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Natural Resource Stewardship and Science

Water Quality Metadatabase for the South Atlantic Landscape Conservation Cooperative

Natural Resource Report NPS/SECN/NRR—2012/581

ON THE COVER
Sampling locations included in the SE Coastal Water Quality Monitoring Metadata Portal where air quality, groundwater, water quality, stream flow, shellfish contaminants, and weather monitoring data have been collected.

Water Quality Metadatabase for the South Atlantic Landscape Conservation Cooperative

Natural Resource Report NPS/SECN/NRR—2012/581

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U.S. Department of the Interior
National Park Service
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Fort Collins, Colorado

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Abstract

Department of Interior Secretarial Order 3289 established a Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that the Department manages. Working at the landscape, regional, and national scales through the establishment of DOI Climate Science Centers and Landscape Conservation Cooperatives, the Department is defining and implementing a vision that integrates DOI science and management expertise with that of our partners, providing information and best management practices available to support strategic adaptation and mitigation efforts on both public and private lands across the U.S. and internationally.

In FY 2010, the Southeast Coast Network received additional program funds to (a) expand monitoring efforts that will improve understanding of the effects of climate change on park resources, and (b) expand partnerships with other federal, state, academic, and NGO institutions to conduct resource conservation within the context of the DOI-led Landscape Conservation Cooperatives program.

As a part of this effort, the Georgia Coastal Research Council developed a metadata-level database of existing water quality monitoring programs across the South Atlantic Landscape Conservation Cooperative (SALCC) geographic range. Specific objectives of this project were to expand the SECN's coastal metadatabase project to:

1. Incorporate water quality metadata information from national databases into the database.
2. Identify project partners from the region, and work with them to provide descriptions of water quality sampling programs.
3. Enter water quality metadata for new programs.
4. Host the database and web portal until such time as it can be transferred to NPS.

This report describes the updates that were made to the system and the website since the original project, summarizes the results of each project objective, and includes a discussion of challenges faced in meeting those objectives.

Background

Department of Interior Secretarial Order 3289 established a Department-wide approach for applying scientific tools to increase understanding of climate change and to coordinate an effective response to its impacts on tribes and on the land, water, ocean, fish and wildlife, and cultural heritage resources that the Department manages. The Secretarial Order states that the Department must continue to provide state-of-the-art science to better understand the impacts of climate change and to develop science-based adaptive management strategies for natural and cultural resource managers. Working at the landscape, regional, and national scales through the establishment of DOI Climate Science Centers and Landscape Conservation Cooperatives, the Department is defining and implementing a vision that integrates DOI science and management expertise with that of our partners, providing information and best management practices available to support strategic adaptation and mitigation efforts on both public and private lands across the U.S. and internationally.

The Southeast Coast Network (SECN) is one of 32 National Park Service (NPS) Networks established to implement an integrated monitoring program under the Natural Resource Challenge. The SECN contains 20 parks, 17 of which contain significant and diverse natural resources. In total, SECN parks encompass more than 184,000 acres of federally-managed land across North Carolina, South Carolina, Georgia, Alabama, and Florida. The parks range in size from slightly more than 20 to nearly 60,000 acres, and when considered with non-federal lands jointly managed with SECN parks, the Network encompasses more than 253,000 acres.

In FY 2010 the Southeast Coast Network received additional program funds to (a) expand monitoring efforts that will improve understanding of the effects of climate change on park resources, and (b) expand partnerships with other federal, state, academic, and NGO institutions to conduct resource conservation within the context of the DOI-led Landscape Conservation Cooperatives program.

We completed a project for National Park Service (NPS) in 2009 that included development of a Coastal Water Quality Monitoring Metadata Database for the Southeast region (from NC to FL). Our goal was to build a tool for storing critical information about coastal water quality monitoring programs, their sponsoring organizations, monitoring locations, and measured parameters. A workshop was convened in June 2008 at Hollings Marine Laboratory in Charleston, SC, to assess stakeholder needs (Alber et al. 2008), which included representatives from various agencies and institutions involved in coastal water quality monitoring in the Southeast. A relational database was then designed to store information on water quality data collected by federal, state, and municipal agencies as well as by research institutions. Water quality parameters used in the database were linked to US EPA STORET codes, when applicable, and were classified into parameter groups and categories to support searches at varying levels of specificity. Optional fields for defining relevant sample media, units, methods and additional search tags were also provided. At the conclusion of this project 40 programs in the South Atlantic were registered in the database, including metadata on 16,182 stations at which 1,093 distinct parameters are measured (i.e., 286,042 total station parameter records).

In 2010, we were funded to extend this database to include relevant monitoring programs across the entire South Atlantic Landscape Conservation Cooperative (SALCC) geographic range. Specific objectives of the Phase II were:

1. Incorporate water quality metadata information from national databases into the database.

2. Identify project partners from the region, and work with them to provide descriptions of water quality sampling programs.

3. Enter water quality metadata for new programs.

4. Host the database and web portal until such time as it can be transferred to NPS.

This report first describes the updates that were made to the system and the website since the original project. We then summarize the results of each project objective, and include a discussion of challenges faced in meeting them. We conclude with a brief discussion of our continuing activities.

Program Updates

The production version of the database ("NPS_WaterQuality") was developed using Microsoft SQL Server 2000™, a high performance, enterprise-class relational database management system. We also used Microsoft Access™ 2003 to design data entry and management forms, standard queries (i.e., database views), stored procedures to support web-based data entry and update forms, and reports. In addition to the Microsoft Access forms, web-based data entry forms were also developed for the database. The portal is currently part of the Georgia Coastal Research Council (GCRC) web site (http://www.gcrc.uga.edu/wqmeta/), which is hosted on a web server in the UGA Department of Marine Sciences running Windows Server 2003 R2 and Internet Information Server 6 (IIS). The project and database design are fully described in our final report (Sheldon et al. 2009).

Database and Middleware

We began this phase of the project by upgrading the *NPS_WaterQuality* database to SQL Server™ 2005, as the original software (Microsoft SQL Server™ 2000) was no longer well supported. This involved making the necessary changes to queries and XML syntax to accommodate version differences.

We also made improvements to the original model and middleware applications, based on our experience using the database for Georgia Coastal Research Council (GCRC) and related projects over the past few years. These included:

Added 12-digit HUC codes to the database – The only monitoring station watershed information stored in the original database was a single 8-digit Hydrological Unit Code (HUC). This represents a very large geographic area that may include many thousands of monitoring stations in some regions. We therefore extended the database model to store both 12- and 8-digit HUCs in order to be able to support watershed searches at different scales, and we revised the database query logic and web services to support searching by either precision.

Automated data mining for watershed information – In order to assign stations to their appropriate HUC codes, we obtained comprehensive GIS Shapefiles from USGS describing all 8- and 12-digit HUCs in the southeastern USA, and mined geographic boundaries and watershed information attributes from these files using a custom MATLAB program. This information was used to populate lookup tables (tables *HUC_Codes* and *HUC12_Codes*, Appendix A) which were then used to match all existing station records in the database to 8- and 12-digit HUCs. We have now automated this process using MATLAB, so that we can provide watershed information for all new stations added to the database moving forward. These changes dramatically improved support for storing contextual watershed information in the database model, and allowed development of enhanced search, display and link features on the revised web portal (see Database and Web Portal Hosting section).

