

A PRELIMINARY WEB PORTAL FOR RI WATER RESOURCES

Principal Investigators

Dr. Thomas B. Boving*, Assistant Professor

Dr. David E. Fastovsky, Professor

Department of Geosciences

University of Rhode Island

*Phone: 401 – 847 7053; boving@uri.edu

Report submitted to:

Rhode Island Water Resources Center

Kingston

June 30, 2004

Abstract

Droughts are fast becoming a part of the natural landscape in Rhode Island and neighboring states, and an informed public is the single most important key to obtaining meaningful and long-lasting responses to such crises. This report represents the preliminary phase of a project that will eventually provide a single, real-time, user-friendly website, designed to provide Rhode Island citizens with a comprehensive overview of the State's water resources. A multi-year graphic record was compiled showing water level fluctuations in the Scituate Reservoir and a 10-day moving average of the drinking water plant influent. These fluxes and levels have been combined to relevant historical data (e.g., average water levels in previous years). The design and content of the webpage was geared toward the general public. Links have been provided to other Rhode Island water resources entities.

INTRODUCTION

"When the well's dry, we know the worth of water."- Ben Franklin

Although southern New England is not commonly considered a region in which water abundance (as distinct from water quality) is a problem, the record from the previous few years suggests that water abundance is indeed an issue about which RI citizens need to be informed. This was exemplified during the most recent draught in 2002, when water levels in New England's reservoirs reached historic lows and citizens were asked to limit water use to for the most urgent application only (e.g. WRB 2002). The purpose of this project was to a) construct the website and b) present current and historical data pertaining to the Scituate Reservoir and its water levels. The goal is to provide a pilot website that eventually will afford a comprehensive, accurate, lucid, and real-time presentation of Rhode Island's water resources.

Although it is relatively easy to find water-related websites in the State of Rhode Island, no comprehensive, real-time, easily understood treatment of water level issues in Rhode Island exists. Providence Water (www.provwater.com) provides regular press releases qualitatively describing the abundance of water in Rhode Island. Details – if provided – pertain only to conditions in the Scituate Reservoir. The US Geological Survey (water.usgs.gov/cgi-bin/daily) maintains a web site that shows maps of “real-time streamflow” data presented in a historical context. NOAA (www.noaa.gov) provides climatological data such as rainfall, temperature, drought indices, and other climatic variables. The State of Rhode Island Water Resources Board (www.wrb.state.ri.us) provides a broad range of data, web links, and press releases dealing with water-related issues.

But, none of the agencies and sites listed above provides a comprehensive, easily understood, real-time treatment of water levels in key RI reservoirs and aquifers. Because the Scituate Reservoir is perhaps the most important public water source in the state of Rhode Island, we have focused attention on it initially. We have compiled a multi-year graphic record of water levels in the Scituate Reservoir, and have associated fluxes in these levels with climatic events and relevant historical data (e.g., average water levels in previous years). Examples of these records are incorporated into the body of this report.

Public education and awareness are crucial aspects of drought management. This project offers built-in functionality to “mainstream” water information to the public via the web. Sometimes, random drought messages through the news media can cause alarm regarding the integrity of supply or the safety of drinking water. This concerted education and outreach program is essential to provide information when wells go dry, or to inform the public and major users of ways to conserve or find alternate sources of water. The web site was designed to provide meaningful information to a wide range of constituents, including students.

METHODS

A project website was created using the Dreamweaver MX software package by Macromedia Inc. (licensed to PI). The website was uploaded to the Department of Geosciences webserver (Dell PowerEdge 6400) and is titled “RI Drinking Water Supply Data Base”. The webserver is secured from unauthorized access by various safety measures (including a firewall and password access protection). The server and the website is remotely accessible to the PI, allowing for frequent updates and additions of data. The website can be accessed via <http://ri-water.geo.uri.edu/>. It was embedded into an existing “Environmental Restauration” website, which provides links to other water related projects of the Geosciences department.

