Water-Use Reporting Subcommittee Report

Prepared for

The RI Water Allocation Program Advisory Committee (WAPAC)

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Water-Use Reporting in Rhode Island

1. Introduction

Rhode Island General Laws, Chapter 46-15.7 *Management of the Withdrawal and Use of the Waters of the State* charges the Water Resources Board (WRB) with conducting and maintaining a detailed inventory of the state's water resources and with identifying water sources where existing uses and users have reached, or threaten to approach or exceed, the safe yield of that source. This charge was intended to correct the historical practice of allocating water resources on a first come, first served, or ad hoc basis with minimal or no consideration given to overall allocation of the resource, and to meet all present and foreseeable needs.

In the 1980s, the Water Resources Board commissioned the Arthur D. Little Study, which was published in 1990 and became the basis for State Guide Plan Element 722, Water Supply Plan for Rhode Island (1991). The study provided preliminary baseline data for categories of water withdrawal (from USGS, 1985) and water use by sector for the 30 largest public suppliers. Currently, the Board has contracted with United States Geological Survey (USGS) and the University of Rhode Island (URI) to complete water use and availability studies that collect actual and estimated water-use data, track the movement of water, including wastewater, and assess the amount of water available. These studies also provide valuable data regarding wastewater, stream flow, and detailed water use in areas not served by public water suppliers. The information from the studies populates an Access database called the New England Water Use Data System (NEWUDS).

With the heightened awareness brought about by persisting drought conditions and with the results of water-use studies and several modeling efforts imminent, the Water Resources Board, at its June 2002 meeting, directed staff to begin public outreach on water allocation and, as a first step, to explore a water-use registration or reporting program targeting the two study areas – the Blackstone and the Wood-Pawcatuck watersheds. Potential benefits of a water-use reporting system include:

1. Addressing existing data "gaps"
   - Complement data reported in the Water Supply Systems Management Plans (WSSMPs) and the water-use studies
   - Bridge the 5-year revision interval for WSSMPs
   - Provide more accurate data on uses that currently are estimated (i.e. self-supply use)
2. Improving water management by providing the data framework for:
   - Assessing the effect of new supplies and users
   - Tracking the movement of water
   - Allocation of water during shortages
3. Providing a mechanism to update the water-use data systems (NEWUDS) with current water-use information.

These data would permit seasonal and annual tracking of water use and would provide a basis for the estimate of future demand, as an aid to basin or statewide planning and decision making including:

1. Identification of competing uses
2. Facilities planning to address water supply shortfalls and to meet future demand
3. Evaluation of environmental impacts of proposed new water withdrawals on wetlands and water quality
4. Identification of stressed watersheds for more refined management
5. Drought management
6. Tracking and evaluating out-of-basin transfers.

The Water-Use Reporting Subcommittee of the Water Allocation Program Advisory Committee (WAPAC) was therefore charged with investigating the need for, and potential structure of, a water-use reporting system in Rhode Island.

Subcommittee's Mission:
Review water-use data and identify gaps in the two pilot basins (Pawcatuck and Blackstone); recommend methods for addressing those gaps.

Deliverables:

- A review and assessment of water withdrawal reporting, registration and permitting systems in other states and how they relate to the overall allocation approach.
- An assessment of current water-use and availability data and, if warranted, recommendations for a reporting system.

This report summarizes the subcommittee's assessment of reporting programs in other states, existing water use data in Rhode Island, and the nature of the gaps in the available data. The report concludes with recommendations for a water-use reporting system that will address those gaps and will provide the State with the data needed to support the stated objective that "*adequate data is essential to determine the capabilities of the state's water resources to support various uses and users and the quantities of water needed for these uses.*" RI-G.L. §46-15.7-1.

2. Water Use Reporting in Other States

In order to provide a reference for developing a reporting program in Rhode Island, the Subcommittee first reviewed water-use registration programs in other states to answer the following questions:

- At what thresholds do other states require reporting?
- How do other states address private wells?
- What types of exemptions and/or grandfathering are allowed by other states?
- What differences exist in reporting for surface-water versus ground-water withdrawals, and
- What applications are required?

The research highlighted findings from the states of Vermont, New Hampshire, Massachusetts, Connecticut, New Jersey, and Maine. The Water-Use Reporting Subcommittee also reviewed a matrix prepared by the New England Interstate Water Pollution Control Commission (NEIWPCC) detailing water allocation and permitting in New England and New York (Appendix I; NEIWPCC, 2003). Pennsylvania's program was specifically researched regarding water-use reporting requirements for the agricultural sector.

The following presents a summary of findings:

Water-Use Reporting Thresholds:

Different states use widely varying thresholds for registration. These thresholds range from >20,000 gallons per day (GPD) in Maine to >100,000 GPD in New Jersey (for 30 consecutive days) and Massachusetts to as high as 250,000 GPD. In two critical watersheds in New Jersey, water allocations to users were reduced by 22% and 50% to alleviate overuse conditions. It is significant that Pennsylvania just passed a law establishing a 10,000 GPD threshold. In Rhode Island, entities that use 3,000,000 gallons per year are considered "major users" and if publicly supplied, their use is required to be reported as part of the supplier's WSSMP. There currently is no requirement for reporting by *self-supply* users in Rhode Island. The Regulated Riparian Model Water Code (American Society of Civil Engineers Standard No. 40-03) states that no permit shall be required for withdrawals less than 100,000 GPD. Because Rhode Island is a small state and water use is predominantly residential, a lower threshold is appropriate.

Most states use an annual average GPD of water withdrawn/used to determine the threshold for registration. Some use an average GPD over any continuous three-month period to account for seasonal water usage. Specifically, Massachusetts requires users of >9,000,000 gallons over any three month period (100,000 GPD) to register. This threshold captures seasonal use such as golf courses and farms. Some states use an average GPD over 30 days for high impact uses.

Many states use geographic considerations in determining registration requirements. Maine bases its threshold on acreage of water bodies where withdrawals take place. Some states require 200'or 400' buffer zones from rivers, streams, ponds, or drinking water reservoirs that are, in some cases, deemed critical areas where registration of water uses is required. Rhode Island law already provides for buffering under the Wellhead Protection and Source Water Protection Programs as well as in certain coastal areas where Special Area Management Plans are in effect. However, given its small size and the abundance of water bodies, a geographic approach would end up capturing virtually the whole state.