Added State-level classification to the database – Another limitation of the original database was that it did not support searching for monitoring stations by state. This oversight was not critical when the database coverage was limited to the coastal zones of four states, but could become problematic as we scaled the database to cover the entire SALCC region. We therefore revised the query logic in all relevant views, stored procedures and query templates to support searches

by either state name or two-letter abbreviation. We also added 'State' and 'S*tateCode'* fields to all database output, including web page, spreadsheet (CSV) and XML formats, and documented these changes in web service descriptions and XML schema files. The SQLXML web services developed for the original web portal were also enhanced for compatibility with the new database model, and now support queries by state.

All of the above changes are illustrated in the updated Entity-Relationship Diagram (ERD) in Appendix A.

Website

The NPS_WaterQuality web portal was originally developed based on user needs identified by participants of an NPS workshop held at Hollings Marine Lab in June 2008 during Phase I of this project. During Phase II we re-styled and refined the original web portal design, improved interactivity using client-side JavaScript code, and added support for extended database content. Many of these improvements were presented at the 2011 Georgia Water Resources Conference, and are summarized in Sheldon et al. (2011).

Updated template and organization – A revised web template was developed using Adobe Dreamweaver® CS 5.5 to provide the web portal with a brighter, more modern look and feel (Figure 1). Navigation was simplified to include only "Site Search", "Organizations", "Programs" and "Resources" links, and legacy top-level links to the login/registration form and pages for adding and updating organization and program records were removed and replaced with contextual links on subsidiary pages (e.g., "Add New Program" and "Update Program" links on Program pages, which invoke the login/register page automatically as needed).

Revised Organizations and Programs web pages – These pages were redesigned to provide more convenient access to information about registered organizations and programs, respectively. Only titles of organizations or programs are initially displayed rather than full details (Figure 2). Clicking on titles executes JQuery JavaScript code to display logos, summary text and links to full details. Links are also provided at the top of the page to display or hide details for all entries at once. This new design facilitates scanning for items of interest and provides much more interactivity than the original portal design.

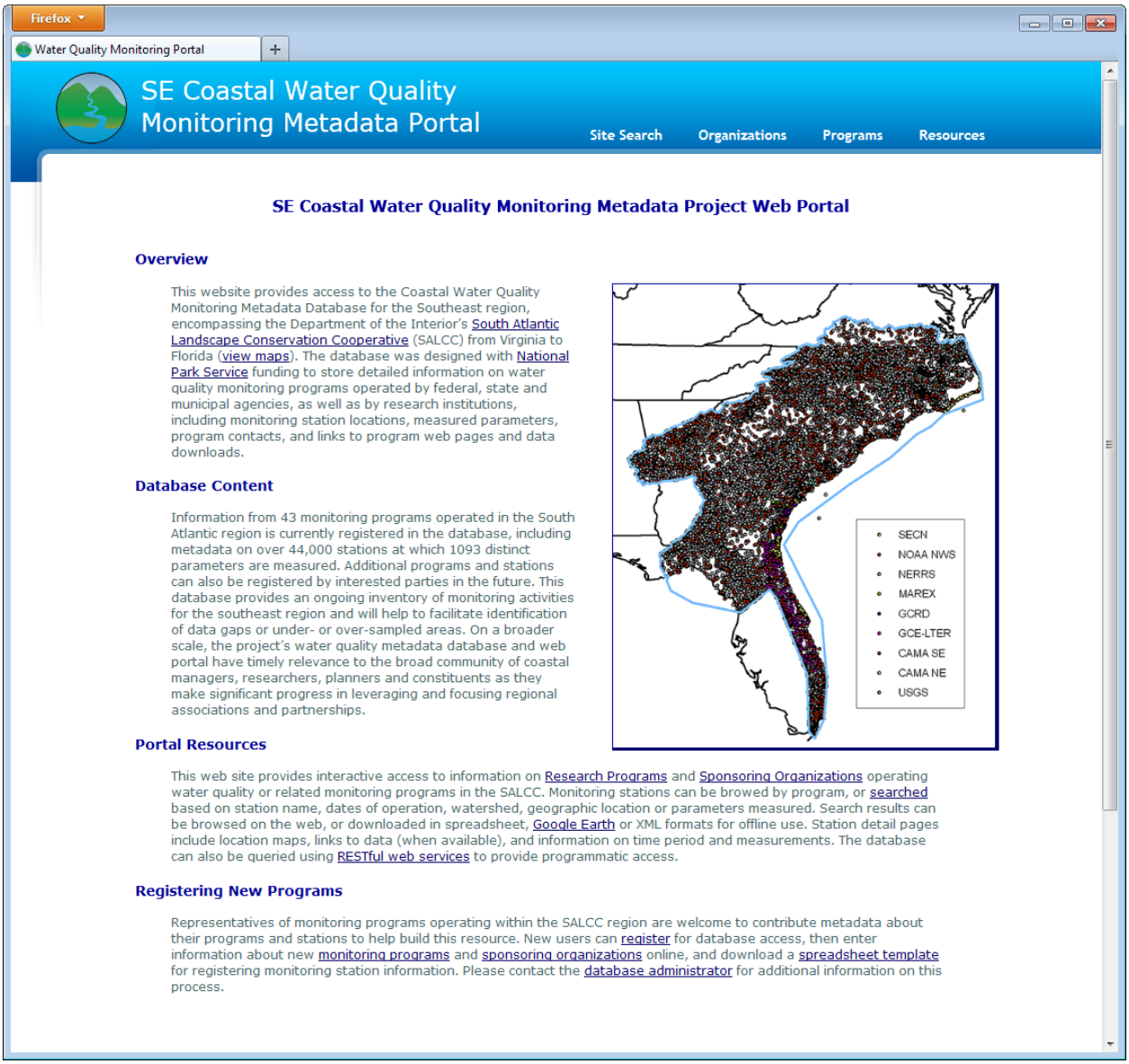

Figure 1. Web portal home page design (http://www.gcrc.uga.edu/wqmeta/).

