by category, 1990

25.3 million gallons per day

INTRODUCTION

In 1977, the Congress of the United States, recognizing the need for accurate, comprehensive, and comparable information on water use, directed the U.S. Geological Survey (USGS) to establish a National Water-Use Information Program to complement other USGS programs on the availability and quality of the Nation's water resources. The Water-Use Program is a cooperative project between USGS offices and various State agencies who are responsible for water-resources management. Currently (1995), a cooperative water-use program is in place in Rhode Island and in the other five States of New England. These six individual programs are closely coordinated to promote development of uniform water-use data bases.

This report was prepared in cooperation with the Rhode Island Department of Environmental Management and the Providence Water Supply Board and is based on data for Rhode Island that were compiled for a national report (Solley and others, 1993). National compilations of water-use information have been done every 5 years since 1950. This report is one of six reports being prepared for the New England States.

The purpose of this report is to provide information on water use in Rhode Island to Federal and State agencies, water-resource professionals, and individuals interested in water-conservation issues. The report focuses on freshwater withdrawals and instream use for hydroelectric-power generation during 1990. Water withdrawals and use are reported in million gallons per day and are generally derived by dividing total annual withdrawals and use by 365 days. This procedure does not alter the values reported for water-use activities that are fairly constant throughout the year, such as domestic withdrawals; however, for water-use activities with significant seasonal variations (such as sand-and-gravel mining and irrigation), the average daily withdrawal rate is smaller than the actual daily withdrawal rate during the season of activity. Data are aggregated by

41°30' —

Base from U.S. Geological Survey data, 1:2,000,000, 1972

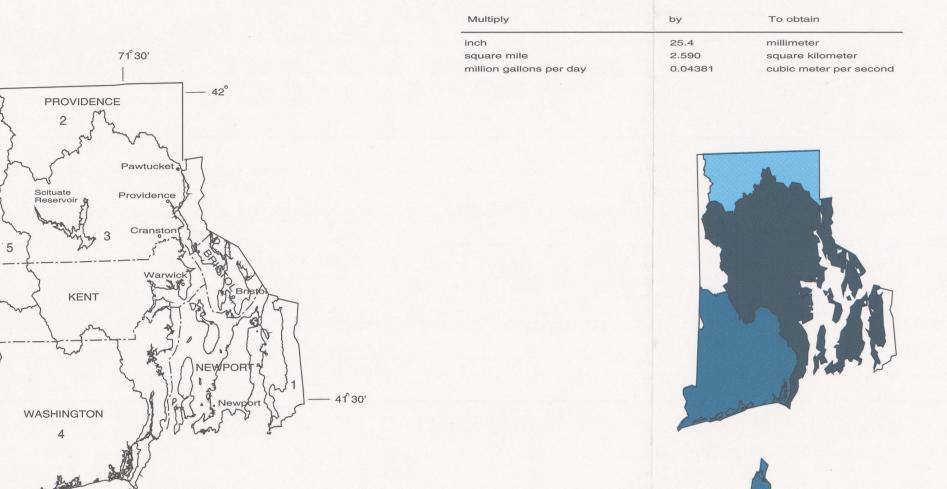
river basin, which is the most commonly used water-resource planning unit in New England. The river basins are equivalent to hydrologic cataloging units, except in coastal areas. The Narragansett basin is the area that drains directly into Narragansett Bay. Hydrologic cataloging units were delineated by the USGS in cooperation with the U.S. Water Resources Council, and a complete description of the units can be found in Seaber and others (1987). In most cases, however, river basin boundaries do not coincide with State boundaries, and the data reported here are only for the part of each river basin within Rhode Island.

Most of the data in this report were estimated because the State of Rhode Island does not have a water-use permit or registration program through which water-use data could be routinely collected. Three types of estimating methods were used: (1) Public supply and some industrial withdrawals were estimated primarily on the basis of site-specific information supplied by owners, such as number of customers; (2) thermoelectric and mining withdrawals and hydroelectric instream use were estimated on the basis of State-provided information, by multiplying an easily obtained characteristic, such as amount of power generated, by a coefficient; (3) domestic, commercial, agricultural, and some industrial withdrawals were estimated by multiplying aggregated data, such as census population data, by a coefficient. The site-specific data were provided by the Rhode Island Department of Environmental Management, the Rhode Island Department of Health, and individual facility operators.