Private Wells/Self Supply

In some states, (i.e. New Jersey and Connecticut) owners of private wells are required to report if they meet the reporting threshold and in others, (i.e. Maine) private wells for domestic use are explicitly exempted from the registration requirement. For private wells, the Subcommittee decided that further investigation was necessary to determine

whether there was a clear need to require registration. Domestic water use can be estimated, but there are data gaps in terms of self-supply for commercial and industrial users. A subsequent section of this report addresses the accuracy of water-use coefficients for estimating self-supply water use.

In Rhode Island, the RI Dept. of Environmental Management (DEM) is authorized to collect well logs from certified drillers (R.I.G.L. §46-13.2-5). These records could be entered into a database and analyzed. The State also has permit data regarding building projects that could be used to assess growth areas and impact.

Exemptions/Grandfathering

The state of Connecticut allows grandfathering of existing water withdrawals, but this system is fraught with problems and can result in over-allocation of the resource. Most states do have exemptions. Pennsylvania requires agricultural users to register if using greater than 10,000 GPD. Most states designate health and safety uses as priorities, but not necessarily as exemptions. The Regulated Riparian Model Water Code (Model Code) specifically exempts domestic uses, which includes outdoor watering. Some states exempt non-consumptive uses such as water-based fish farming. The Subcommittee also found that in many cases, exemptions have been tied to other existing regulations. Rhode Island identifies commercial agricultural use as a priority use in RIGL §46-15.7 but does not explicitly exempt agricultural users from reporting or registration requirements.

Ground Water versus Surface Water

Most states seem to apply the same rules to surface and to ground water withdrawals. Fees and length of time to register may differ depending on the source. Fees might depend on the size of a watershed, whether the withdrawal results in an out-of-basin transfer, whether the withdrawal is in a critical area, and/or the potential impact of the withdrawal.

Application Requirements

Most states have a short registration form (1 to 2 pages), which is updated annually or over longer time periods. Registration periods in other states range from once every five years for some users to once every 10 to 20 years for public water suppliers. Registration requirements are typically phased in over 1 to 5 years to allow for the purchase of meters and other necessary equipment. Permit renewals may require revaluation unless the user can justify no additional impact.

Fees are sometimes related to GPD withdrawn (i.e., the lower the GPD, the lower the permit fee). In Rhode Island, the current well registration fee is $100 to $200. Some states use a sliding scale of $500 to $4,000 depending on the GPD. In Connecticut, the minimum is $1,200. In Rhode Island, public, industrial and commercial users already pay monthly water quality protection charges.

Applicability to Rhode Island

Thresholds - The Subcommittee researched the number of major users in Rhode Island and percent of water usage by major users in five public water systems in the two focus watersheds: the Wood-Pawcatuck Watershed and the Blackstone Watershed. Data worksheets from Water Supply Systems Management Plans (WSSMPs) for Cumberland, South Kingstown, Pascoag, Westerly, Woonsocket and United Water RI were analyzed. Three of these systems did not have any users that exceeded 20,000 GPD on an annual basis. Two systems had five users and one system had three users that exceeded 20,000 GPD on an annual basis. Based on this review, a threshold of >20,000 GPD would not appear to capture an inordinate number of users. The Model Code provides for entire classes of water users to register when the aggregate of small uses adds up to a large use. Because Rhode Island is a small state and water use is predominantly residential, a lower threshold would be more appropriate and would allow the State to capture water use that is significant at a watershed or basin level. A threshold should be based on yearly water use with an additional threshold for any three-month period to account for seasonal use.

Geographic Approach - A geographic approach, establishing registration thresholds based on distance from a critical resource (i.e. surface water body) would not be appropriate in Rhode Island, as it would capture the majority of the state.

Private Wells - A clear need must be established before any effort to register annual withdrawals from private wells. In some watersheds, self-supply use is a significant percentage of the total basin water use and therefore must be considered. A subsequent section of this report addresses the accuracy of water-use coefficients as a tool for estimating self-supply withdrawals and use.

Exemptions/Grandfathering - Grandfathering of uses is not practical; however, the potential need for some exemptions based on regulations currently in place should be investigated.

Ground Water versus Surface Water – The ground-water and surface-water resources of Rhode Island are intimately linked; the same threshold values should therefore apply to both ground-water and surface-water withdrawals.

Application Requirements – A registration application or form should be web based and relatively short to ensure maximum compliance. Further research is necessary to determine the appropriate fees for registration.

3.0 Summary of RI Water Use/Withdrawal Reporting Laws And Regulations

Water Resources Board

Title 46, Chapter 46-15.7 Management of the Withdrawal and Use of the Waters of the State, states that "*Management of the amounts, purposes, timing, locations, rates, and other characteristics of fresh water withdrawals from ground or surface waters is essential in order to protect the health, safety, and general welfare of the people of the state of Rhode Island, to promote the continued existence, diversity, and health of the state's native wildlife and plant species and communities, and the fair and equitable allocation of the water resource among users and uses, and to insure that long-range rather than short-range considerations remain uppermost. To support these objectives adequate data is (sic) essential to determine the capabilities of the states water resources to support various uses and users and the quantities of water needed for these uses.*"

The Water Resources Board (WRB) is identified as the State agency that manages the withdrawal and use of the waters of the State of Rhode Island and is charged as follows: "*The Board shall conduct a comprehensive and detailed inventory of the water resources of this state, and shall maintain the inventory on a current and valid basis.*

(1) The purpose of this inventory shall be to establish the quantity of water existing in every water source, the quantity that is being used or is needed for every significant purpose, as listed in § 46-15.7-1(a)(2) preceding, and the quantity that is available to support other uses.

(2) The Board shall use data available from state and federal agencies, local governments, elements of the state guide plan, water supply system management plans, persons who withdraw water, and any other valid information that contributes to accomplishing the purpose of this chapter. It is the responsibility of each water user to provide data, or the best available estimates, on their water withdrawals.

(3) The Board shall gather any other information that will assist it in determining the capability of the state's water resource to support various uses and users, and the quantities of water being used to support these. All of the uses and users listed in § §46-15.7-1(a)(2) and any others that are relevant shall be included."