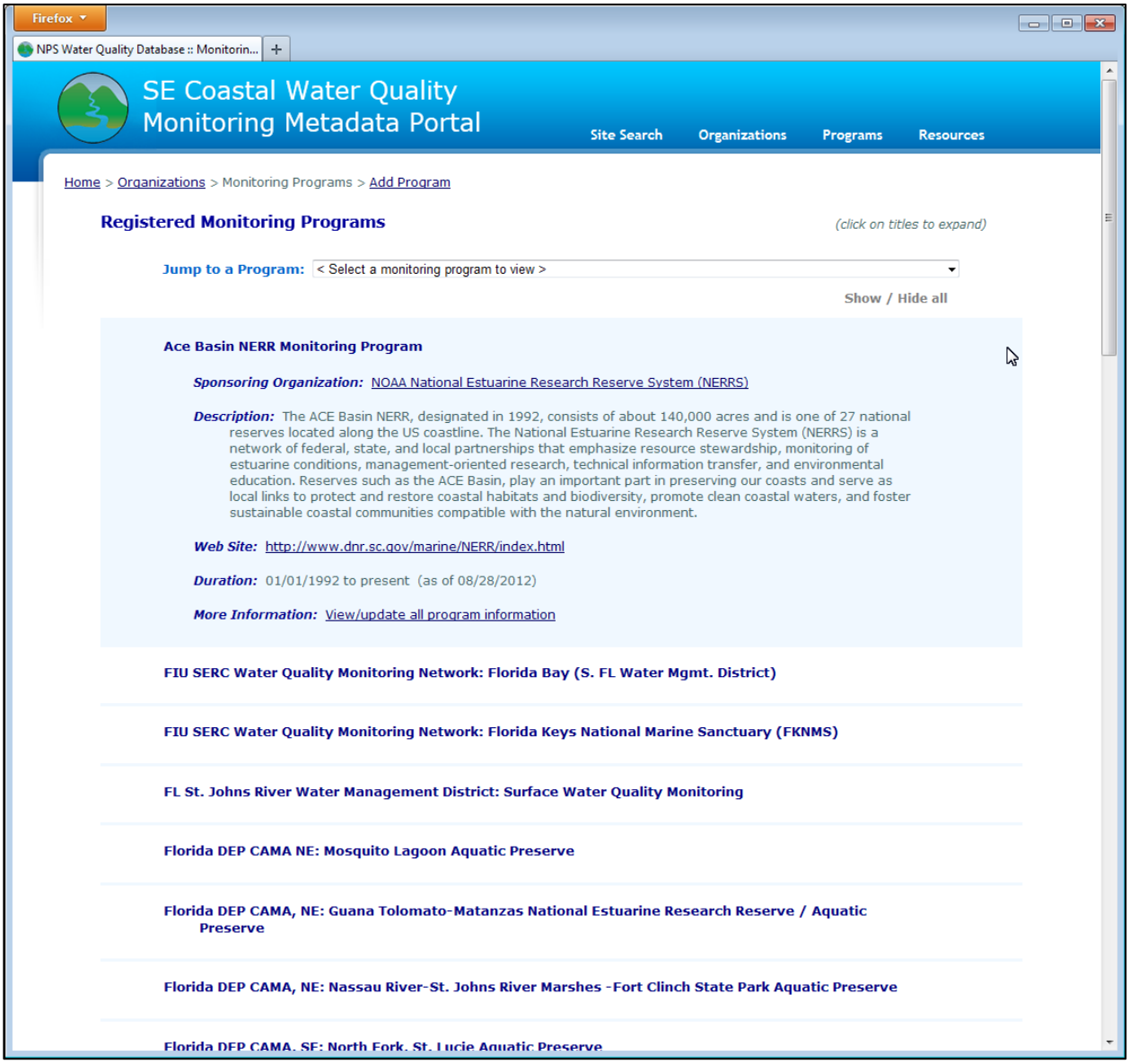

Figure 2. Monitoring program list page with interactive Javascript functions for displaying and hiding program details (http://www.gcrc.uga.edu/wqmeta/app/programs.asp).

Improved site search page – The site search page (http://www.gcrc.uga.edu/wqmeta/app/search.asp) was redesigned to include a dynamically-generated list of site types from the database (i.e., displayed in a more compact layout), and to add support for State searches as an alternative (or supplement to) geographic bounding box searches (Figure 3). The embedded Google Map widget used to define bounding boxes was also revised to display the expanded geographic coverage of the database and to provide a "Clear" button for resetting coordinates between searches. Initial form control settings can all be set programmatically by passing parameters to the web page URL – this capability is used to provide program-specific station search links on organization and program pages, and for "Station Search" links on the search results page to support refining the query (e.g., http://www.gcrc.uga.edu/wqmeta/app/search.asp?State=GA&HUC=03060204).

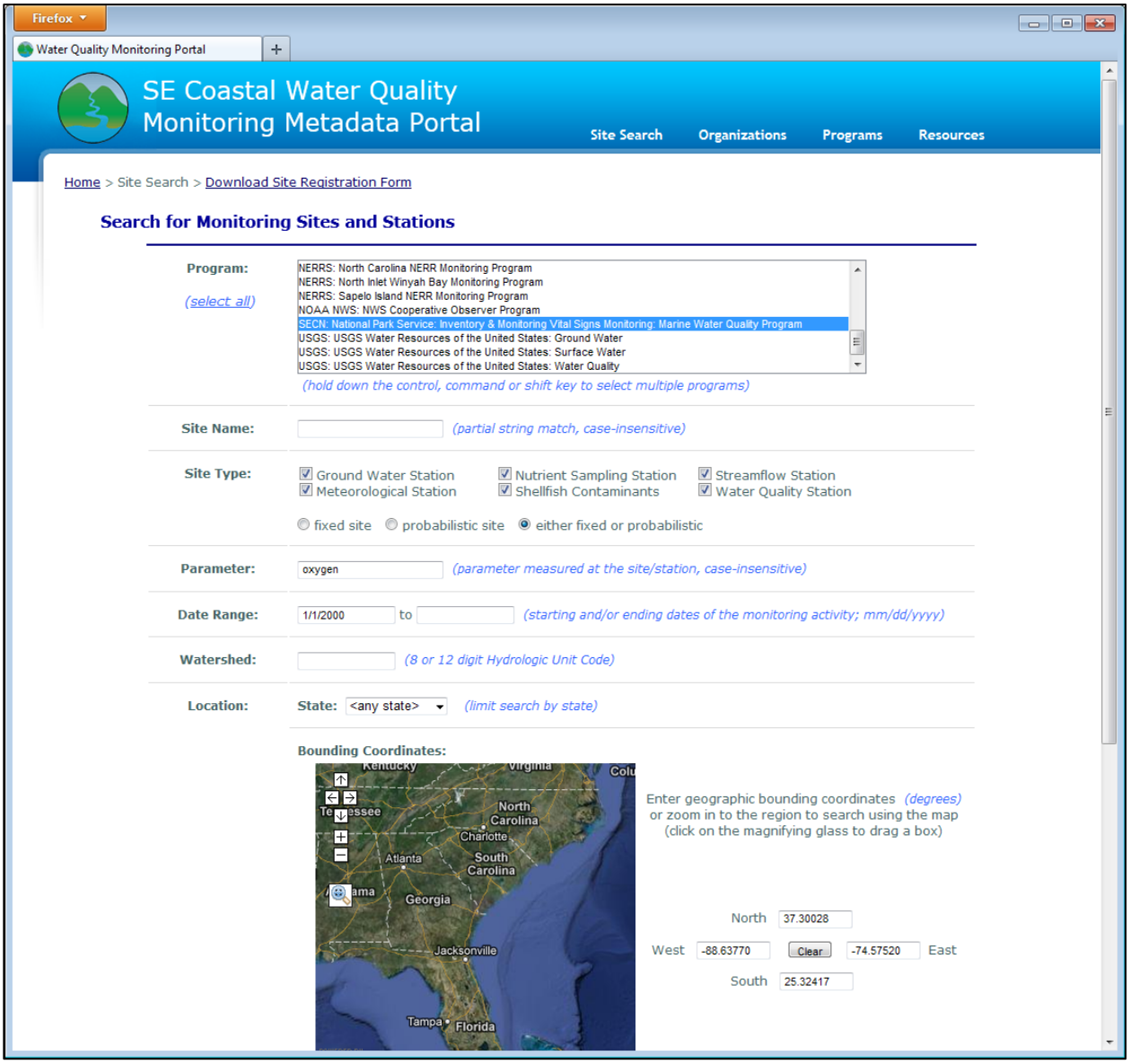

Figure 3. Revised site and station search page (http://www.gcrc.uga.edu/wqmeta/app/search.asp). Changes include dynamic "Site Type" fields, a "State" selection menu, and "Clear" button for geographic bounding box coordinate fields.