Scituate water level data were collected fully automated by the Providence Water Supply Board (PWRB). The data consisted of four readings per day (every six hours) and include in addition to the Scituate level, the PWRB drinking water plant influent, water consumptions by 11 water suppliers served by PWRB, and the water levels in 5 water storage facilities are recorded. The data set is delivered by email to the PI at 7 AM every morning. Table 1 shows an example of the daily transmitted data set. Because of security concerns, it was decided not to publicize any of the additional daily data.

From: root <root@provwater.com> Date: Wed, 19 May 2004 07:10:00 -0400 To: boving@uri.edu																		
05/18/04	13:00	285.057	69.1417	480.658	393.631	303.78	12.697	227.949	225.499	9.26518	1.24969	2.28791	3.3138	4.72344	6.96557	6.88278	4.85958	8.15824
05/18/04	19:00	285.057	83.5459	483.33	396.523	302.938	12.598	226.943	224.598	9.36466	1.25306	2.40513	3.27106	4.38828	6.63736	9.55678	4.11722	8.57436
05/19/04	01:00	285.028	86.2091	482.377	395.497	303.121	12.2964	227.946	224.598	8.76713	0	0.0315018	0	3.43773	2.23297	2.97436	3.7265	5.96044
05/19/04	07:00	285.057	86.7664	481.249	393.241	304.879	12.796	229.448	225.8	9.16408	0	2.48425	3.33578	3.95971	6.82784	8.6337	4.1514	9.19853

Figure 1: Example of the daily updated Scituate Reservoir levels that are automatically recorded by the PWRB every six hours (first three columns). All other columns show water fluxes to the main PRWB customers, elevations in local water storage facilities, and PRWB drinking water plant influent.

RESULTS

The “RI Drinking Water Supply Data Base” website was designed with ease-of-use in mind and following the latest industry standards. All descriptions and explanations were kept comparable short and scientific lingo was avoided as much as possible. The material present is understandable by users Grade 7 and higher. The website relies heavily on visualization, e.g. a graph of the current Scituate Reservoir level can be uploaded by simply clicking on a thumb-nail picture. Resolution and graph size were kept at moderate levels for minimal download times. This was deemed necessary to serve those citizens that do not have access to high-speed internet connections. The website also provides links to the Providence Water Supply Board (PWSB), the Rhode Island Water Resources Board (WRB) and the Rhode Island Water Resources Center websites. The WRB in particular provides additional information about the status of Rhode Island’s water resources. For example, the WRB issues a *Draught Advisory*, *Watch*, *Warning*, and *Emergency* (in order of increasing draught severeness) if warranted.

The central parts of the project website are a description of the data flow and the graphic representation of the water level and water consumption data. The following paragraph is an excerpt from the website.

“The Scituate Reservoir, located about 15 miles west of Providence, RI, serves most of Rhode Island’s population with drinking water. Water storage in the main Scituate reservoir began in 1925 and a nearby treatment plant went in operation in 1926. Since then, the water level in the reservoir has been constantly monitored. In recent years, the Scituate Reservoir was equipped with modern computer based recording equipment to monitor reservoir water level and treatment plant influent. The digital records are collected by the Providence Water Supply Board (PWBS), which operates the Scituate Reservoir. PWBS then forwards water level and plant influent data automatically to Dr. Boving’s data base where the data stream is converted into graphs for immediate display on this website.”

Figure 2 shows an example of the water data graph displayed on the project website. The graph was generated from daily data sets supplied automatically via email by PWBS. All incoming data were retrieved over a T-1 line. At URI-GEO the incoming data converted into a common data format (ASCII comma delimited format). Incoming data was stored on a PC (Dell Dimension 8200) and backed up on an external hard-drive (Maxtor 120 GB) on a weekly basis. The raw data was loaded into MS-EXCEL (the statewide standard).