Water Supply Systems Management Plans

Title 46 Chapter 46-15.3 Public Drinking Water Supply System Protection, Section 5.1 Water supply systems management plans and Section 7.5 Completion and filing of water supply systems management plans (http://www.rilin.state.ri.us/Statutes/TITLE46/46-15.3/INDEX.HTM), outlines the required public supplier water reporting requirements. The reporting requirement applies to public suppliers that obtain, transport, purchase, or sell more than 50,000,000 gallons of water per year. In addition, suppliers are required to identify "major users" defined as customers who purchase more than 3 million gallons per year.

RI Department of Environmental Management

Up until 1997, the RI Department of Environmental Management (RIDEM) had regulatory purview over water supply management. The agency still oversees a variety of water-use activities including watershed protection, water quality classification, wastewater discharge permitting, and groundwater pollution control.

RIDEM does not have explicit legislative authority to require water withdrawal or water-use data reporting. RIDEM maintains legislative authority to collect data on the installation of private wells.

R.I.G.L. §46-13.2-5 Record of wells:

(a) Within thirty (30) days after completion of a well, a well drilling contractor shall provide the owner, the [RI well drilling] board, the department of health, and the department of environmental management a record indicating:
    (1) The well owner's name and address,
    (2) The location of the well,
    (3) The well depth,
    (4) The geologic materials and thickness of materials penetrated,
    (5) The amount of casing,
    (6) The static water levels, and
    (7) Any other information that may be required by regulations adopted under this chapter.

(b) A record for a drive point well where no earth materials are removed from the well bore shall be sufficient if the owner's name, well location, depth, casing, static water level, and screen data are indicated.

Well drilling records are maintained as paper records and are not currently incorporated into a statewide database. A copy of the record is sent to the USGS and RIDOH. Unfortunately, all well logs are in hard copy format and are filed by town. RIDEM has records that go back to the mid 1970s but well logs were not required to be submitted until 1990. Therefore, prior to that date, the records are somewhat incomplete. Well logs are a matter of public record and can be viewed at any time.

4. Current Sources of Water-Use Data in RI

Water Supply Systems Management Plans

Municipalities and water suppliers subject to R.I.G.L. §46-15.3-5.1 must review their plans at least once every five (5) years, and amend or replace their plan to remain current. An interim report must be submitted no later than 30 months from the Board's approval date of the WSSMP. The 30-month report must include the following updated water system data:

- Metered water production from each source on a monthly basis;
- Metered water purchased from other water supplier(s) by interconnection, on a monthly basis;
- Estimate of population served, and number of service connections or area connections (institutional);

- Total, metered, retail water sales by user category on an annual basis or area connection data (institutional);
- Metered, wholesale water sales by interconnection on a monthly basis;
- Estimated volume of water used for fire-fighting purposes on an annual basis;
- Estimated volume of non-account water on an annual basis;
- Identification of major users (>3 million gallons per year).

Some water suppliers (i.e. Kent County Water Authority) also identify their largest users whether or not they meet the "major user" definition.

The Subcommittee learned that there are differences in data collection and reporting in the WSSMPs that limits current use of the data for statewide compilation purposes. Although the WSSMP worksheets are set up to capture monthly data, water supplier billing cycles vary across the state with some operating on monthly, quarterly or even annual billing cycles. Additional staff would be required to read and maintain the meters. Installation of automated meters could improve the flow of data at a cost of approximately $200 per meter. The financial impact on public water suppliers is, therefore, significant. For example, if the cost of a master meter is $8,000, then an overall investment for a medium-size water supplier might be $250,000. Not every utility will, or can, provide all data monthly if it is financially impractical.

Currently 28 suppliers submit WSSMPs. The total number of community and noncommunity public water suppliers in the state is approximately 485. The WSSMPs therefore capture water use by the largest public suppliers, but no volume data are currently being collected for smaller public suppliers and for self-supply (community, commercial/industrial) users. The total estimated annual water production by those 28 suppliers is 38,250 million gallons (38,250,000,000) per year based on data from plans submitted for years ranging from 1999 to 2002.

RI Department of Environmental Management

Although RIDEM collects data on wastewater discharges through the RI Pollution Discharge Elimination System (RIPDES) permitting process, it collects very little information regarding water withdrawal and/or usage. Selected data may be submitted to RIDEM as part of special studies conducted on a particular water body or stream pursuant to the wetlands regulations and/or water quality certification process including water use information, staff gage heights at streams, precipitation measurements, and average daily pumping. Data intervals vary-- weekly for staff gage readings and monthly for pumping information. RIPDES data are kept in a database and reviewed on a quarterly basis. These data may be valuable as a quality control check on estimated withdrawal and use data, and as a primary source for return flow data. Staff gage and withdrawal data are not maintained in a database.

Some examples of data currently being collected by RIDEM include:

- Ocean State Power – continuous monitoring station on the Blackstone River. RIDEM has the ability to retrieve data on demand in real-time.

- Return flow data – Waste Water Treatment Facilities, point source discharge (RIPDES permit) monthly average and daily maximum, semi annual or monthly reporting depending on permit requirements.
- Kingston Water District - monthly reporting requirements pursuant to a wetlands permit. Once the wells are on line, monthly data will be transmitted electronically to RIDEM as collected by a stream gage with recordings taken at ½ hour intervals.

The level of reporting/monitoring requirements is not uniform among RIDEM permit programs. RIDEM permitting requirements have become more stringent for public suppliers and often include data reporting. This is not true for non-public entities. There are farmers pumping from wells, ponds and/or streams who have no permits and who do not report and farmers with wells and permits (freshwater wetlands permits and/or water quality certifications) but no data reporting requirements. Beyond the 200-foot buffer around major water bodies, no permit or review is required unless there is an impact on a down-gradient wetland. Siting power lines in a wetland is sometimes enough to "trigger" a permit with data-reporting requirements.

AD Little Report/State Guide Plan Element 722

In October 1990, the Arthur D. Little Company (ADL) completed a water supply analysis for the State of Rhode Island, which was subsequently adopted as State Guide Plan Element 722. ADL personnel collected information on source waters, withdrawals, demand, conservation practices, system infrastructure, and supply augmentation in order to determine whether the state's combined long-term water needs could be met. The research also addressed many peripheral, though related, criteria concerning population, employment and housing, economic development, pollution and the environment.