Just as it did prior to the re-design, station search results can be downloaded in spreadsheet (CSV text), XML or Google Earth (KML) format. Google Earth files include timespan tags to illustrate the temporal coverage of stations returned in the search results, and map place marks include popup informational "balloons" that provide a brief station description and link to complete station details, which can be viewed directly in the Google Earth application (Figure 4).

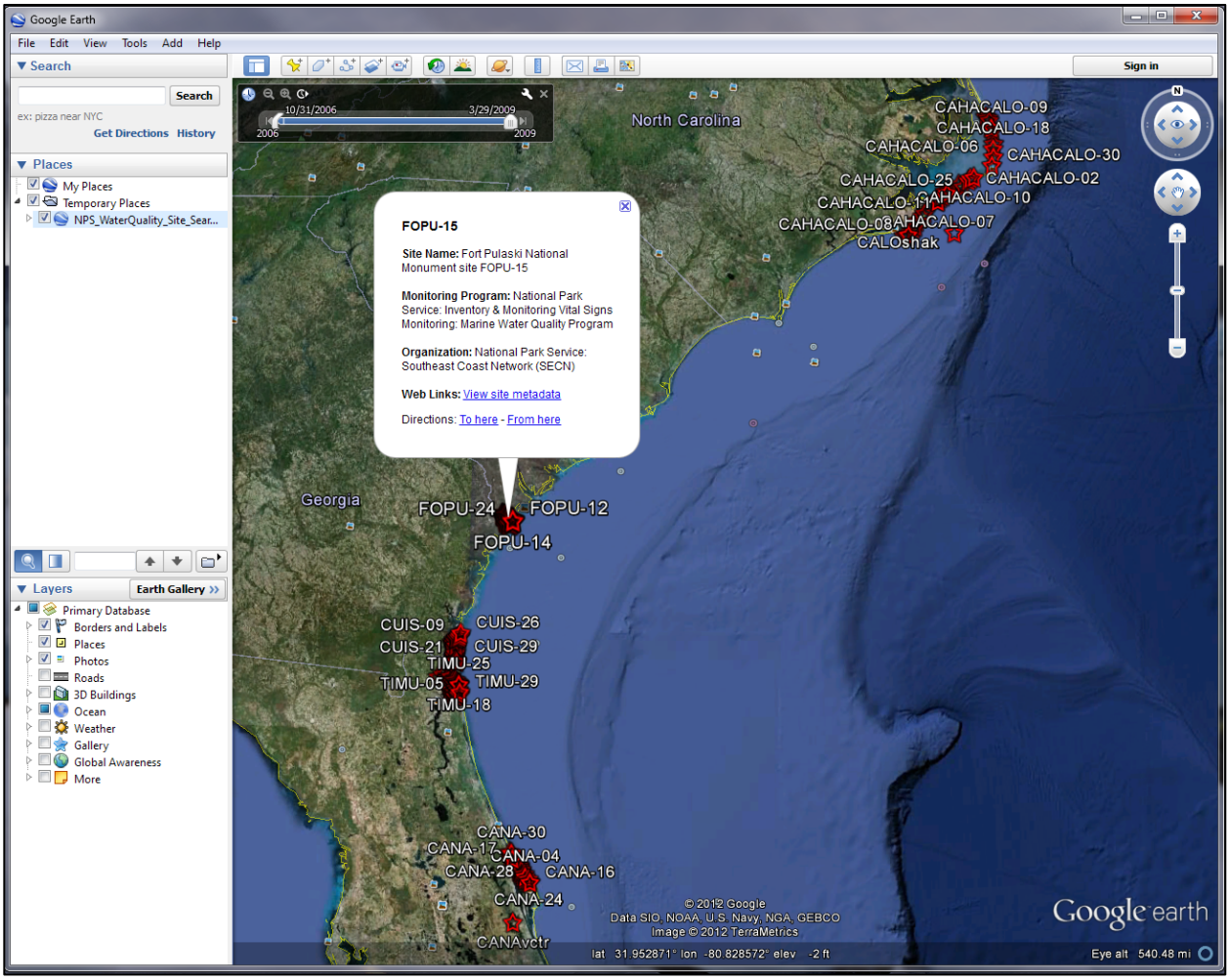

Figure 4. Display of station search results in the Google Earth application. Station placemark balloons contain brief descriptions and links to complete details on the SE Coastal Water Quality Monitoring Metadata Portal web site.

Improved linkages to watershed information – Monitoring station details pages were also significantly enhanced in the new web portal. As mentioned above, both 8- and 12-digit HUCs are now displayed along with complete descriptions of each respective watershed (Figure 5). The HUC codes are also hyperlinked – clicking on the HUC displays all stations in the NPS_WaterQuality database within the respective watershed, supporting quick searches for nearby stations regardless of program and parameters measured. In addition, a USGS icon is included which represents a link to the USGS Water Resources web page for the corresponding 8-digit HUC, allowing visitors to access a wealth of additional links to USGS and EPA resources for the watershed. These enhancements dramatically increase the utility of the web portal for exploring monitoring activities by watershed.

Added a Resources page – The web portal now includes a "Resources" page to provide access to all relevant documents, presentations and database design information, plus links to web service and schema specifications and materials from the 2008 Hollings Marine Lab workshop (http://www.gcrc.uga.edu/wqmeta/app/documents.asp).

