State of Rhode Island and Providence Plantations
Water Resources Board
One Capitol Hill, Third Floor
Providence, RI 02908
(401) 222-7901

RHODE ISLAND WATER RESOURCES BOARD
JOINT MEETING OF THE WATER ALLOCATION AND TECHNICAL COMMITTEE
Wednesday, February 12, 2014
10:00 AM – 11:00 AM

RI Department of Administration
One Capitol Hill, Providence RI
Legal Conference Room 3F, 3rd Floor

1. CALL TO ORDER

2. ITEMS FOR DISCUSSION

Water Availability Estimates

a. Staff updates on water availability estimating work

WSSMP Updates

b. Coordination of HAP Supplier Plans
   i. QDC
   ii. KCWA
   iii. North Kingstown
c. Coordination of Chipuxet Supplier Plans
   i. Narragansett
   ii. Kingston
   iii. URI
   iv. South Kingstown
   v. United Water
d. Coordination of East Bay Supplier Plans
   i. Pawtucket
   ii. East Providence
   iii. BCWA
e. Current WSSMP Reviews
   i. North Kingstown
   ii. Newport

3. ADJOURNMENT

February 4, 2014
Date

Kenneth J. Burke, P.E., MBA
General Manager and Treasurer

The meeting place is accessible to the handicapped in conformance with RIGL 42-46-2. Individuals requesting interpreter services for the hearing impaired must notify the Board office at tel. 222-7901 at least 72 hours in advance of the meeting date. If requested, tapes of the meeting will be made available.

Overseeing Body: RI Water Resources Board
Public Body: RI Water Resources Board
Public Contact Information: Kenneth J. Burke, PE

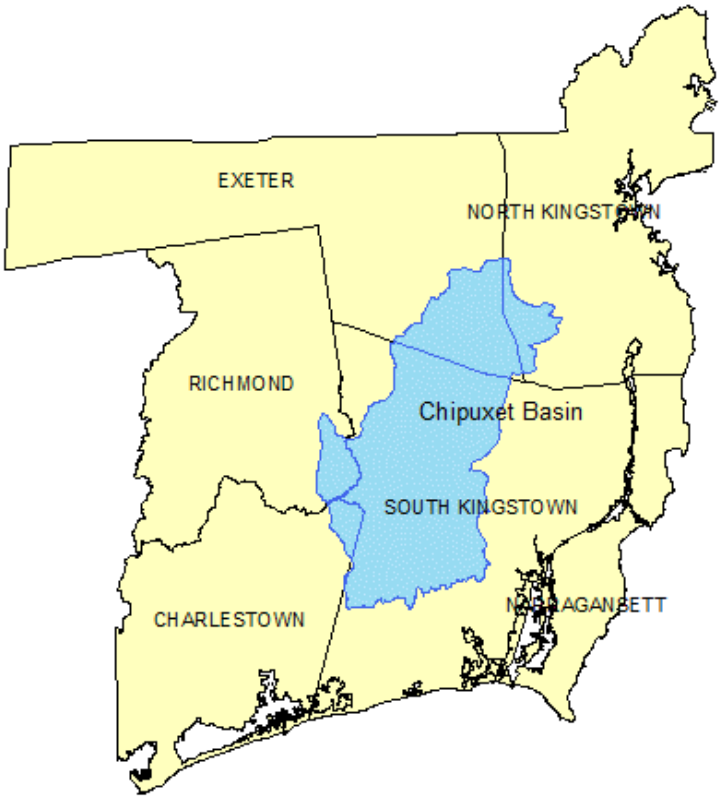
The Chipuxet Basin: A Case Study for Establishing Groundwater Availability

General Introduction and Purpose Statement

In March, 2012, the Water Resources Board adopted a strategic plan which included regional and statewide assessments of water use and availability. Two watersheds-the HAP and the Chipuxet- were identified for further evaluation to establish a template for determining groundwater availability and developing municipal guidance-. WRB and RIDEM staff worked together to refine the estimated available water using RIDEM's stream depletion methodology and more recent water use information collected by WRB. This pilot area serves as a template for establishing groundwater availability using a basin (watershed) approach. [1]

The drainage basin totals 36.93 square miles and is located primarily in the towns of South Kingstown (66%) and Exeter (18%) followed by North Kingstown (8%), Richmond (5%) and Charlestown (3%). North Kingstown, Richmond and Charlestown use the basin primarily for self-supply for domestic purposes. [2] Exeter also has direct agricultural withdrawals that are significant during dry summers (1 MGD). Public water supply withdrawals for three major water suppliers occur within the boundaries of the Town of South Kingstown. The water is used by South Kingstown and Narragansett.

Figure 1: Chipuxet Basin and Towns



Generally, domestic self-supply uses have minimal impacts on the basin from a water quantity perspective as roughly 15% of the water is used and 85% is returned to an on-site septic system within the basin. Public supplies are mostly exported out of basin either as wholesale sales or as wastewater. Net exports from the basin were estimated at 2.7 MGD for 1995-1999.[3]

The pages that follow describe the technical approach to determining water availability and sustainable use of the Chipuxet basin.