The consultants divided the state into four geographical regions to more accurately characterize local trends and priorities. Among the major findings, approximately twenty-eight water districts served about half of the state's geographic area and nearly 90% of its population. These statistics are important because only the largest suppliers are required to prepare detailed, water supply systems management plans.

The culmination of the analysis resulted in an exhaustive set of recommendations complete with implementation schedules and designated jurisdictions. The principal areas of focus centered on solutions which could be attempted within six to eighteen months as well as the state's critical role in effecting change. Justification regarding the need for improved data collection and analysis is embedded in the planning, operations and regulatory section. In sync with State Guide Plan Element 721, Water Supply Policies for RI, the ADL report urged a more proactive planning effort integrating water quality *and* quantity considerations for both water and wastewater.

Recommendations germane to this study are listed below:

- *Annual data should be made available on water use (and wastewater discharge) by component and uniform user classes (residential, nonresidential, leakage,*

other non-account); on rate levels and structures (both water and wastewater); on major users or dischargers; on service area changes and number of accounts; on wholesale water sales and purchases; on water resource withdrawals, levels and quality; on the physical characteristics of water supply storage facilities and transmission lines (for both annual and daily peaking requirements/ capabilities); on the performance of, and expenditures on, ongoing supply and demand management activities, and on plans or projections for changes in any of the above. These data should conform to that developed and used by USGS and others at the national and regional level.

- *Monthly data should be made available on freshwater withdrawals, water sales, and water resource levels, as well as wastewater treatment.*

- *Where feasible, it should be the objective to read meters quarterly to both assure a better database, and to assure better customer awareness of water use.*

- *The submission of consistent information certified by the water utility (data or estimates) should be made a requirement for any consideration of rate filings with the PUC, and for any participation in state or federal financing programs and consideration or approval of system extensions or expansions.*

Rhode Island Department of Health

The Rhode Island Department of Health (RIDOH) Office of Drinking Water Quality works closely with local water suppliers, other state and federal programs, and various divisions within the RIDOH to ensure the safety of the State's drinking water. The office regulates the construction and operation of all public water systems and sources and assures the safety of drinking water supplies through monitoring requirements. RIDOH therefore collects data from public suppliers on the quality of water (both pre- and post-treatment) to ensure that the public water supply meets US Environmental Protection Agency (USEPA) safe drinking water standards. RIDOH does not, however, collect volume data from suppliers. Water quality data are submitted to the USEPA and are accessible on its web site: http://www.epa.gov/enviro/html/sdwis/sdwis_query.html.

RIDOH also keeps records for pumping capacity (not actual pumping) of Community and Non-Community Wells; there are 158 community wells and 473 non-community wells.

USGS Water-Use Studies

The Water Resources Division of the USGS has been compiling water-use data on a 5-year interval since the 1950's including source (ground water or surface water), use (domestic, commercial, industrial, etc) and discharge (public wastewater, private disposal, return flow, etc.).

Water use, including consumptive use, is delineated by major use categories such as public drinking water supply, industrial, commercial, domestic and agricultural use. Water-use data include metered readings for public suppliers and other major users and

estimated data for self-supply users. Self-supply estimates are based on water-use coefficients that correspond to type of industry or commercial enterprise using standard industrial classification (SIC) codes or type of agricultural activity. Commercial and industrial water-use, for example, may be estimated by multiplying the number of employees working in a given enterprise by the per-employee water-use coefficient (as identified by the SIC code). Metered data are generally more accurate than estimated; however, regular calibration of meters is typically required to ensure accuracy. Ongoing evaluation of estimation methods is also critical as changing technology (more efficient use/reuse of water) and production techniques (more automation/fewer employees) may result in significant changes in water-use coefficients over time.

The USGS initially developed the State Water-Use Data System (SWUDS) for storage and retrieval of site-specific information and the federal Aggregate Water-Use Data System (AWUDS) for national statistics. At that time, the trend in water related information was centered on groundwater modeling and withdrawal. Data were compiled for each state by county and classified by 8-digit hydrologic subregion. As information accumulated, it was archived in the National Water Data Storage and Retrieval System (WATSTORE).

Data that were formerly stored and processed on a mainframe computer are now accessible online at http://water.usgs.gov/watuse/. The SWUDS database was redesigned to be more compatible with state and local needs. In the northeastern district, the New England Water Use Data System (NEWUDS) has emerged as a prototype designed to reflect regional data requirements.

Natural Resource Conservation Service (NRCS)

The NRCS works extensively with agricultural producers on irrigation water management activities. For over 12 years, NRCS has provided technical and financial assistance to growers across the state to improve irrigation systems and manage water with the goal of water conservation. Five farmers report their use to NRCS on a regular basis. "Use" is measured by what reaches the crop (through a rain gauge), versus what is pumped at the stream/pond/well site. All of the information is confidential, protected under the US Privacy Act of 1974, as amended. The most accurate information available will come out of NRCS' Ground water and surface water conjunctive use management optimization model underway in the Pawcatuck watershed by the USGS. NRCS has received voluntary cooperation from farmers controlling about 50% of irrigated turf acreage in the watershed to have their use metered. Published information will be generalized to maintain confidentiality of the data. .

US Environmental Protection Agency Data Systems

The Safe Drinking Water Information System (SDWIS) is EPA's primary database for the collection of water quality information concerning public drinking water supply (http://www.epa.gov/enviro/html/sdwis/sdwis_query.html). The EPA also requires major industrial users and wastewater facilities to submit annual summary data regarding discharges to surface water bodies. Under NPDES (National Pollutant Discharge

Elimination System), this information is stored in the agency's Permit Compliance System (PCS) database.

SDWIS has been expanded to include information regarding water withdrawal, population served, potable water treatment techniques and other features. A recent initiative, called the Source Water Assessment and Susceptibility Analysis, will require the mapping of water quality data at the source of supply in relation to inventoried pollution sources. The agency is also designing a state counterpart to the federal SDWIS database, though reportedly, many New England states have already developed computer tracking systems particular to their needs.