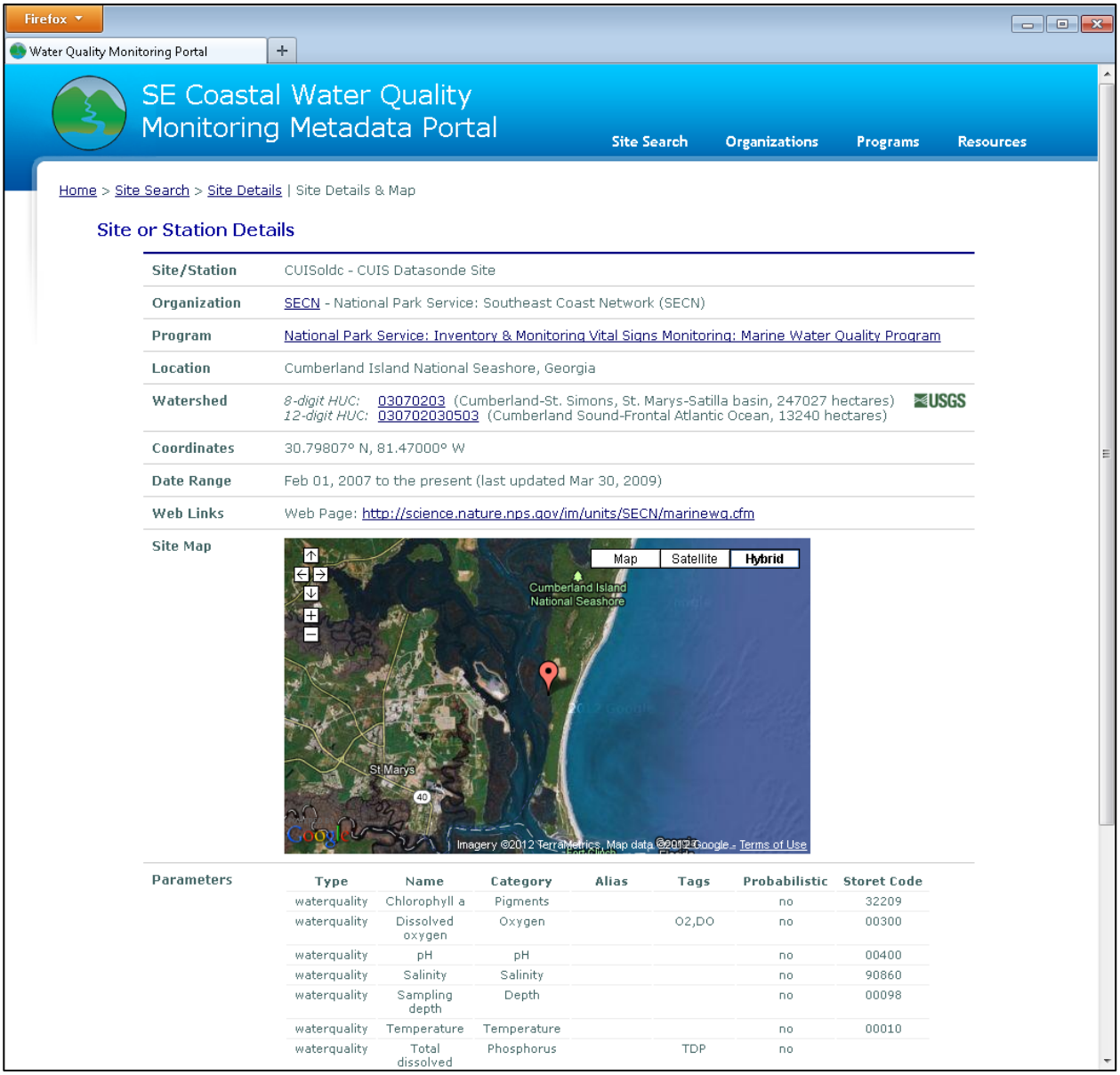

Figure 5. Revised site details page, including comprehensive watershed information and links to USGS resources (http://www.gcrc.uga.edu/wqmeta/app/station_details_map.asp?id=16025)

Objectives

Objective 1: Incorporating Metadata from National Databases

Many states and municipalities rely on large federal databases to distribute monitoring data they collect, including the USGS National Water Information System (USGS NWIS) and US EPA STORET. Mining metadata from these systems to populate the meta-database was therefore an important activity of the original project, and resulted in the majority of the over 16,000 station records included in the original database. We repeated that process for the extended domain included in Phase II of the project, adding and updating station and parameter records to include all relevant USGS NWIS stations across the entire SALCC region. We also updated records for NOAA National Estuarine Research Reserve (NERR) stations across the region. Both USGS and NERR provide web services to query station and parameter metadata so these services were leveraged to populate the database.

We targeted several additional national databases relevant to water quality research for inclusion in the database, including precipitation stations registered in the NOAA National Climatic Data Center (NOAA NCDC) and National Atmospheric Deposition Program National Trends Network (NADP NTN) and Mercury Deposition Network (NADP MDN). Metadata for NOAA NCDC stations were mined programmatically using MATLAB software originally developed for the Georgia Coastal Ecosystems LTER (GCE Data Toolbox for MATLAB, https://gce-svn.marsci.uga.edu/trac/GCE_Toolbox). This software systematically retrieved information from the NOAA web server for all NWS stations within the relevant geographic region, and parsed station metadata and parameter information from the HTML code returned from the server. Metadata for NADP NTN and MDN stations were also mined from station lists and NADP station description web pages using MATLAB.

Through the above efforts we have added metadata for an additional 27,950 monitoring stations to the database (total 44,132), and an additional 479,370 station-parameter records (total 765,412). A total of 44 monitoring programs are now registered in the database, and additional programs and stations are still being added. A map of database coverage as of February 2011 is presented in Figure 6 to illustrate the expanded geographic scope of the database.

Challenges – Significant challenges remain in developing a unified system for discovering water quality monitoring activities. One of the biggest gaps is the fact that we were unable to mine metadata from the EPA STORET system to include in the NPS_WaterQuality database. This is unfortunate, as STORET represents a large repository of information, and it is where many municipalities and agencies deposit their data. Although we successfully obtained basic metadata for a large number of monitoring locations through STORET, complete information regarding site characteristics and which parameters measured at each station can only be retrieved via email, which we were not able to automate. We also determined that there is significant overlap between data registered in NWIS and STORET, so it is unclear how many of these records would represent duplicate information. The newer Water Quality Exchange Network (WQX) protocols being implemented by EPA and states may facilitate this process in the future; however, public query interfaces for this system are still not fully implemented.

