESRI ArcGIS Server technology and will soon replace the older Enviromapper for Water system (http://www.epa.gov/waters/). Figure 7 provides an example of how drinking

water HUC12 indicator information could be implemented in MyWATERS Mapper and shared with the general public.

Figure 7. HUC12-based drinking water indicator for EPA's new publicly available MyWATERS Mapper System

For the types of cross-program indicators illustrated for the RCRA LQGs, there is interest in EPA from the Office of Environmental Information (OEI) and the Office of Enforcement and Compliance Assurance (OECA) to apply the drinking water SPAs as part of a webservice covering a wide range of EPA regulated facility point locations. These indicators could leverage a combination of a database service and a REST-based (Representational State Transfer (REST) Exchange Network Service) web service wrapper (Clark 2010). This approach could leverage SPAs housed in the DWMA in combination with facility location inputs from EPA enterprise regulatory data systems. The final indicator products would document whether a specific regulatory point falls with a SPA.

The initial audience for these indicators could be accommodated suing OECA's Extranet system called OTIS (Online Tracking Information System). OTIS is a collection of search engines (http://www.epa.gov/Compliance/data/systems/multimedia/aboutotis.html) which enables EPA staff, state/local/tribal governments and federal agencies to access a wide range of data relating to enforcement and compliance. OTIS can be used for many functions, including planning, targeting, analysis, data quality review, and pre-inspection review. Access to OTIS can be granted by EPA's OECA to State environmental agencies, state attorney general offices, other state agencies, local and tribal governments that have EPA program delegation, and Federal government departments and agencies, including the military. Eventually, it might be possible to share this indicator with the general public through OCEA's Enforcement and Compliance History Online (ECHO) Web site (http://www.epa-echo.gov/echo/).

Figure 8 illustrates how information for a regulated facility-within-SPA web service could be provided through an EPA system such as OTIS or ECHO. During EPA responses to the Gulf BP-Spill, oil absorbing booms and other materials with spill contaminants were often routed initially to RCRA Large Quantity Generator (LQG) facilities. Depending on the nature of the wastes (liquid or solid), wastes that could contain hazardous wastes would then be appropriately transferred to either permanent RCRA hazardous water disposal sites or to Underground Injection control wells. Figure 8 shows how information from three types of facility point sources could be presented as indicators (Anzzolin and Cooter 2011). Setting up this sort of drinking water indicator cross-program web service would be of value in special emergency response situations as well as for ongoing routine environmental management functions.

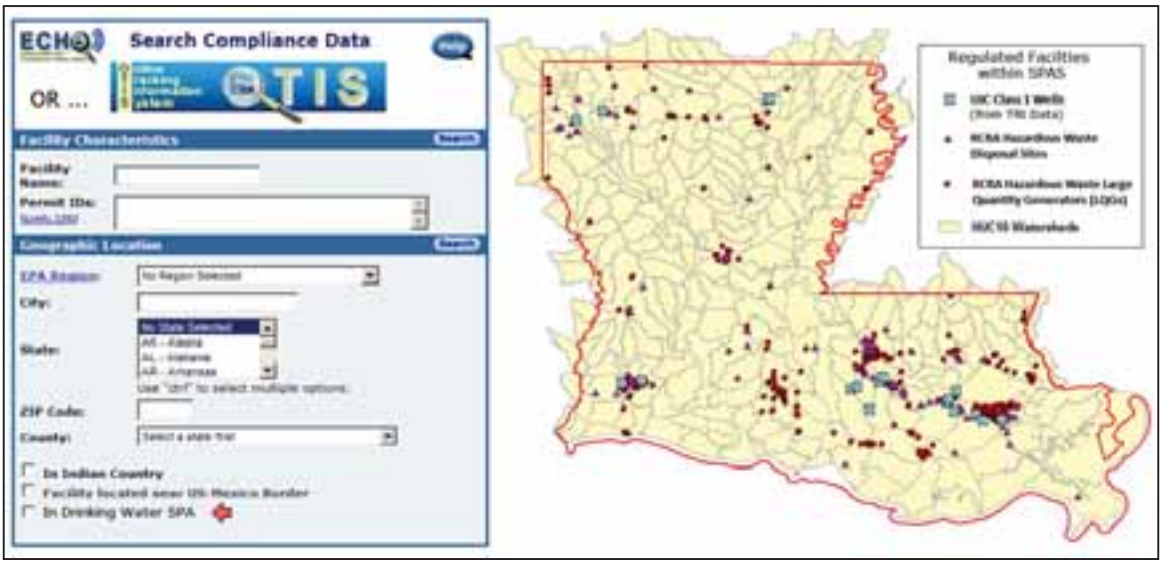

Figure 8. Proposed cross-program drinking water indicator service implemented in either OTIS or ECHO

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Author Information

William Cooter, Ph.D.
RTI International
3040 Cornwallis Road
Research Triangle Park, NC 27709
sid@rti.org

Kibri Everett
RTI International
3040 Cornwallis Road
Research Triangle Park, NC 27709
keverett@rti.org

David Chrest
RTI International
3040 Cornwallis Road
Research Triangle Park, NC 27709
davidc@rti.org

James (Jay) Rineer
RTI International
3040 Cornwallis Road
Research Triangle Park, NC 27709
jrin@rti.org

Brandon Bergenroth
RTI International
3040 Cornwallis Road
Research Triangle Park, NC 27709
bbergenroth@rti.org

A. Roger Anzzolin
US EPA Office of Water, Office of Ground Water and Drinking Water
1200 Pennsylvania Avenue NW (4606M)
Washington, DC 20460
anzzolin.roger@epa.gov