Water Quality Protection Program

The Water Quality Protection Program provides a mechanism for collecting funds for the purpose of funding water quality protection activities or buying land in proximity to a water source. For every one hundred gallons of water pumped (by major water suppliers), one cent is collected by the RI Water Resources Board.

Suppliers project surcharge payments for one year based on estimated gross billing and total gallons to be billed. Exemptions, lost water, or water used for public safety purposes are not included in "Total Gallons to be Billed". Actual surcharge payment submissions often coincide with a supplier's billing cycle: monthly, quarterly or annually.

These data are not considered a viable source of water withdrawal information. Systems used to measure and/or report water uses are not exact. Gallons billed often do not correspond to the surcharge submitted. An extensive audit of all participating suppliers indicated multiple discrepancies, both in overpayment of the surcharge, as well as underpayment. In some cases, this may be the result of not properly billing all users or not accounting for exemptions, lost water, or water used for public safety purposes.

In most cases, since water suppliers are submitting projected water use based on annual production, it would seem that total production, as reported in the WSSMPs, would be more accurate in terms of projecting average monthly use.

5. Analysis of Current Data and Identification of Data Gaps

The Subcommittee examined the availability and quality of data currently available for characterization of public supply and self supply withdrawals and use. The data analysis included data from the WSSMPs and from the USGS 1995-1999 water-use compilations for the two pilot basins: the Wood-Pawcatuck and the Blackstone (Figure 1).

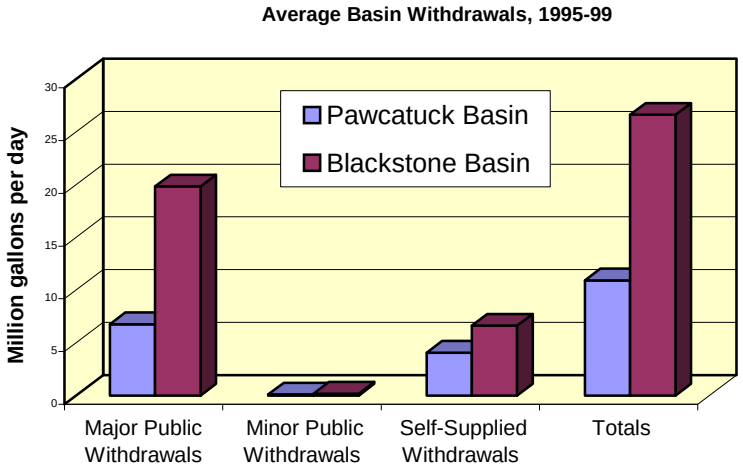

Figure 1. Comparison of water withdrawal characteristics for the Wood-Pawcatuck and Blackstone pilot basins (USGS, provisional data).

Public Supply

Public water supply data were examined at two levels:

Major suppliers - defined as large suppliers that produce >50 millions gallons per year and are required to submit WSSMPs, and

Minor suppliers – defined as small, community water systems not subject to WSSMP requirements; these systems have at least 15 service connections or regularly serve 25 individuals daily at least 60 days out of the year. Non-community systems serve the public but do not meet the definition of a community supply.

Major Suppliers

All major suppliers are self-metered and currently collect a variety of production, delivery, and water-use data for both internal use and state reporting. Currently, water suppliers use different methods to compile, record, and submit data. Data in the WSSMPs are presented in a variety of formats including text, tables, spreadsheets, drawings and maps. Hard copy documentation does not lend itself to efficient review or analysis. Additionally, varying interpretations of plan requirements result in variability in the content of responses. Lastly, not all suppliers have a repository of historical data or internal capacity to build one.

The most conspicuous data gaps occur in the worksheets, particularly those that deal with water demand, withdrawals, and water use (17 of 38 worksheets). Though the worksheets are not mandatory, many suppliers use them. Data are sometimes missing altogether, incomplete, or recorded in different units of measurement. Worksheet data are reported by year and by month; however, the veracity of the monthly data is questionable in some instances.

The RI WRB provided electronic spreadsheet templates to suppliers and their consultants for use in the most recent round of WSSMP updates. However, since the events of 9-11,

digital data has not been forthcoming. The WSSMP regulations were subsequently revised, which, in effect, further restricts access to the data. Nonetheless, a new WSSMP database is being designed to capture data collected in the WSSMP plans and related worksheets.

Specific data gaps identified by the Subcommittee include:

- Availability of both withdrawal (i.e., production) and use data (uneven implementation)
- Uniformity of reporting period (suppliers report different years)
- Availability of monthly data (required in WSSMPs but uneven implementation)
- Availability of data by use category (required in WSSMP but uneven implementation)
- WSSMPs capture only a portion of the water supply picture in basins with a high percentage of self-supply use (i.e. Wood-Pawcatuck Basin).

A fair amount of information infrastructure is in place to collect data from the major public water suppliers; however, inconsistent reporting coupled with long time intervals (30 months for pertinent updates and 5 years before a whole new plan is submitted) limits the usefulness of the data. Nevertheless, the WSSMP program is significant in terms of the systematic collection of water withdrawal and use data. The Subcommittee therefore discussed amending the WSSMP requirements to improve the quality of data and increase the frequency of reporting data.

Specific amendments to the regulations that are proposed include:

1) Require "major" public suppliers (those required to submit WSSMPs) to report monthly, water withdrawal data annually on a calendar year basis.
2) Require "major" public suppliers to breakdown and report water use by category (domestic, commercial, industrial, institutional, "nonaccount" water) quarterly, based on a calendar year.

These amendments will result in a dataset that will permit comparison of water withdrawals on an annual basis with the resolution needed to identifying seasonal trends in overall water use by category of use. The monthly withdrawal reporting provision could be implemented relatively quickly; the quarterly data requirement may take time to implement as suppliers update their water meters and accounting software as well as improve their ability to report.

Minor Suppliers

All minor public water suppliers are subject to RIDOH water quality reporting requirements; some minor suppliers may be required to submit discharge data to RIDEM pursuant to a RIPDES permit. There are, however, no withdrawal reporting requirements for minor suppliers.