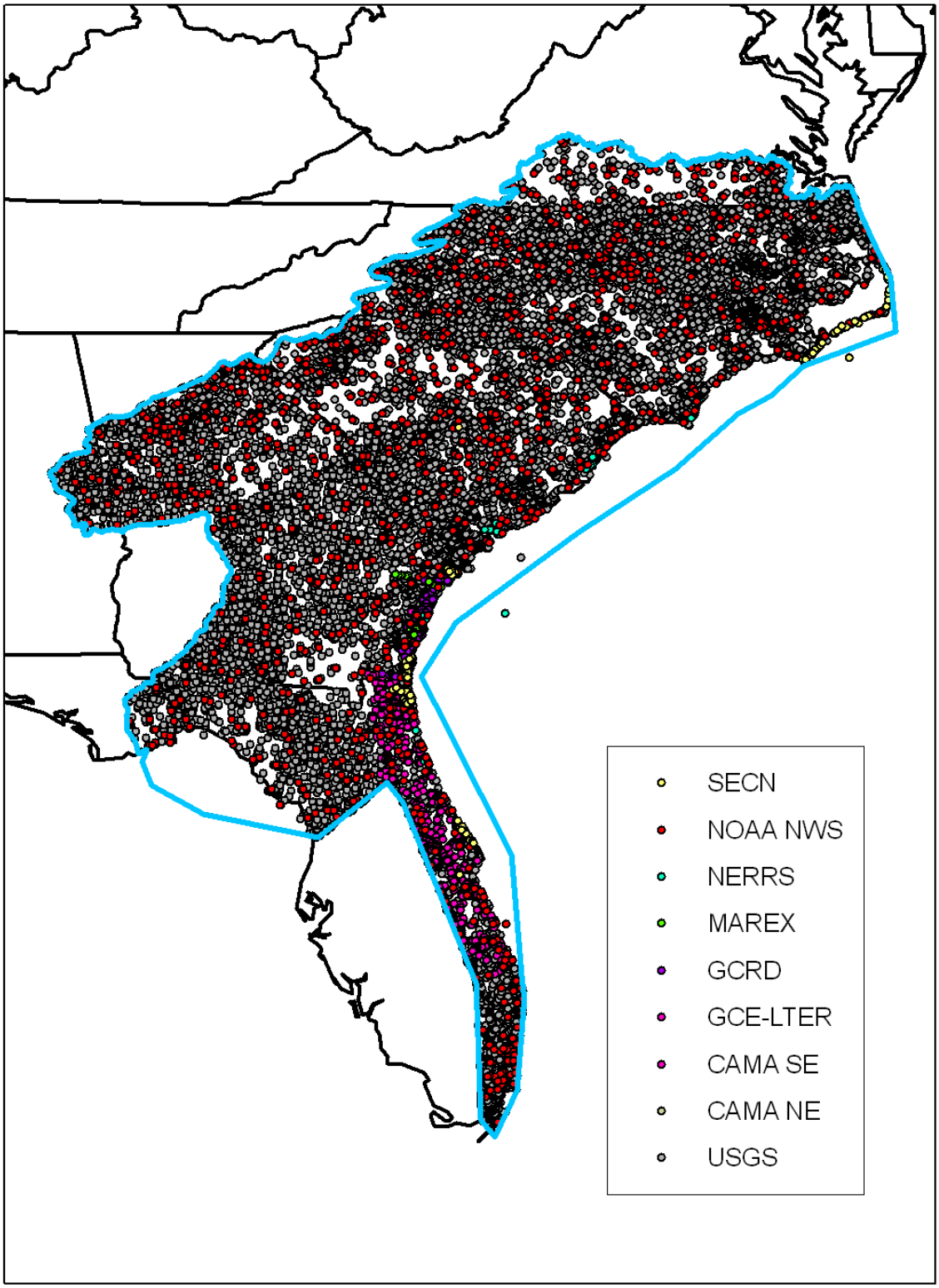

Figure 6. Map of station records in the NPS_WaterQuality database as of February 2011. The blue line represents the geographic boundary of the SALCC region augmented to include the coastal zone of Florida targeted in the original SE Coastal Water Quality Monitoring Metadata Project database.

An additional issue is that federal agencies and other organizations continue to redesign their web sites and data delivery systems, and many new trends in web design preclude mining metadata from web pages programmatically or providing links to information stored in remote systems. During the past year, the NOAA NCDC developed a new Climate Data Online (CDO) web site to distribute meteorological data collected across the country (http://www.ncdc.noaa.gov/cdo-web/). While this site provides a richer and more attractive user interface for locating climate data, the session-based JavaScript web application precludes passing parameters from external web sites to pre-configured searches. In addition, the content-rich station description pages on the first generation NCDC web site have been replaced with simple JavaScript pop-up windows. As a result we can no longer provide direct links to station information or data download pages for NCDC stations, and can only point visitors to the main CDO query form for them to copy and paste station names manually.

Similarly, the NOAA NERR program redesigned their Centralized Data Management web site (http://cdmo.baruch.sc.edu/) several years ago using an Adobe Flash™ user interface that prevents passing in parameters. Both of these programs offer some support for programmatic access using web services, but their implementations differ radically and are not suitable for developing lookup-links on a web portal. In some ways these new web development trends offer one step forward and two steps back in terms of information accessibility.

Objective 2: Identification of New Partners

In addition to the information obtained from National Databases (Objective 1), we were interested in including any additional monitoring programs that were within the SALCC and met our programmatic criteria of having an existing or planned long-term data collection program with public data access. In Phase I of the project we already included several State Agency-managed programs and at least three programs that are primarily associated with Research programs at Universities, as well as data from municipalities such as the City of Jacksonville, Florida. For this new phase, we identified over 25 potential additional partners or programs for potential inclusion using targeted web searches and ongoing inquiries with professional contacts, including representatives of the efforts already included in the database. This included a few federal-state monitoring programs, additional state programs, municipal programs, nonprofit organizations (some local, others with a wider scope), academic research programs, and various partnerships among these entities.

We initiated contact with potential partners through email, briefly introducing the Portal, its purpose and our interest in their program. If we did not receive a reply, a follow up email was sent, followed by a telephone call. If the results were positive, we asked them to complete a query form that we developed with the information required to add a program to the database (Objective 3).

To date, we have only been able to obtain two firm commitments for additions to the database. The first is from the Virginia Department of Environmental Quality (Office of Water Quality Monitoring and Assessment), which operate the Virginia DEQ Estuarine Probabilistic Monitoring Program. This will be a useful addition, in that the database already includes information on state agency programs from NC, SC, GA and eastern FL, creating a full complement of State Agency coastal water quality programs from all relevant states in the

SALCC geographic region. The second confirmed addition is the Lower Cape Fear River Program, operated by the Center for Marine Science, University of North Carolina at Wilmington. They operate a monthly sampling and monitoring program at 35 stations for numerous water quality parameters. Lab results are state-certified, and data are made available to the public. As of this writing, personnel from both programs are currently working to complete the query form for addition to the database.

Challenges – We faced numerous obstacles meeting this objective, as the majority of our calls and emails remain unanswered. We surmise that the primary reasons for the "No Replies" were either that the e-mail did not reach a person with the time or knowledge to respond, or because the program had been discontinued (likely due to budget cuts). In cases where a contact was made, one or more additional challenges became apparent, including: no online data access; data were not organized or compiled in a format that could be readily shared; monitoring that would have originally met the long-term criteria of this project had funding cut unexpectedly or prematurely. In many cases, groups had not had the time to work with the data sufficiently. These combined issues prevented most of these programs from being appropriate for the database.

One likely reason that the Virginia DEQ and UNC-W programs can be readily included is that both efforts are embedded within relatively stable organizational infrastructures that provide support in terms of continuity and institutional memory. In contrast, municipalities appear to have fewer programs that fit the criteria for longevity and data access required for the NPS_WaterQuality database. That said, there are likely existing programs in municipalities and other organizations that could be included but have not yet been identified.

Objective 3: Entering Metadata for New Programs

Microsoft Access® 2003 database interfaces (i.e., Access Data Page applications) developed during the original project were updated and used by GCRC staff to manage database contents for this project. Existing web form interfaces were also updated to allow program representatives to register and update organization and program metadata directly. A "query form" was set up as a Microsoft Excel® spreadsheet template developed to facilitate submission of station and parameter metadata (http://www.gcrc.uga.edu/wqmeta/workshop/files/NPS_WQMeta_station_info_form.xls). Entering fine-grained station metadata using web forms was considered tedious and inefficient, whereas a spreadsheet provides a familiar and user-friendly interface that supports copy-and-paste, database queries and other time-saving techniques to facilitate this process. Content submitted via template was then augmented and uploaded directly to the database by GCRC staff using Microsoft Access®.

Challenges: – Even with a simplified query form, it is still difficult to get an agency to commit the time to register a program in the database. This is likely something that will need to be done on an individual basis, with GCRC staff or others facilitating the process. However, it is possible that as the database becomes more widely known and its utility appreciated, an additional number of programs will see the value in committing the resources to include their information. This is also a function that could possibly be undertaken by the Governor's South Atlantic Alliance or other regional organization.