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[1] **§ 46-15.7-3 Functions of the water resources board,** charges the Board with establishing the quantity of water existing in every water source. The statute defines source as *any location at which ground or surface water may be withdrawn for any purpose, including tidal waters, harbors, estuaries, rivers, brooks, watercourses, waterways, wells, springs, lakes, ponds, impoundments, diversion structures, wetlands, aquifers, recharge areas, and any others that are contained within, flow through, or border on this state or any portion thereof.* (§46-15.7-2(4)).

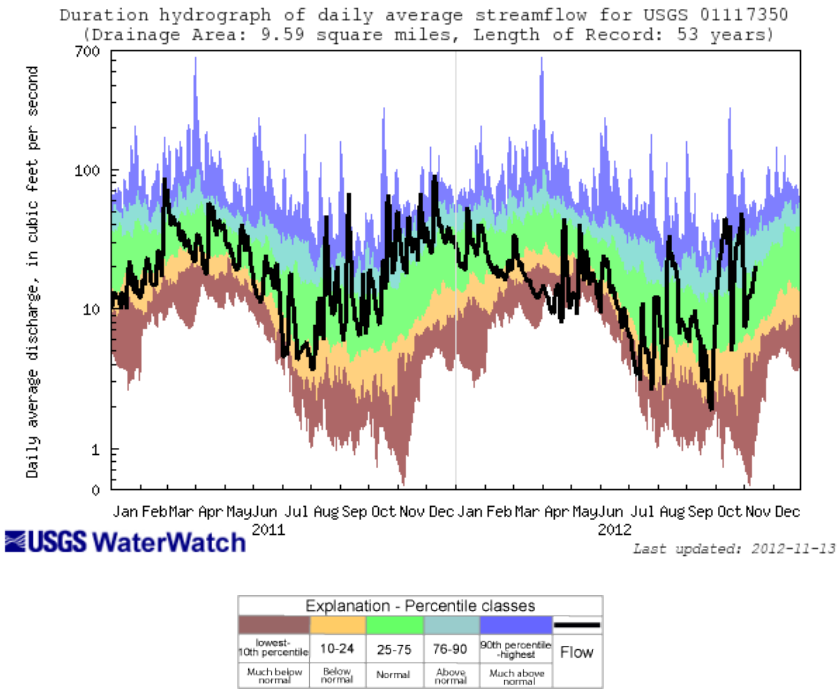
[2] The amount of impervious cover should be assessed and minimized through local land use controls to address watershed water quality and recharge considerations.

[3] *Estimated Water Use and Availability in the Pawcatuck Basin, Southern Rhode Island and South Eastern Connecticut, 1995-99; US Geologic Survey Scientific Investigations Report 2004-5020, Prepared in cooperation with the RI Water Resources Board.*

Basin Water Availability

Water availability varies annually with the seasons, over wet years and dry years and with demand and use of the resources. Even with all the variability, it is generally true across all seasons, and years, that there is less water in the system naturally in the summer than other times of the year. The graph below illustrates this variability with data for the Chipuxet stream gage at Route 138. RIDEM's Stream Depletion Methodology recognizes these variations. The SDM varies with available water such that six times the low flow SDM (July, August, and September) is available in January-April, four times the water is available in November, December and May and twice the low flow SDM is available in October and June. Regarding use of the resource, demands generally peak when less water is available naturally-namely summers, especially dry summers. Public policy and laws regarding water supply recognize the need to understand and protect the environment, use groundwater sustainably and minimize impact to the public and the environment during drought.