Residential water use by minor suppliers is estimated by the USGS using a 67 gal/day per capita water-use coefficient. This per capita water-use coefficient was developed using aggregate metered data and total population served and is considered a relatively accurate

estimate of use. In addition, examination of USGS water-use compilation data for the period 1995-1999 shows that in the two pilot basins, minor public supply use is a very small percentage of total basin water use (Figure 1). Although there was some discussion about the accuracy of these estimates – for example, the population served in a coffee shop and in a nursing home have very different per capita requirements, but for the purpose of designation as a minor supplier, are counted equally. The Subcommittee agreed that estimated use is considered sufficient for most minor public suppliers; any additional reporting requirements for use above a threshold would be consistent with reporting requirements for other self-supply users (see below).

Self-Supply

Self-supply, or water withdrawn directly by the user, comprises approximately 13% of total water withdrawals in Rhode Island. The percentage varies considerably by basin, however, with self-supply accounting for approximately 37% of water withdrawals in the Wood-Pawcatuck Basin. Accurate characterization of the self-supply component of water withdrawals will be a critical component of water resources management planning for some basins.

Self-supply withdrawals and use are currently estimated using water-use coefficients as follows:

- **Self-supply domestic** – estimated using a per capita water-use coefficient.
- **Self-supply commercial and industrial** – estimated using the Standard Industrial Classification (SIC) Code based on a per employee, water-use coefficient.
- **Self-supply agricultural** – estimated using a per head livestock coefficient or a per irrigated acre crop coefficient.

The Subcommittee examined the water-use coefficients to determine whether they provide an accurate estimation of water-use in these categories.

Self-Supply Domestic

Self-supply domestic use is estimated by the USGS using a 71 gal/day per capita water-use coefficient. This coefficient is specific to domestic use and therefore differs slightly from the bulk minor self-supply coefficient of 67 gal/day per capita cited above. This coefficient, which represents an average annual usage rate, compares favorably with metered data from the pilot studies. One Subcommittee member noted that in some subdivisions served by public water, homeowners regularly drill wells to support lawn sprinkler systems. There is currently no accounting of these withdrawals, which could be a significant component of summer self-supply withdrawals in some watersheds.

The Subcommittee agreed that this estimation technique provides a good level of accuracy, however it does not provide for seasonal variations in water demand. Future research to develop a range of domestic coefficients for water use which reflect seasonal variability, use of domestic irrigation systems (sprinklers), lawn size, and age (vegetation) could be valuable to assist local land use decision makers on water availability for subdivisions. Conducting studies of public water systems as well as a

"metered study" for self-supply (variables: with/without sprinklers, lot sizes, etc.) were suggested to improve estimates and establish an accurate range of coefficients.

Self-Supply Commercial and Industrial

Self-supply commercial and industrial are considered jointly because the same technique is used for estimation of water withdrawals, namely SIC code-based gal/day per employee water-use coefficients. The water-use coefficient is a per employee annualized average. Seasonal variations can be determined if seasonal employment data are available. The Subcommittee examined a comparison between estimated and metered use to assess the level of accuracy inherent in the coefficient-based estimation approach.

Table 1. Comparison of estimated and metered water use for selected commercial/industrial SIC codes.

Type of Industry	SIC code	Water-Use Coefficient (gal/d/empl)	# Employees	Estimated Water Use (gal/day)	Metered Water Use (gal/day)	**% Difference**
Textile Mill Products	2261	315	500	157,500	88,849	**77%**
Printing, Publishing	2711	42	145	6,090	14,384	**-58%**
Chemical Products	2843	289	25	7,225	21,315	**-66%**
Stone, Clay, Glass and Concrete	3281	202	30	6,060	28,230	**-79%**
Primary Metals	3357	178	265	47,170	29,151	**62%**
Primary Metals	3357	178	75	13,350	84,751	**-84%**
Fabricated Metals	3496	95	440	41,800	57,671	**-28%**
Jewelry, Precious Metals	3951	36	970	34,920	31,024	**13%**
Finance, Insurance, Real Estate	6733	71	1,074	76,254	24,156	**216%**
Services (Business)	7389	106	350	37,100	109,041	**-66%**
Services (Racing)	7948	106	500	53,000	18,562	**186%**
Services (Nursing Facilities)	8051	106	100	10,600	13,011	**-19%**
Services (Hospitals)	8062	106	900	95,400	42,110	**127%**
Services (Residential Care)	8361	106	200	21,200	15,589	**36%**

Although some estimates were relatively close to the metered use, the majority of the estimates resulted in errors in excess of 50%. Several comparisons revealed overestimation errors larger than 100% (estimated use was more than double metered use) and underestimation errors larger than 50% (estimated use was less than half of the metered use). The Subcommittee determined that this level of accuracy is insufficient, particularly for large self-supply users whose use could constitute a significant component of water use in a given basin. The Subcommittee, therefore, agreed that self-supply use above a hydrologically significant threshold should be reported. Threshold determination is addressed later in this report.

Self-Supply Agricultural

Self-supply agricultural use is estimated based on USGS coefficients for irrigation and livestock. Crop irrigation is estimated by county and then disaggregated by town or basin based on mapped land use. Livestock use is estimated by county using county livestock totals and the disaggregated by town or basin based on land use. Self-supply agricultural

use is not a significant component of water use in the Blackstone basin but is estimated to comprise 12% of withdrawals in the Wood-Pawcatuck basin. Accurate characterization of the agricultural self-supply component of water withdrawals in this basin is therefore critical to basin-wide water resource management. The Subcommittee examined comparisons between estimated and metered irrigation use for crops to assess the level of accuracy inherent in the coefficient-based estimation approach. No data are available to compare estimated versus metered livestock use in Rhode Island.

The first round of estimates was completed using USGS turf irrigation coefficients and metered data from the Pawcatuck resulting in an average use of 600 gal/day/acre for the period June through August. Metered data for this same period showed a use of 1,800 gal/day/acre. The Subcommittee discussed the method being used and potential reasons for the large discrepancy between estimated and metered use. A second estimate, using rainfall data from 2000, 2001 and 2002 found a 3-year average use of 1,140 gal/acre per day for the period June through August which includes withdrawals ranging from 0 gal/acre/day for June to 2,144 gal/acre/day for July. A Rhode Island-specific water use coefficient for turf irrigation will ultimately be derived from the Pawcatuck optimization project.