Objective 4: Database and Web Portal Hosting

The NPS_WaterQuality database is currently hosted on a high capacity Dell PowerEdge 2900 server in the Department of Marine Sciences at UGA, running SQL Server 2005 Standard on Windows Server 2003 R2. This server is equipped with a quad-core Xeon processor and RAID-5 drive array populated with high speed Serial-attached SCSI drives, which provide excellent performance and scalability. The SE Coastal Water Quality Monitoring Metadata Portal web site (http://www.gcrc.uga.edu/wqmeta/) and associated web services are also hosted on a server in UGA Marine Sciences (Dell PowerEdge 1900) running Windows Server 2003 R2 and Internet Information Server 6. Both of these systems are operated by the Georgia Coastal Ecosystems LTER program (GCE-LTER) and GCRC, and are backed up nightly to a RAID-5 array on a separate data storage server and to LTO-3 tapes weekly. We also performed a security review of the web code and hardened the web applications against malicious users.

Challenges – Although long-term hosting of this database may eventually shift to NPS or another agency, the GCE-LTER and GCRC have committed resources to host the database and web site indefinitely as part of the normal operations of these programs.

Continuing Activities

The NPS_WaterQuality database (http://www.gcrc.uga.edu/wqmeta/) is now operating in "production" mode, and is being actively promoted by GCRC and partner programs (e.g. the Georgia Coastal Ecosystems Long Term Ecological Research program). The improvements in both scope and functionality accomplished during this second phase of the project provides researchers, program managers and planners with a useful tool for assessing where environmental monitoring data are being collected in the entire Southeast USA. Although a database is only useful if its content is current, the tools and technology developed for this project have proven effective in automating database updates, making long-term maintenance of this resource practical. The provision for end-users and program representatives to contribute metadata for new monitoring programs and stations also improves the likelihood that this resource will remain relevant.

We have been involved in several proposed efforts to link this database to other web sites and web portals being developed for integrated coastal resource planning, including the regional databases being developed by SECOORA and other groups associated with the Governor's South Atlantic Alliance. However, none of these proposals have been successful to date. Many other groups across the SE USA are also proposing to develop environmental data portals that complement or duplicate the resources we have developed. Although none of these projects have yet reached the stage where they can leverage our system, we continue to offer support and collaboration on these efforts. We will continue to promote this database, and look for opportunities to expand or leverage it to support environmental research and resource management.

Literature Cited

Alber, M., Laporte, C., Sheldon, W.M. Jr. and Carpenter, J.P. 2008. Workshop Summary: SE Coastal Water Quality Monitoring Metadata Workshop, 05-June 2008 at Hollings Marine Laboratory, Charleston, SC. (http://www.gcrc.uga.edu/wqmeta/workshop/files/NPS_SE_CWQ_Workshop_Summary.pdf)

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Appendix A. Entity-relationship diagram for the SE Coastal Network Water Quality Inventory & Monitoring Program Database (*NPS_WaterQuality*, version 3.1, 28-Aug-2012).

The database model was implemented using Microsoft SQL Server 2005 on Windows Server 2003 R2 by Wade Sheldon, Dept. of Marine Sciences, University of Georgia. Changes from version 1 are highlighted in yellow.

Figure A-1. Entity-relationship diagram for the Southeast Coastal Network Water Quality Inventory and Monitoring Program Database.

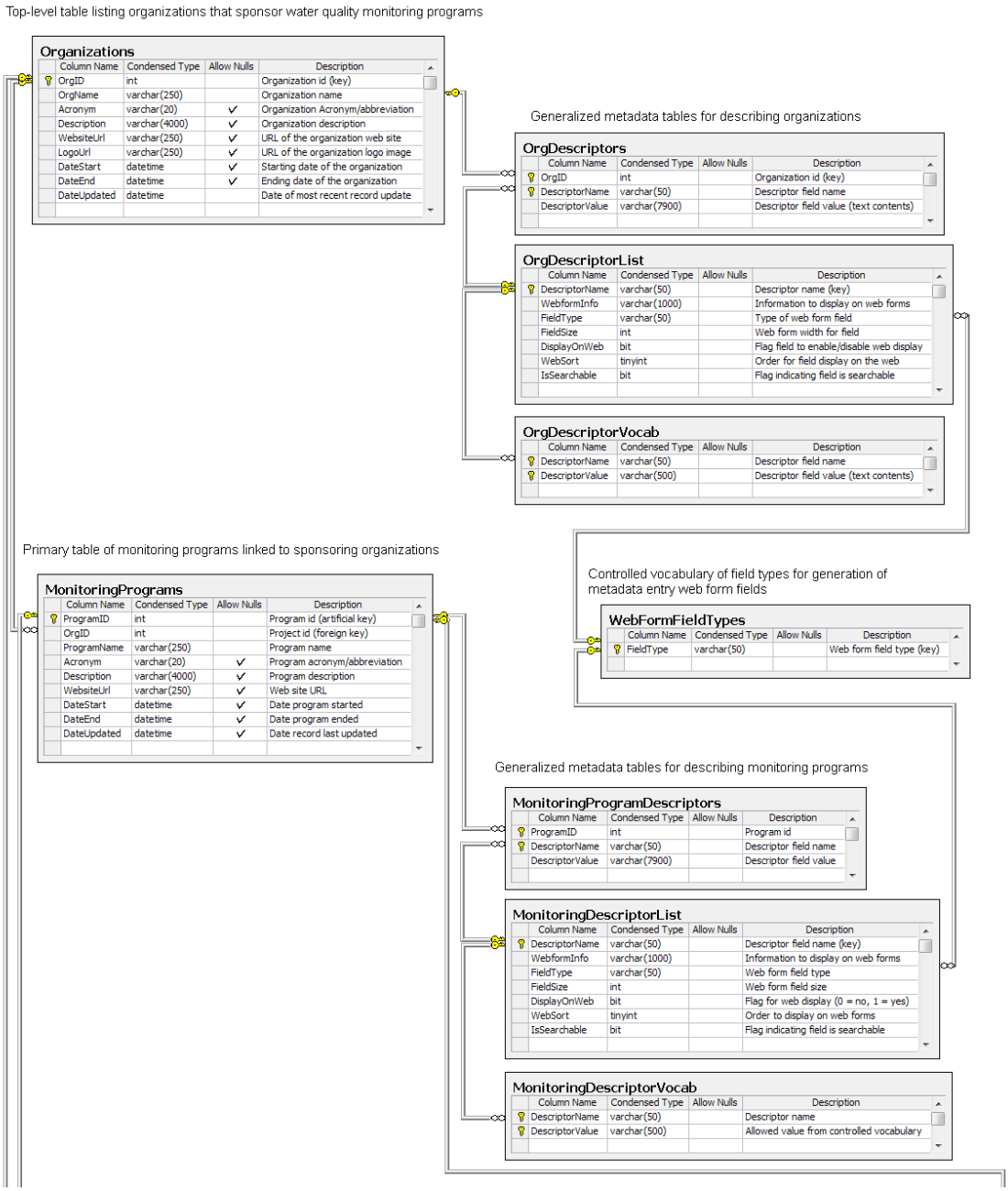

Figure A-1. Continued.