REFERENCES CITED

- Seaber, P.R., Kapinos, F.P., and Knapp, G.L., 1987, Hydrologic unit maps: U.S. Geological Survey Water-Supply Paper 2294, 63 p.
- Solley, W.B., Pierce, R.R., and Perlman, H.A., 1993, Estimated use of water in the United States in 1990: U.S. Geological Survey Circular 1081,
- U.S. Department of Commerce (Bureau of the Census), 1991, 1990 census of population and housing, summary population and housing characteristics, Rhode Island: Washington D.C., Bureau of the Census, publication 1990/CPH-1-41, 82 p.





WATER WITHDRAWALS IN MILLION GALLONS PER DAY

GREATER THAN 100

---- RIVER BASIN BOUNDARY

Agricultural 2%

EXPLANATION

KILOMETERS

20 MILES

Table 1.--Area, population, and estimated withdrawals and hydroelectric instream use of water for river basins in Rhode Island, 1990 [Units are in million gallons per day (Mgal/d), except where noted; population numbers are rounded to the nearest hundred people; other numbers are rounded to nearest 0.1 Mgal/d or to three significant figures; values may not add to totals because of independent rounding; mi ², square miles]

Index maps of Rhode Island showing river basins (larger map) and total freshwater withdrawals by river basin (smaller map), 1990.

Map code				1 Area (mi²)	Population (thousands)	Estimated withdrawals								
							Self-supplied							
	River Basin	ca	Hydrologic catalog- ing unit			Public supply	Domes- tic	Commer- cial	Indus- trial	Mining	Agricul- ture	Thermo- electric	Total with- drawals	Hydro- electric instream use
1	Cape Cod	010	090002	23	4.9	0.0	0.2	0.0	0.0	0.0	0.0	0.0	0.2	0.0
2	Blackstone	010	090003	100	120.1	6.1	.3	.4	.2	.3	.2	.0	7.5	339
3	Narragansett	010	090004	464	797.7	88.0	3.8	2.1	9.7	6.2	1.7	.0	112	.0
4	Pawcatuck-Wood	010	090005	266	74.8	7.5	.6	3.0	1.7	.3	.5	.0	13.6	.0
5	Quinebaug	01	100001	35	5.9	.0	.0	.1	.0	.0	.0	.0	.1	.0
	TOTAL			888	1,003.4	102	4.9	5.6	11.6	6.8	2.4	.0	133	339

EXPLANATION

---- County boundary

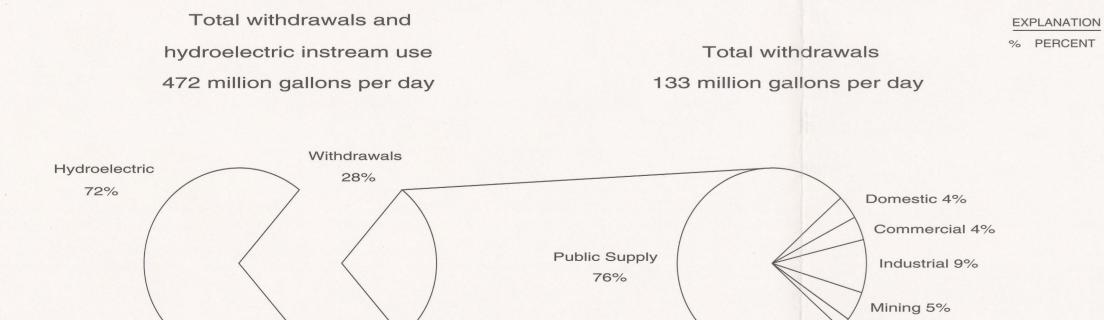
----- River basin boundary

River Basin, identified

All areas for river basins are calculated because river basin boundaries extend beyond State boundaries.

recreation, aquatic habitat, and navigation.