The variability in irrigation water use and the discrepancy between estimated and metered use led most of the Subcommittee to conclude that better methods of estimating agriculture water use are needed. The Subcommittee also noted that significant differences in water use are evident depending on the irrigation technology used. For example, a Washington County turf farm reduced irrigation water use by 40% through a modification of the irrigation system. Coefficients were therefore expected to produce uneven results when compared to metered data. Although golf courses are commercial and not agricultural, estimation of the amounts of self-supplied water used for golf course irrigation should be treated similarly to that of agriculture.

Most of the Subcommittee believed that the current level of accuracy is problematic, particularly for large, self-supply users whose use could constitute a significant component of water use in a given basin.

The Subcommittee acknowledged that metering of irrigation lines was not a practical approach and that an effort should be made to develop techniques that will permit accurate estimation of agricultural water use. The seasonal nature of the use is also important and must be considered in any reporting approach.

The Subcommittee voted, with strong dissention from the RI Farm Bureau, that agricultural self-supply use above a hydrologically significant threshold should be reported. The Subcommittee noted that metering was not required, but that the Water Resources Board should determine acceptable methods of determining use. Threshold determination is addressed in the next chapter.

6. Potential Water-Use Data Reporting System

Examination of existing water-use data identified several data gaps that need to be addressed. Reporting by major public suppliers must address data frequency and level of detail concerns identified in Chapter 5.

Current estimates for minor public suppliers and self-supply domestic, commercial, industrial, and agricultural users were accepted as accurate for use up to a threshold volume, but use above the threshold should be reported using metering or some other accurate method of measurement.

These data are needed because water-use reporting must be refined enough to permit hydrologic analyses during critical periods and by stream reach. For example, evaluation of annualized demand versus supply data may not identify seasonal problems associated with peak demands and low stream flow periods. Similarly, analysis of water supply and demand data at the basin level may not identify sub-watershed or stream reach level water supply problems.

Reporting Threshold

In order to determine an appropriate threshold for a possible water-use reporting program, the Subcommittee discussed the need to adopt a hydrologically significant threshold. Permitting and registration thresholds in other New England states are highly variable (see Appendix I) and in all cases were thought to be too high to capture water use that is significant at a Rhode Island watershed scale.

Hydrologic Significance

As a mechanism to check the hydrologic significance of a threshold, the Subcommittee looked at potential thresholds based on based on watershed characteristics. For example, "first order" streams, as identified by DEM, may be more sensitive to withdrawals from nearby wells and may, therefore, need a threshold depending upon the watershed size. Because the state is dominated by first order streams, they are the focus of this analysis.

18 first order watersheds were examined:

Harrisville	450 acres	Jamestown	188 acres
Tributary of Bear Brook	300 acres	Near Sawdy Pond	131 acres
Tributary of Breakheart Brook	749 acres	Cornucussoc Brook	876 acres
Tributary of Locustville	106 acres	Frenchtown Brook	142 acres
Tributary near Chapman Pond	803 acres	West Greenwich	126 acres
Mink Brook	617 acres	Crompton	131 acres
Smelt Brook	992 acres	Warwick (West Shore Road)	133 acres
Point Judith	155 acres	Cumberland	57 acres
Pettaquamscutt (Boston Neck)	281 acres		

Based on these watersheds, a minimum of approximately 100 acres (0.15 mi^2) is required to generate a perennial stream. Previous analysis regarding impacts on flow-healthy streams versus flow-threatened streams indicated that a consumptive use of 0.15 MGD/mi^2 moved a watershed from flow-healthy status to flow-threatened status;
0.15 MGD/mi^2 x 0.15 mi^2 = 22,500 gal/day.

This suggests that a hydrologically significant reporting threshold for Rhode Island should, at a minimum, capture use above 20,000 gal/day.

Water-Use Reporting Threshold Value

The Subcommittee discussed the implications of a 20,000 gal/day threshold considering several factors: the potential for multiple self-supply users withdrawing at a rate just below the threshold resulting in a significant withdrawal in the aggregate; the potential burden of requiring reporting by an excessively large number of users; and the relationship to the existing WSSMP "major user" threshold (8,200 GPD). To address these concerns, the Subcommittee examined a range of thresholds (10,000, 15,000 and 20,000 gal/day) relative to a) estimated withdrawals from existing non-transient, non-community, self-supply wells and b) the number and size of self-supply commercial/industrial enterprises the threshold would capture.

A comparison between estimated water use and potential thresholds for self-supply wells statewide showed that a 20,000 gal/day threshold would capture fewer than 20% of the non-community wells. A 10,000 gal/day threshold would capture approximately 40% of the non-community wells. Using the coefficient of 67 gal/d per person, only minor, commercial/industrial self-supply users (ex. nursing homes, condominium complexes) serving approximately 300 people would be captured using the 20,000 gal/d threshold.

From the most current information received in 2003 from the RI Water Resources Board, six minor suppliers of the approximately 47 minor suppliers in the state would fall within the 20,000 gal/day threshold. Table 2 shows the approximate employee workforce threshold that would trigger reporting for a commercial/industrial enterprise.

Table 2. Estimate of Employee Workforce required to reach the Water-Use Reporting Threshold:

IWR-MAIN Coefficients for Aggregate Estimates

Category & Two Digit SIC code	Non-residential employee water-use coefficient (gallons/employee/day)	(Median or Mean)	Number of employees to reach the threshold of 20,000 gal/d
Industrial [20-39]	**116**	**(median)**	
Food [20]	469	(median)	43
Tobacco [21]	217	(mean)	92
Textile Mill Products [22]	315	(median)	63
Finished Apparel [23]	13	(median)	1538
Wood, Lumber [24]	78	(median)	256
Furniture [25]	30	(median)	667
Paper Products [26]	863	(median)	23
Printing, Publishing [27]	42	(median)	476
Chemical Products [28]	289	(median)	69
Petroleum [29]	1,045	(median)	19
Rubber [30]	119	(median)	168
Leather [31]	148	(mean)	135
Stone, Clay, Glass, and Concrete [32]	202	(median)	99
Primary Metals [33]	178	(median)	112
Fabricated Metals [34]	95	(median)	211
Machinery [35]	58	(median)	345
Electronic Equipment [36]	71	(median)	282
Transportation Equipment [37]	63	(median)	317
Instruments [38]	66	(median)	303
Jewelry, precious metals [39]	36	(median)	556
Commercial [40-97]	**94**	**(median)**	
Transportation, communication, utilities [40-49]	51	(median)	392
Wholesale Trade [50-51]	58	(median)	345
Retail Trade [52-59]	58	(median)	345
Finance, insurance, and real estate [60-67]	71	(median)	282
Services [70-89]	106	(median)	189
Public administration (Government) [91-97*]	71	N/A	282