Figure 2: Stream Flow Variability at the Chipuxet Gage at Route 138



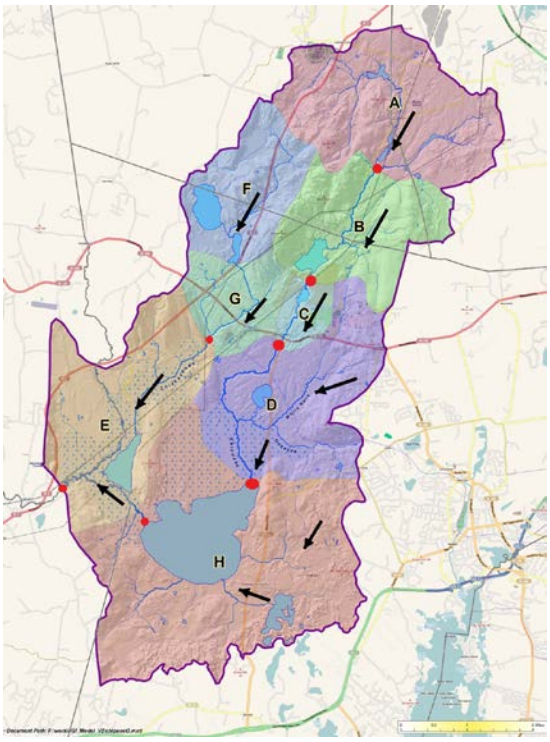
Safe Yield and Sustainable Use

Rhode Island General Laws define safe yield in terms of critical dry periods, the drought of record and an assessment of "adverse effects". The application of this definition must vary for surface water reservoir systems and for groundwater aquifers. "The safe yield of a given aquifer system is not a fixed independent quantity but rather a value conditioned by a particular set of constraints applied to a given aquifer system."[4] Constraints usually include regulations related to low stream flows, wetlands maintenance, restrictions of storage depletion, water quality limits, etc. [5] The RIDEM has established a methodology (RIDEM Stream Depletion Methodology, May, 2010) for calculating allowable depletions that are presumed to be protective of aquatic ecosystems during varying 'hydroperiods' including the low flow period.. For this effort, the SDM has been used by WRB and by RIDEM as a screening level method to establish sustainable yields with the understanding that detailed models and site specific

[4] Water Supply Analysis for the State of Rhode Island Final Report to the Rhode Island Water Resources Coordinating Council, Arthur D. Little, October 1990, p. III-39.
[5] Ibid., p.III-39

studies may be used to refine availability estimates during permitting. The SDM is also referenced in the WRB Strategic Plan and this document as the Resource Protection Goal. It been applied by the WRB as the best available approximation for groundwater safe yield as defined in the Rhode Island General Laws[6]

Figure 3: Chipuxet Basin Stream Reaches



In order the calculate the Chipuxet Basin Resource Protection Goal using the RIDEM Stream Protection Goal the basin is divided into reaches that accommodate stream flow, hydrology and water use considerations (Figure 3). The next steps in the process are to calculate the 'natural' low flows for the basin in order to establish the Resource Protection Goal (allowable depletion values) for each reach (A-H) and for the entire basin (E) for the low flow hydroperiod (July, August, and September).

There are several methods for determining natural low flows including hydrogeologic models. For this effort, the published Pawcatuck Optimization model report was used. The model results include a scenario with no water use which was used to calculate a natural low flow (7Q10) and the resource protection goal for the Chipuxet basin (see Appendix 3 for more detail). The results of the interpretation from the model are found in Table 1 below.

Table 1 – Natural 7Q10 and Stream Depletion Method for each evaluation point

Reach	River Name	Natural 7Q10 (MGD)	Incremental SDM By Reach (MGD)	Cumulative SDM by Reach (MGD)
A	Chipuxet	2.6	0.8	0.8
B	Chipuxet	2.8	0.05	0.85
C	Chipuxet	3.0	0.15	1.0
D	Chipuxet	4.5	0.4	1.4
H	Pawcatuck (Exit of Worden's Pond)	7.6	0.9	2.3
F	Chickasheen	0.6	0.2	0.2
G	Chickasheen	1.1	0.13	0.33
E	Pawcatuck at Kenyon	0.3 **10 (9-11)**	0.37 **3.0**	3.0 **3.0**

***** Note: The SDM for the Chipuxet is 30% of the natural 7Q10. The natural 7Q10 value of 9 MGD is used to calculate the allowable depletion (SDM).

[6] RI General Laws define safe yield in section **§ 46-15.7-2 Definitions.** Safe yield" means a sustainable withdrawal that can be continuously supplied from a water source without adverse effects throughout a critical dry period with a one percent (1%) chance of occurrence, or one that is equivalent to the drought of record, whichever is worse.

Water Withdrawals and Use

As stated in the introduction, the Chipuxet basin supports the water needs of a variety of users. Direct withdrawals support several major public water supplies, agriculture, a recreational use (Yawgoo), and private residential wells.

Chipuxet withdrawals vary by month, by season, and by year depending on the type of use and the amount of precipitation. Generally, water demands are higher in the summer months and in dry summers. Irrigation withdrawals, peak water supply withdrawals and 7Q10 low flows occur during the summer months. Because the statutory definition of safe yield is a drought definition (drought of record or 1% occurrence) and the SDM establishes a goal to protect the resources at low flows, it is prudent to evaluate the withdrawals consistent with the time period that the low (7Q10) flows occur. Using the summer values also establishes the amount of water that is needed to irrigate, support public health and tourism during peak season. The uses of the Chipuxet basin are briefly summarized below. Additional detail regarding methodology for estimating agricultural uses and estimating the allowable depletions are included in Appendices 1 and 2.

Self-Supply Withdrawals

Self-supply/self-disposed withdrawals, though included, are considered negligible (less than 0.1 MGD consumptive use across the basin). Yawgoo Ski Area does use water in the Chipuxet Basin, but minimally during the July-September time period as snow making occurs from November through April during periods of higher streamflows.