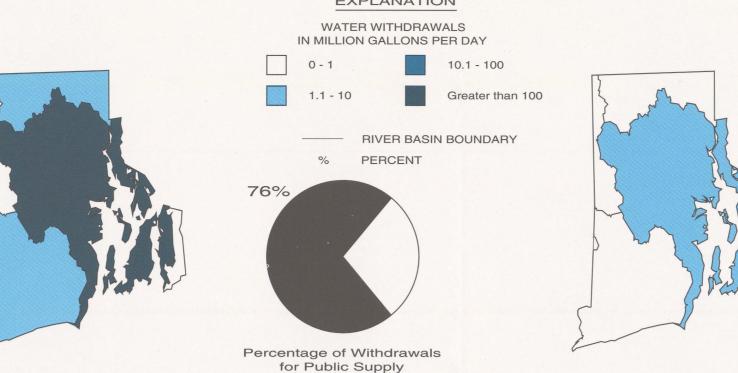
A water withdrawal generally refers to water removed for use from streams, reservoirs, or the ground. However, water can also be used without being moved from the stream channel--this is called instream use. The dominant instream use in Rhode Island is for hydroelectric-power generation. Hydroelectric instream use is discussed separately from withdrawals in this report for two reasons. First, unlike withdrawals, virtually no change in the quantity of the water takes place during hydroelectric instream use. Second, the volume of water used for hydroelectric-power generation is so large that it overshadows the combined withdrawals for all other uses. In Rhode Island, hydroelectric instream use is about 2.5 times the total withdrawals. Other important instream uses include wastewater assimilation,



Hydroelectric instream use and total withdrawals

in Rhode Island, 1990

WITHDRAWALS BY WATER-USE CATEGORY AND RIVER BASIN



Public-Supply Withdrawals

Public-supply withdrawals: Water withdrawn by public and private water suppliers who provide water to various users, such as domestic, commercial, and industrial users, and thermoelectric powerplants. Public supply also includes public use, losses, and transfers to other public suppliers or

- * Public-supply withdrawals, 102 million gallons per day, accounted for 76 percent of total withdrawals. * Public suppliers served approximately 934,100 people or about 93
- percent of the State's population. * The largest withdrawals for public supply were in the Narragansett basin. This basin contains the Scituate Reservoir that serves most of Rhode Island, including the cities of Providence, Cranston, and Warwick.

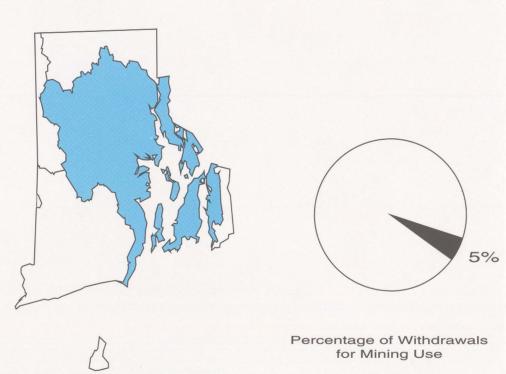
Percentage of Withdrawals

for Commercial Use

Commercial Withdrawals

Commercial withdrawals: Water withdrawn for use in motels, hotels, restaurants, office buildings, and other commercial facilities, plus institutions, such as hospitals or schools. Water withdrawn for air

- conditioning and fish hatcheries also is included. * Commercial self-supply withdrawals, 5.6 million gallons per day, accounted for 4 percent of total withdrawals.
- * The largest withdrawals for commercial self-supply were in the Pawcatuck-Wood river basin and Narragansett basin. These basins include the coastal areas of Block Island and Newport, where large numbers of seasonal visitors, particularly during the summer, contribute to commercial withdrawals.



Mining Withdrawals

Mining withdrawals: Water withdrawn for use in the extraction of minerals, which includes withdrawals associated with quarrying, dewatering, milling (crushing, screening, washing, flotation), and other preparations customarily done at the mine site or as part of a mining activity.

- * Mining withdrawals, 6.8 million gallons per day, accounted for 5 percent of total withdrawals. All mining operations in Rhode Island were * Construction sand and gravel, crushed stone, and dimension stone
- were the major mineral commodities in Rhode Island. * The largest water withdrawals for mining were in the Narragansett
- EXPLANATION IN MILLION GALLONS PER DAY GREATER THAN 100 ---- RIVER BASIN BOUNDARY

Hydroelectric Instream Use

Hydroelectric instream use: Water used in the generation of electricity at plants where the turbine generators are driven by moving water. * Hydroelectric instream use, 339 million gallons per day, which was from one plant in the Blackstone river basin, used about 2.5 times the total

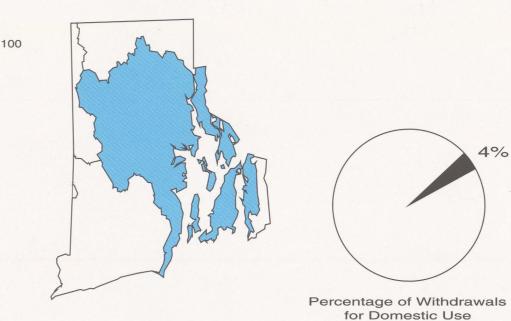
volume of water withdrawn for all other uses. * This hydroelectric powerplant generated approximately 1 percent of all electric power in Rhode Island in 1990.