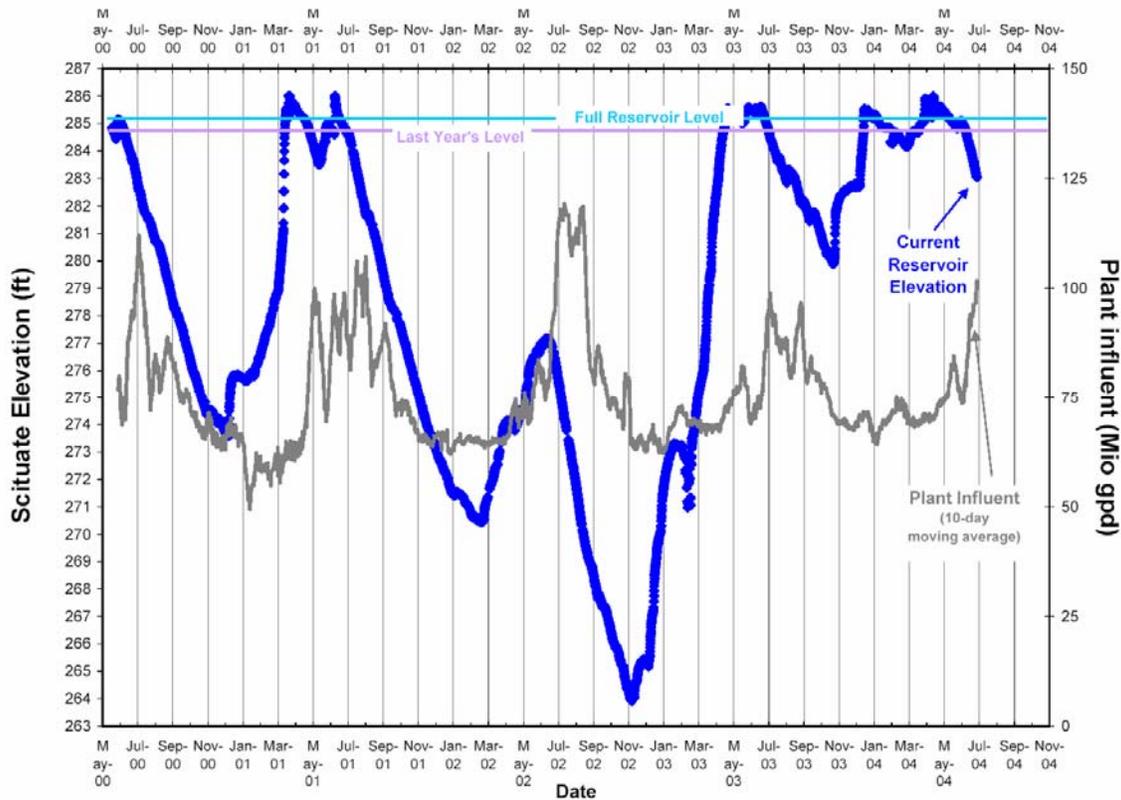


Figure 2. Water levels in the Scituate Reservoir, 05/01/00 – 06/30/04. Diamond line represents approximately 5700 data points taken at a rate of 4/day. Solid line represents a 10-day moving average of plant influent. Also indicated are last year’s reservoir level and the Scituate Reservoir overflow elevation (285 ft above sea level).

In the future, an upgrade to an ORACLE database system may become necessary as the amount of data generated approaches the capacity of EXCEL. Within the MS-EXCEL environment, the data was organized based on the following criteria: data source, date and time of collection, sampling location, sample value, and comments. Besides calculating delta-values (=changes), the data was continuously added to graphs and tables. EXCEL graphs were converted into Adobe Acrobat files (pdf format). The graphs show, for example, daily water table fluctuations at a given measurement point. The 10 day moving average of the plant influent were calculated and graphed together with the daily water level data. Currently, the raw data cannot not be downloaded from the website.

First success has been made with a pilot system (Java script) that automatically extracts data from incoming PWRB email (see Figure 1) and converts it into an EXCEL graph. Currently, problems remain with linking the graph to the server. The ultimate goal is to automatically update the website in near real-time and to include data from as many reliable sources as possible. It is expected that a network evolves over a period of years, as additional monitoring, quality control, and data exchange systems are put in place and as additional hydrological modeling is developed. This effort will continue even after the end of this project's funding period.

ACKNOWLEDGEMENTS

This project was made possible by a grant from the Rhode Island Water Resources Center. We thank former URI graduate student Mr. Prashanth Galisukumar for his help developing the website and the data transfer protocols.

REFERENCES

State of Rhode Island Water Resources Board (WRB) – Press releases on 01/17/2002 and 10/02/02.