Agriculture Withdrawals

The need for irrigation increases as precipitation decreases. Agricultural representatives have stated that they need 1”/acre/week for crop health. For purposes of establishing available water, the agricultural irrigation needs are calculated based upon acres of cropland land and the estimated amount of irrigation water that would be required during dry years to provide 1’ per acre per week. For four separate dry years, week by week precipitation was noted and the difference between the actual precipitation and 1” was calculated. This water was assumed to be irrigated water taken from the river. If it rained more than 1” in a week, the irrigated water need was assumed to be 0 for that week and the excess water cannot be used. The final results confirmed studies by the USGS (SIR 2004-5139) and resulted in an irrigation need of 1900 gal/acre/day during a dry year. RIDEM calculated the irrigated land in each sub watershed and applied the agricultural water demand. Finally, the number was multiplied by 75%, assuming that there is 25% fallow land at all times (communications, Division of Agriculture). The details of this analysis are available in Appendix 2.

Public Supply Withdrawals

WRB assembled public supply data from the most recent annual report submissions covering the fiscal year 2013 (July 1, 2012- June 30, 2013). Peak demand is July 2012 data unless otherwise noted.

The graphics and tables that follow show locations and distributions of withdrawals from the basin and compare current use to the Resource protection goal.

Figure 3: Chipuxet Water Withdrawals and Use, Public Supply Districts and Reaches

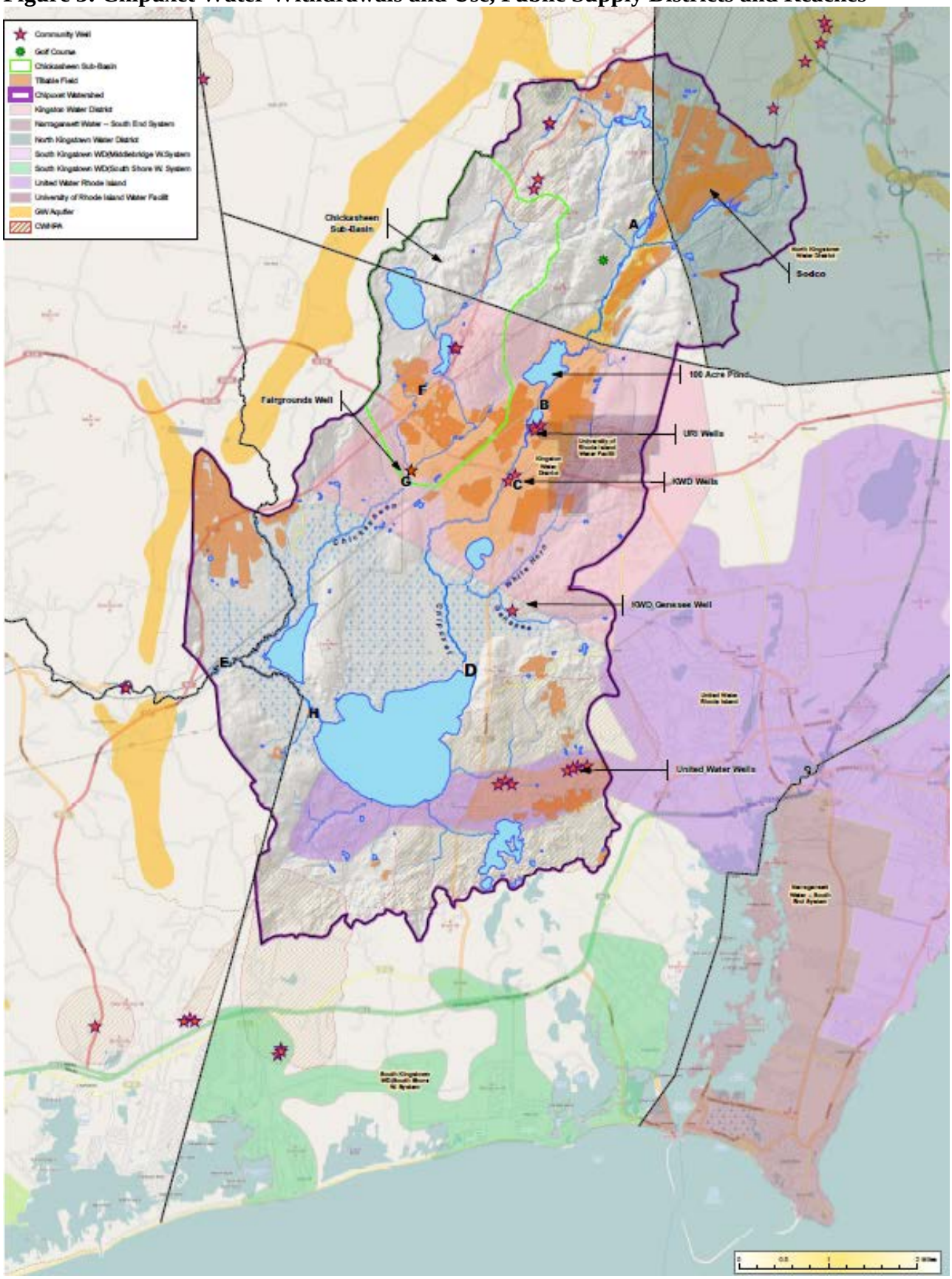


Table 2 shows the distribution of withdrawals by Municipality and withdrawal entity. Table 3 shows withdrawals in the basin by reach and compares the amount of water used to the amount available at low flows (Resource Protection Goal). Table 4 combines all the data and to evaluate current and future municipal demands and the impacts of each use geographically (by reach) as withdrawals occur upstream and downstream.[7]