TOTAL

River Basin

Pawcatuck-Wood

Total withdrawals



Domestic Withdrawals

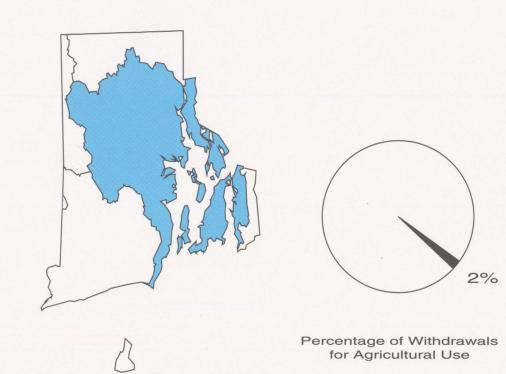
- Domestic withdrawals: Water withdrawn for normal household purposes in homes, apartments, or in any place where people are included in a census survey. Domestic withdrawals include water used for drinking, preparing food, bathing, washing clothes or dishes, flushing toilets, and watering
- * Domestic self-supply withdrawals, 4.9 million gallons per day, accounted for 4 percent of total withdrawals.
- * Approximately 69,300 people or about 7 percent of the State's population were self-supplied.
- * The largest withdrawals for domestic self-supply were in the Narragansett basin because this basin has the highest population density.

Percentage of Withdrawals for Industrial Use

Industrial Withdrawals

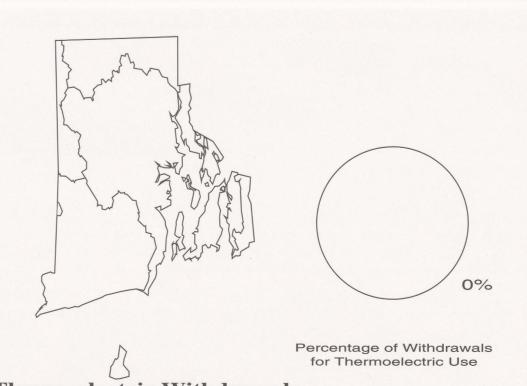
Industrial withdrawals: Water withdrawn for use in fabricating, processing, washing, and cooling industrial materials.

- * Industrial self-supply withdrawals, 11.6 million gallons per day, accounted for 9 percent of total withdrawals. * The largest industrial water withdrawals in Rhode Island were for manufacturing chemicals, pigments, pharmaceuticals, and textiles.
- * The largest withdrawals by industries were in the Narragansett



Agricultural Withdrawals

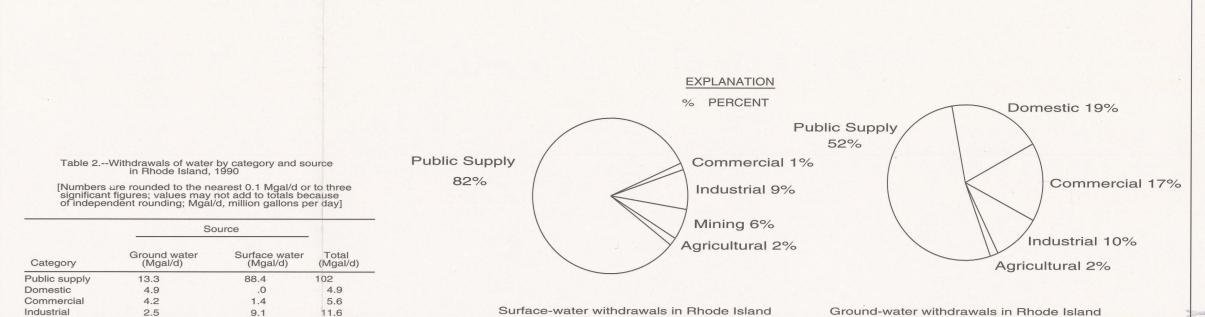
- Agricultural withdrawals: Water withdrawn for use in irrigation and * Agricultural withdrawals, 2.4 million gallons per day, accounted for 2 percent of total withdrawals. All agricultural use in Rhode Island was
- assumed to be self-supplied. * The largest withdrawals for agriculture were in the Narragansett basin and the Pawcatuck-Wood river basin.
- * Irrigation was the primary use for agricultural withdrawals. Turf grass and potatoes are important crops in Rhode Island.