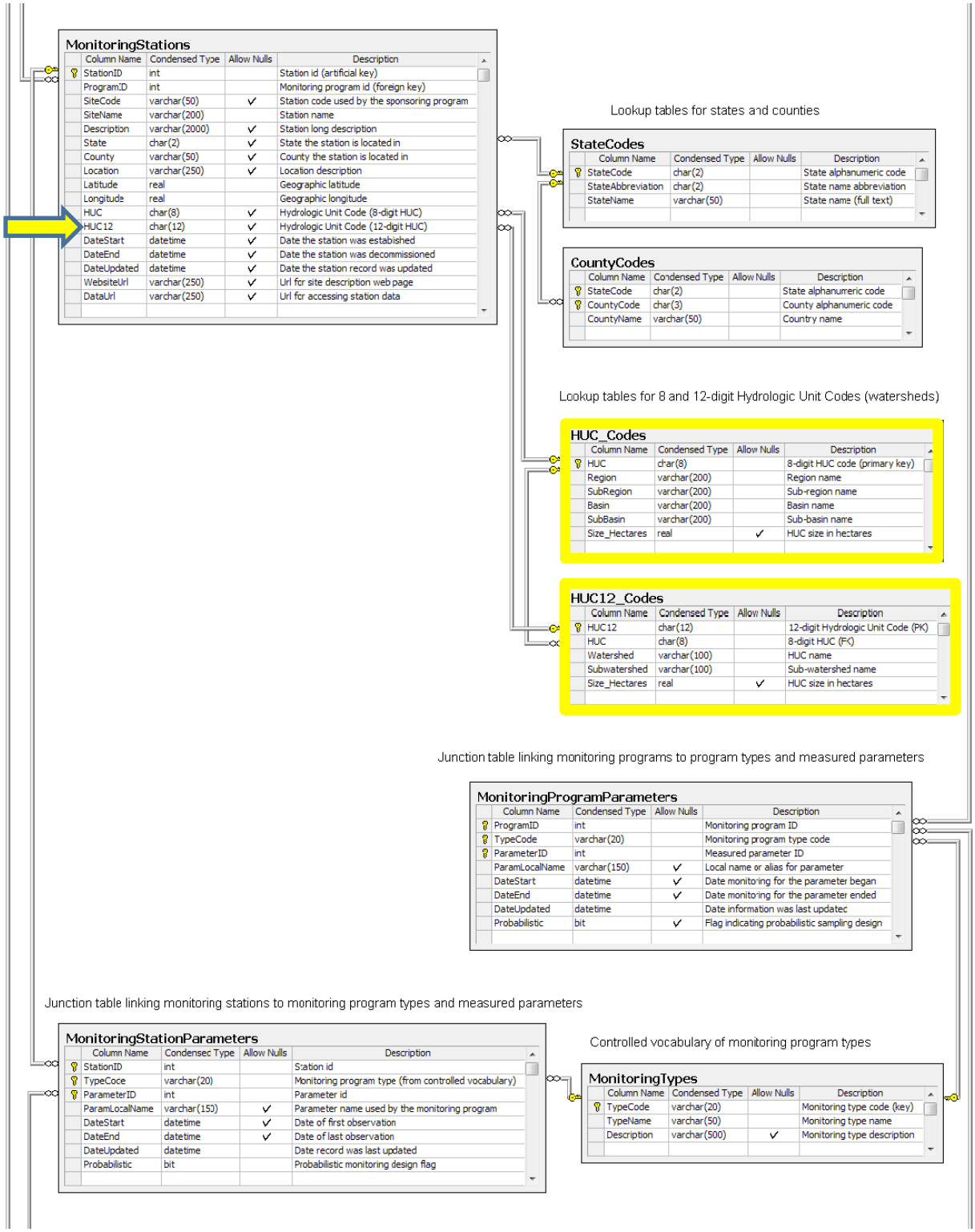

Figure A-1. Continued.

Table of measurement parameters (expanded suite of EPA STORET codes with groups, categories and names parsed from parameter descriptions to support varying search granularity)

Parameters

Column Name	Condensed Type	Allow Nulls	Description
ParameterID	int		Artificial key
StoretCode	char(5)	✓	US EPA Storet Code
ParameterGroup	varchar(50)		Parameter group
ParameterCategory	varchar(100)		General category of parameter
ParameterName	varchar(250)		Name of parameter
ParameterDesc	varchar(500)		Full description of parameter, with medium, units, methods
SampleMedium	varchar(250)	✓	Medium from which parameter measured, if applicable
ParameterUnits	varchar(250)	✓	Units of measure, if applicable
ParameterMethods	varchar(500)	✓	Measurement methodology, if applicable
SearchTags	varchar(500)	✓	Optional list of search tags for the parameter
Updater	varchar(50)		ID of person last updating the record

Lookup list of official US EPA STORET codes

Storet_Codes

Column Name	Condensed Type	Allow Nulls	Description
StoretCode	char(5)		U.S. EPA Storet Code
ParameterGroup	varchar(50)		Parameter grouping
ParameterDesc	varchar(200)		Parameter description

Controlled vocabulary of parameter groups with web display management fields

Parameter_Groups

Column Name	Condensed Type	Allow Nulls	Description
ParameterGroup	varchar(50)		Group name (key)
WebDisplayName	varchar(200)	✓	Name for web display
NPS_Database	bit		Flag for inclusion in NPS database
StoretParameterGroup	bit		Flag indicating group drawn from Storet

Junction table linking database user information to organizations (used to determine access and update permissions on web forms)

OrgUpdaters

Column Name	Condensed Type	Allow Nulls	Description
OrgID	int		Organization id
UserID	varchar(50)		User id (authorized user foreign key)

Database user contact information table

DatabaseUsers

Column Name	Condensed Type	Allow Nulls	Description
UserID	varchar(50)		User id (key)
NamePrefix	varchar(5)	✓	Name prefix
GivenName	varchar(50)		Given (first) name
MiddleName	varchar(50)	✓	Middle name
SurName	varchar(50)		Surname (last name)
NameSuffix	varchar(5)	✓	Name suffix
Organization	varchar(250)	✓	Organizational affiliation
Address1	varchar(250)	✓	Mailing address line 1
Address2	varchar(250)	✓	Mailing address line 2
Address3	varchar(250)	✓	Mailing address line 3
City	varchar(100)	✓	City name
State	char(2)	✓	State Abbreviation
PostalCode	varchar(10)	✓	Zip code (+4)
Email	varchar(100)		Email address
Phone1	varchar(50)	✓	Phone number
Phone2	varchar(50)	✓	Alternate phone number
WebsiteUrl	varchar(250)	✓	Web URL

Web site login information for database users

Logins

Column Name	Condensed Type	Allow Nulls	Description
UserID	varchar(50)		User id
Password	varchar(250)		Password
Role	varchar(50)		Database role
DateExpires	datetime	✓	Expiration date of password

Controlled vocabulary of database user roles (used to control access to web-based update forms)

DatabaseRoles

Column Name	Condensed Type	Allow Nulls	Description
Role	varchar(50)		Database role
RoleDescription	varchar(250)		Role description

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

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National Park Service
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