Table 2 – Distribution of Peak Withdrawals by Municipality (MGD)

Water Withdrawal Entity	Exeter	Richmond	South Kingstown	Narragansett	Total Peak Use
Agriculture	1.10	0.70	1.60		3.40
URI			0.33		0.33
KWD[8]			0.37		0.37
United Water (Purchased Water)			0.75	1.38	2.13
United Water Retail Service Area[9]			1.87	1.03	2.90
Self Supply[10]	0.01	0.01	0.05		0.07
Total Peak Use	**1.11**	**0.70**	**4.97**	**2.41**	**9.20**

Table 3 – Distribution of Peak Withdrawals by Withdrawal Entity (MGD) Compared to Resource Protection Goal (SDM)

Reach	*Agriculture needs in each Reach in (MGD) for a 7Q10 year*	*Estimated Self Supply*	*Public Water Supply (MGD)*		*Public Withdrawal Entity*	*Cumulative Peak Withdrawals (MGD)*	*SDM (30% of the natural 7Q10) (MGD)*	*Cumulative Exceedence by Reach (MGD)*
			Annual Average	*July*				
A	*1.10*	*0.01*				*1.11*	*0.80*	*-0.31*
B	*0.2*					*1.31*	*0.85*	*-0.46*
C	*0.3*		*0.38*	*0.37*	*KWD,URI*[11]	*1.98*	*1.00*	*-0.98*
D	*0.3*		*0.30*	*0.33*	*KWD*[12]	*2.61*	*1.40*	*-1.21*
H		*0.05*	*3.07*	*5.03*	*UWRI*	*7.69*	*2.30*	*-5.39*
F	*0.5*		***Chickasheen Basin***			*0.50*	*0.20*	*-0.30*
G	*0.3*					*0.80*	*0.33*	*-0.47*
E	*0.7*	*0.01*				*0.71*	*0.37*	*-0.34*
Entire Basin	***3.40***	***0.07***	***3.75***	***5.90***		***9.20 MGD***	***3 MGD***	***-6.20 MGD***

[7] Buildout data was compiled from the WRB Supplemental Water Study. The analysis is zoning based. Future water use is calculated at 65 gpcd for additional residential use and 80 gallons per 1,000 square feet for commercial.
[8] A portion of Kingston Water District (KWD) is not sewered. The withdrawal value should be offset by return flows similar to the method used for self- supply withdrawals. 90% of KWD withdrawals occur in Reach D and 10% in Reach C.
[9] Source: United Water RI FY 2013 annual report to the Water Resources Board. July 2012 data is used.
[10] Charlestown (Reach E) and North Kingstown (Reach A) are not shown but contribute to the total and are included in the main database.
[11] URI water withdrawals were highest in September and were generally higher in the winter than the summer. The July figure is used in the table.
[12] KWD provided July 2013 data to more accurately reflect current and projected peak uses.

Table 3 –Current Peak Withdrawals by Municipality and Reach in the Chipuxet/Chickasheen Basins Compared to the Resource Protection Goal (SDM)

Users and Customers[13]	Reach	Low Flow SDM By Reach	July [14] Demand by Reach	July % Total Reach Demand	July Available Water	July Over/Under
Exeter - agriculture[15]	A	0.80	1.10	98.98%	0.79	(0.31)
Exeter - small self supply	A	0.80	0.01	0.88%	0.01	(0.00)
Total Exeter			**1.11**		**0.80**	**(0.31)**
North Kingstown - agriculture	A	0.80	0.00	0.00%	0.00	(0.00)
North Kingstown - small self supply	A	0.80	0.00	0.14%	0.00	**(0.00)**
Total North Kingstown			**0.00**		**0.00**	**(0.00)**
South Kingstown - agriculture (Reach B)	B	0.05	0.20	100.00%	0.05	(0.15)
Kingston Water (Wells 1,2)	C	0.15	0.04	5.55%	0.01	(0.03)
URI Water	C	0.15	0.33	49.48%	0.07	(0.26)
South Kingstown - agriculture (Reach C)	C	0.15	0.30	44.98%	0.07	(0.23)
Kingston Water (Well 3) [16]	D	0.40	0.33	52.61%	0.21	(0.12)
South Kingstown - agriculture (Reach D)	D	0.40	0.30	47.39%	0.19	(0.11)
South Kingstown - agriculture (Reach F)	F	0.20	0.50	100.00%	0.20	(0.30)
South Kingstown - agriculture (Reach G)	G	0.13	0.30	100.00%	0.13	(0.17)
United Water Retail (South Kingstown)	H	0.90	1.87	36.85%	0.33	(1.54)
United Water sold (South Kingstown Water)	H	0.90	0.75	14.67%	0.13	(0.61)
South Kingstown - small self supply	H	0.90	0.05	0.96%	0.01	(0.04)
Total South Kingstown			**4.97**		**1.40**	**(3.56)**
United Water Retail (Narragansett)	H	0.90	1.03	20.28%	0.18	(0.85)
United Water sold (Narragansett Water)	H	0.90	1.38	27.24%	0.25	(1.14)
Total Narragansett			**2.41**		**0.43**	**(1.99)**
Richmond - agriculture	E	0.37	0.70	99.18%	0.37	(0.33)
Richmond - small self supply	E	0.37	0.00	0.48%	0.00	(0.00)
Total Richmond			**0.70**		**0.37**	**(0.33)**
Charlestown - agriculture	E	0.37	0.00	0.00%	0.00	0.00
Charlestown - small self supply	E	0.37	0.00	0.34%	0.00	(0.00)
Total Charlestown			**0.00**		**0.00**	(0.00)
Total Chipuxet Basin	**All**	**3.00**	**9.20**	**0.00**	**3.00**	**(6.20)**
Estimated Demand at Buildout[17]			**12**			**(9.00)**