Thermoelectric Withdrawals

Thermoelectric withdrawals: Water withdrawn for use in the process of generating thermoelectric power. The water is primarily used for cooling. No freshwater withdrawals were made for thermoelectric-power generation. All fossil-fuel thermoelectric powerplants in the State use

SURFACE-WATER AND GROUND-WATER WITHDRAWALS



by category, 1990

108 million gallons per day

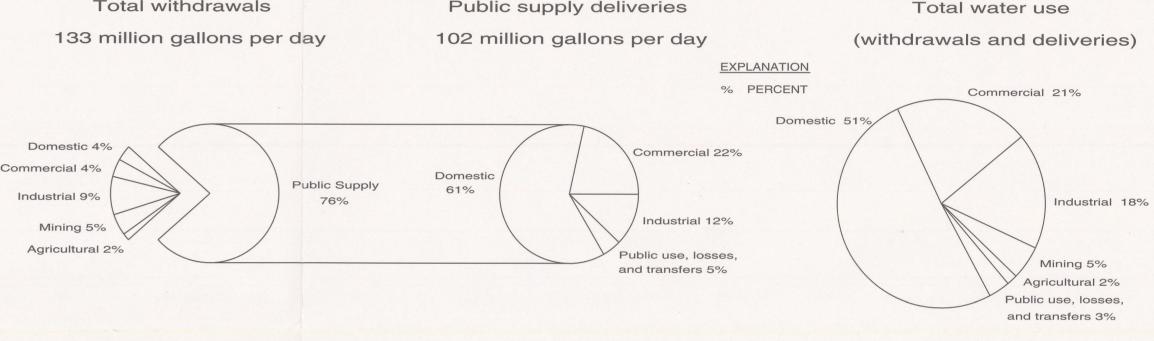
Surface water is water that is present at land surface, such as in streams, reservoirs, and lakes. The major fresh surface-water body in Rhode Island is the Scituate Reservoir in the Narragansett basin, which contains more than 80 percent of the reservoir storage capacity in the State.

> During 1990, surface-water withdrawals were 108 million gallons per day and accounted for 81 percent of total withdrawals in Rhode Island. The largest surface-water withdrawal was in the Narragansett basin. Public supply accounted for 88.4 million gallons per day or 82 percent of all surface-water withdrawals.

Ground water is the subsurface water that is present beneath the water table in soils and geologic formations that are fully saturated. When geologic formations yield significant quantities of water, they can be referred to as "aquifers." Rhode Island has two major types of aquifers-those in glacial deposits (such as stratified drift or till) and those in crystalline bedrock (such as granite).

During 1990, ground-water withdrawals were 25.3 million gallons per day and accounted for 19 percent of total withdrawals in Rhode Island. Narragansett basin has the largest total volume of ground water withdrawn. Public supply accounted for 13.3 million gallons per day or 53 percent of total ground-water withdrawals. Most of these withdrawals were from large-diameter wells (greater than or equal to 6 inches) in stratified-drift aquifers.

SELF-SUPPLY WITHDRAWALS AND PUBLIC-SUPPLY DELIVERIES



Total withdrawals and distribution of public-supply deliveries

Surface Water

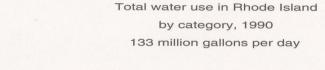
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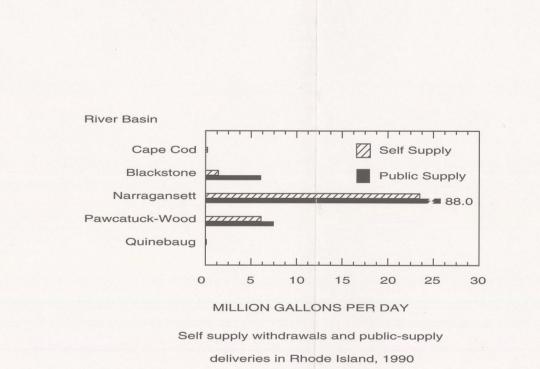
MILLION GALLONS PER DAY