* SIC (Standard Industrial Classification) Code for Finance, Insurance, Real estate value; instead of 106 for Public Administration)

IWR-Main-Institute of Water Resources Municipal and Industrial Needs: IWR-MAIN is an urban water model that provides a disaggregated estimate of the current and future municipal and industrial demand for water for a given study area. Water demands are estimated by sectors such as single-, multi-family residential, commercial, manufacturing, and government.

For example, for jewelry industries, only employers with at least 556 employees would have to report water use, using the 20,000 gal/d threshold based on SIC code estimates. A textile mill would report if there were at least 63 employees based on the SIC estimates.

Upon considering this information, the Subcommittee found that a 10,000 gal/day reporting threshold would better serve the needs of a statewide water use database to capture data at a level that is significant for a watershed and a significant percent of self-supply users.

The WSSMP reporting requirements for major public suppliers require identification of major users-- customers receiving more than 3 Mgal/yr, which is equivalent to 8,200 gal/day. The Subcommittee concluded that it would be appropriate to apply a uniform "major user" criteria across both public and self-supply categories. The Subcommittee also recommends adopting a threshold consistent with the WSSMP "major user" threshold of 3 million gallons/year annualized use (>8,200 gallons/day or >740,000 gallons over a consecutive, three-month period). The three-month interval will ensure that seasonal use at the threshold rate is captured.

Proposed Reporting System

Three categories of users will be recognized under the new system:

1. Major suppliers subject to modified WSSMP requirements
2. Major self-supply users (> 8,200 gal/day threshold)
3. Minor self-supply users (< 8,200 gal/day threshold)

Reporting requirements for each category:

1. Metered data for major suppliers
2. Metered or other WRB approved reporting method for major self-supply users
3. None for minor self-supply users

Specific reporting requirements:

"Major" public suppliers would be required to report monthly water withdrawal data annually on a calendar year basis. Water use would be broken down by category quarterly (domestic, commercial, industrial, institutional, agricultural, and "nonaccount" water, such as that used for fire-fighting or lost in the system) based on a calendar year.

Require water-use reporting for use above the "major user" threshold of 3 million gallons per year (>8,200 gallons/day or >740,000 gallons over a three-month period) for all self-supplied users as well as "minor" public suppliers statewide.

No reporting would be required for self-supply users below the reporting threshold. Water use at this level will be estimated using coefficients.

7. Summary & Conclusions

Following a review of water-use data in the state of Rhode Island, the Subcommittee found significant data gaps that should be addressed. The Subcommittee recommends development of a statewide water-use reporting program for the State of Rhode Island to provide the data needed to support the aforementioned objective that "*adequate data is essential to determine the capabilities of the state's water resources to support various uses and users and the quantities of water needed for these uses.*" (RI-G.L. §46-15.7-1) The Water Use Reporting Committee, therefore, recommends the following to the full WAPAC Committee:

Subcommittee Recommendations

1. Require "major" public suppliers (those required to submit WSSMPs) to report monthly water withdrawal data annually on a calendar year basis. The Subcommittee found that this could be accomplished in the short term and that these data are available now.

2. Require "major" public suppliers to breakdown and report water use by category (domestic, commercial, industrial, institutional, agricultural, "nonaccount") quarterly, based on a calendar year. There was recognition that this may take time to implement as water systems update meters and accounting software and otherwise improve their capacity for reporting. The Subcommittee recommends at the time of system upgrades, with full compliance no later than 2010.

3. Require water-use reporting for use above the "major user" threshold of 3 million gallons per year (>8,200 gallons/day or >740,000 gallons over a three-month period) for all self-supplied users as well as "minor" suppliers statewide. Voluntary reporting of metered data or by other accurate method of measurement accepted by the Water Resources Board should commence in January 2005 and become mandatory by January 2007.

4. Conduct research to develop a range of domestic coefficients for water use that consider seasonal variability, use of domestic irrigation systems (sprinklers), lawn size, and age (vegetation), to assist local land use decision makers regarding water availability for subdivisions. Public water system studies and data as well as a "metered study" for self-supply with/without sprinklers, and/or with varying lot sizes were offered as potential approaches to improving data and establishing a range of coefficients.

Implementation and Management Considerations

The Subcommittee recognizes that implementation of the reporting program will require a phase-in period. In particular, suppliers and major users may need to develop the information infrastructure needed to meet the reporting requirements. The Subcommittee hopes that incentives can be provided to encourage participation during the voluntary phase-in period. During the phase-in period, a review of WSSMP reporting should be completed to evaluate the degree to which existing requirements are being met by major suppliers.

Data collected through this reporting program will be stored in relational databases. The WRB must ensure that the databases are populated and operational by January 2005. WSSMP regulations require electronic submission of plans to minimize additional data entry steps that would be necessary with "paper" records. It is estimated that a 0.25- 0.5 full-time employee will be needed to oversee the database and monitor report compliance, data quality, database integrity and annual report preparation.

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9. APPENDIX

A. Water Registration Programs (from the Research Committee)

B. Water Allocation in New England and New York: State Survey Summary Matrix (NEWWA)

C. Narrative Description of State Water Use Data Collection Programs (USGS)

D. USGS Data Collection for Water Use Projects and Compilations

E. USGS Summary of Pilot Threshold Versus Metered and Estimated Water Use

F. Water Withdrawals from the Pawcatuck and Blackstone Watersheds (USGS)

G. Estimates of Water Use from the RI Farm Bureau

H. Agricultural Water Use Registration Form (State of PA)

I. Well Completion Report (DEM)