[13] Self -supply uses are dispersed and are assigned to reaches geographically. In aggregate, self-supplied consumptive uses totaled 0.07 MGD for the 1995-1999 study period (*Estimated Water Use and Availability in the Pawcatuck Basin*).
[14] July demand for major suppliers is assembled from the most recent annual data submission (July 2012) with revisions as appropriate to consider system specific adjustments.
[15] Some of the water withdrawn in Exeter is used in North Kingstown. The total amount is assigned to Exeter.
[16] 90% of KWD withdrawals occur in Reach D.
[17] WRB estimated buildout demand in 2008 for areas served by public supply. Projected self-supply has not been calculated by basin. Agriculture is assumed to remain constant.

Management Options

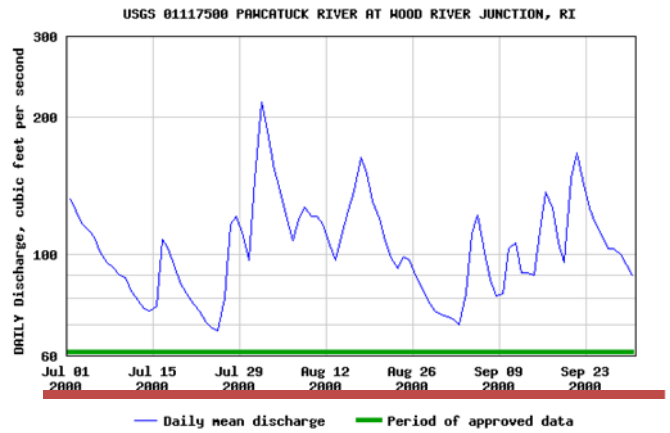
Overall Goal: Facilitate, regulate, and incentivize demand management and supply augmentation to meet current and future water demand and improve the health of the Chipuxet watershed.

1. Reduce peak withdrawals during low flow periods (July – September)
2. Reduce peak demands during low flow periods (July – September)
3. Develop new or alternate sources to alleviate summer supply issues.
4. Other techniques (aquifer recharge, dam management, desalination)
5. Identify areas that exceed/threaten to exceed their safe yield
6. Identify further site specific studies to refine the SDM

Appendix 1: Calculation Estimates of Agricultural Water Use in Rhode Island

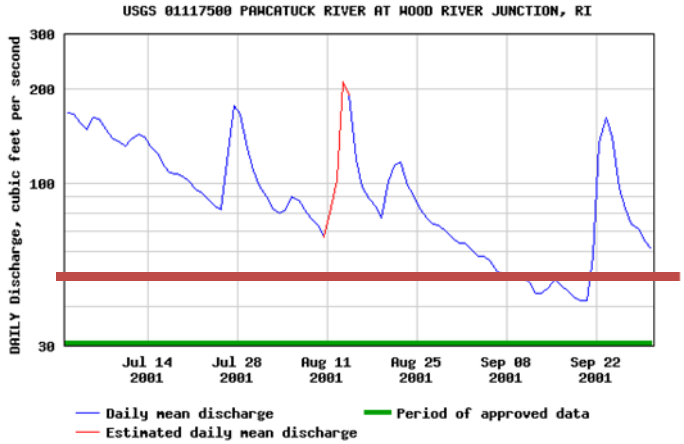
Natural 7Q10 = 15.47 cfs

Week including	precip	make-up water	gal/acre/wk	gal/acre/day
7/1/2000	0.27	0.73	19710	2816
7/8/2000	0.09	0.91	24570	3510
7/15/2000	0.01	0.99	26730	3819
7/22/2000	0.6	0.4	10800	1543
7/29/2000	1.27	0	0	0
8/5/2000	1.24	0	0	0
8/12/2000	0.63	0.37	9990	1427
8/19/2000	no data			
8/26/2000	no data			
9/2/2000	0.62	0.38	10260	1466
9/9/2000	0.24	0.76	20520	2931
9/16/2000	1.14	0	0	0
9/23/2000	1.5	0	0	0
9/30/2000	0.31	0.69	18630	2661