Withdrawals in Rhode Island by river

basin and source, 1990

in Rhode Island, 1990





who provide water to various users, such as domestic, commercial, and industrial users, and thermoelectric powerplants. It also includes public use, (water used for fire fighting, hydrant flushing, sanitation, and parks), losses that result from leaks in the distribution system, transfers to or from other river basins, and meter errors that may over-register or under-register the actual volume of water flowing through the meter. In the table below, large positive values in the column headed "Public use, losses, and transfers" reflect large exports of public-supply water to other river basins, whereas negative values reflect imports. During 1990, withdrawals for public supply were 102 million gallons per

Public supply is water withdrawn by public and private water suppliers

day, about 76 percent of the water withdrawn in Rhode Island. (Public use, losses, and transfers were included in this amount.) The largest publicsupplied deliveries were in the Narragansett basin, where public-supply systems in the cities of Providence, Pawtucket, Cranston, Warwick, and Bristol served residents and local commercial and industrial users. Domestic deliveries, 62.6 million gallons per day (64 percent) was the largest category of public supply. Commercial deliveries (23 percent) and industrial deliveries (13 percent) accounted for the second and third largest uses of public supply. The seasonal influx of tourists who utilize hotel and restaurant services accounts for the relatively large percentage of commercial deliveries.

Self-supply water is water that is withdrawn from a surface-water or ground-water source by a user rather than obtained from a public supplier. During 1990, self-supply withdrawals were 31.2 million gallons per day, about 24 percent of the water withdrawn in Rhode Island. The largest selfsupply withdrawals were in the Narragansett basin. The largest use of selfsupplied water, 11.6 million gallons per day, was for industrial purposes and accounted for 37 percent of self-supply water. Mining (22 percent), commercial (18 percent), domestic (16 percent), and agriculture (8 percent) were the other uses of self-supply water.

Total water use is the quantity of water use for a specific category and is the combination of self-supply withdrawals and public-supply deliveries. The domestic-use category, which only accounts for 4 percent of total withdrawals, is the largest total water-use category (51 percent) in Rhode Island

102 31.3 133

Category Public supply (Mgal/d) Self supply (Mgal/d) Domestic 62.6 4.9 Commercial Industrial 22.1 5.6 Industrial 12.5 11.6 Mining .0 6.8 Agriculture .0 2.4		
Commercial 22.1 5.6 Industrial 12.5 11.6 Mining .0 6.8 Agriculture .0 2.4	Public supply S (Mgal/d)	f supply Total lgal/d) (Mgal/d
Industrial 12.5 11.6 Mining .0 6.8 Agriculture .0 2.4	62.6	4.9 67.5
Mining .0 6.8 Agriculture .0 2.4	22.1	5.6 27.7
Agriculture .0 2.4	12.5	11.6 24.1
	.0	6.8
D. L.P.		2.4 2.4
Public use, losses, and transfers 4.4 .0		.0 4.4

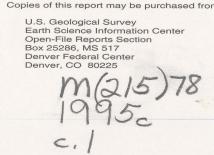
[Units are in million gallons per day (Mgal/d), except where noted; population numbers are rounded to the nearest hundred people; other numbers are rounded to the nearest 0.1 Mgal/d or to three significant figures; values may not add to totals because of independent rounding]

	Population with public supply (thousands)	Population with self supply (thousands)	Public-supply deliveries							
River Basin			Public use, losses, and transfers	Domestic	Commercial	Industrial	Thermo- electric	Total		
Cape Cod	2.9	2.0	0.0	0.0	0.0	0.0	0.0	0.0		
Blackstone	115.7	4.4	3	3.9	2.5	.0	.0	6.1		
Narragansett	744.1	53.6	4.3	53.4	18.3	12.0	.0	88.0		
Pawcatuck-Wood	65.8	9.0	.8	4.9	1.3	.5	.0	7.5		
Quinebaug	5.6	.3	4	4	.0	.0	.0	.6		
TOTAL	934.1	69.3	4.4	62.6	22.1	12.5	.0	102		

ESTIMATED WITHDRAWALS AND USE OF FRESHWATER IN RHODE ISLAND, 1990



For additional information write to:



1995