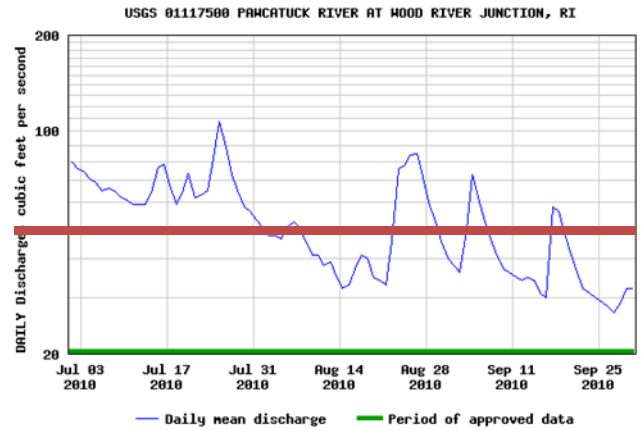
AVG IRRIGATION 1681 gal/acre/day

7/1/2001	0.55	0.45	12150	1736
7/8/2001	0.58	0.42	11340	1620
7/15/2001	0.09	0.91	24570	3510
7/22/2001	0.71	0.29	7830	1119
7/29/2001	0.55	0.45	12150	1736
8/5/2001	0.35	0.65	17550	2507
8/12/2001	1.65	0	0	0
8/19/2001	1.76	0	0	0
8/26/2001	0.2	0.8	21600	3086
9/2/2001	0.06	0.94	25380	3626
9/9/2001	0	1	27000	3857
9/16/2001	3.15		0	0
9/23/2001	0.46	0.54	14580	2083
9/30/2001	0.31	0.69	18630	2661



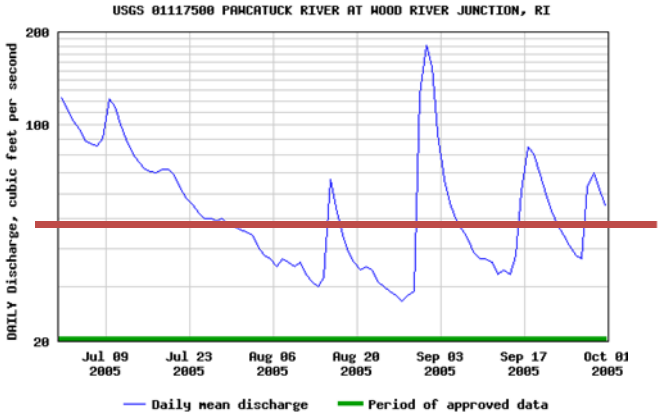
AVG 1967 gal/acre/day

7/3/2010	0.66	0.34	9180	1311
7/10/2010	0.36	0.64	17280	2469
7/17/2010	1.31	0	0	0
7/24/2010	1.89	0	0	0
7/31/2010	0.12	0.88	23760	3394
8/7/2010	0	1	27000	3857
8/14/2010	0.04	0.96	25920	3703
8/21/2010	0.08	0.92	24840	3549
8/28/2010	2.31	0	0	0
9/4/2010	0.99	0.01	270	39
9/11/2010	0	1	27000	3857
9/18/2010	0.82	0.18	4860	694
9/25/2010	0	1	27000	3857
10/2/2010	0.96	0.04	1080	154



AVG 1920 gal/acre/day

7/1/2005	0.11	0.89	24030	3433
7/8/2005	0.75	0.25	6750	964
7/15/2005	0	1	27000	3857
7/22/2005	0.19	0.81	21870	3124
7/29/2005	0.01	0.99	26730	3819
8/5/2005	0.01	0.99	26730	3819
8/12/2005	0.21	0.79	21330	3047
8/19/2005	0.1	0.9	24300	3471
8/26/2005	0.8	0.2	5400	771
9/2/2005	3.45	0	0	0
9/9/2005	0	1	27000	3857
9/16/2005	2.92	0	0	0
9/23/2005	0.14	0.86	23220	3317
9/30/2005	1.22	0	0	0



AVG 2391 gal/acre/day

USGS SIR 2004-5139 p13

When irrigating, turf fams apply an average of 1820 gal/d/acre

Turf farms irrigated between 35 and 63 days per year during 2000 and 2001

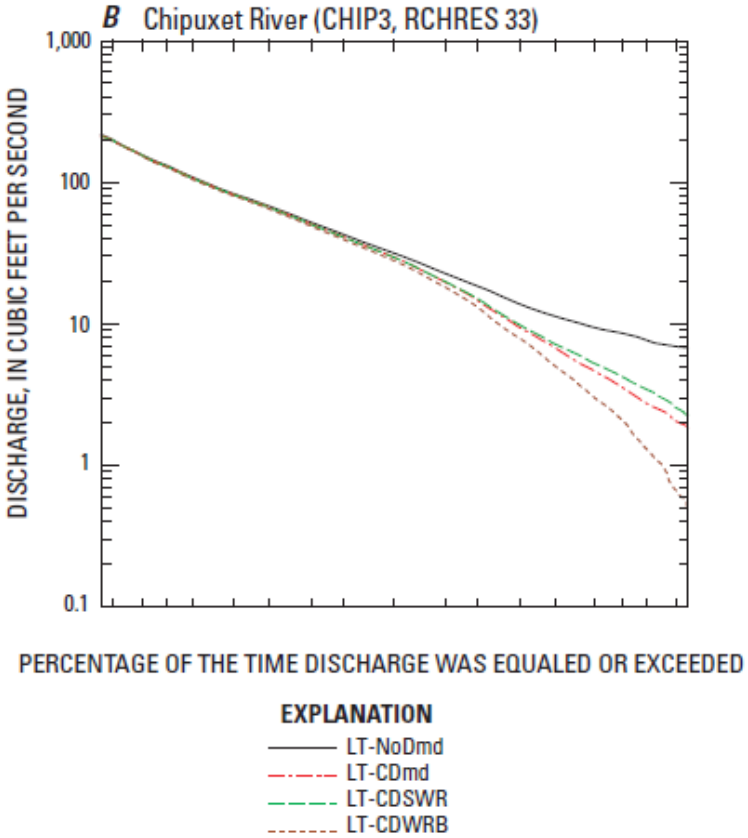
Average of the 4 years

AVG **1990** **gal/acre/day**

Final application is 1900 gal/acre/day for allocation

Appendix 2: Summary of Method Used to Calculate the Natural 7Q10 and Allowable Depletions Using the Pawcatuck Optimization Model

The natural 7Q10 represents the expected lowest 7 consecutive day average flow that would occur (on average) once every 10 years assuming little to no human effect on flows. Using the best available tools, there are a number of ways that natural 7Q10 can be determined (See also published Stream Depletion Report, RIDEM May, 2010). Multiple historic methods were reviewed in order to calculate the natural 7Q10. [18] Given that the existing Pawcatuck Optimization model is the most accurate method of calculating the natural 7Q10, the model results were interpreted and the No Demand (LT-NoDmd) or Natural flow condition was compared to the Current Demand (CDmd) flow condition. The current 7Q10 under the Current Demand Scenario occurred at the 99th percentile. The Natural 7Q10 was then derived by applying same 99th percentile return frequency to the No Demand scenario. Published graphs from the HSPF model were used to determine the natural 7Q10 for points C, E, and G (The Figure above shows the model scenarios for Reach C at the Chipuxet gage at Route 138). The 7q10 value occurred at the 99th percentile. This equates to a 1% chance of occurring in any day or 1 in 100 day occurrence. It should be noted that even the best analysis is subject to some amount of error. Conversations with USGS have expressed that the model output could have as much as a + or -20% margin of error at the low flows for a variety of reasons (see also USGS SIR 2009-5127 model fit section, pp. 159-177). The remaining reaches were estimated based on their proportionate share of the total drainage basin. The results of the interpretation from the model and the drainage area ratios are found in Table 1 and the Natural 7Q10's are provided.



[18] They include USGS WRIR 84-4254 (p. # 10) (modflow model-Chipuxet 138 above), Streamflow at the Chipuxet gage (011178350) from 1975-2004, USGS 93-4046, and USGS 2009-5127 Pawcatuck HSPF model

State of Rhode Island and Providence Plantations
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To: Water Resources Board Technical Committee
From: Romeo N. Mendes, P.E., Supervising Engineer
Date: 2/3/14
Subject: Southern Region Water Supply and Demand Estimating

Background: The Board's Strategic Plan approved in March of 2012 provides Water Supply and Demand Estimating Data for the entire State. The plan details that certain basins primarily located in the southern region either exceed or threaten to exceed allowable depletions. Two such areas are the Hunt and Chipuxet River aquifers. Within the Hunt, three public water suppliers, KCWA, North Kingstown and QDC withdraw groundwater and five water suppliers URI, Kingston, South Kingstown, Narragansett and United Water use groundwater from the Chipuxet. The Water Resources Board has determined that the resource protection goals for the Hunt and Chipuxet basins are exceeded.

Discussion: Staff is reviewing the KCWA, North Kingstown and QDC water system supply management plans noting that each system's supply management component lists presumed or maximum pumping capacity. Staff notes that these values may inadvertently be confused as the WRB's resource protection goal of the resource.

Hunt Water Supplier - Pumping Capacities (mgd)

	KCWA	N. Kingstown	QDC	Total
WRB Resource Protection Goal	0.56	1.39	0.48	2.43
Pumping Capacities	2.3	2.2	5.5	10.0
Difference	**(1.74)**	**(.81)**	**(5.02)**	**(7.57)**

The summary table below depicts peak summer withdrawals compared to the WRB's resource protection goal.

Resource Protection Goal vs. Water Supplier Current Peak Summer Withdrawal (mgd)

	KCWA	N. Kingstown	QDC	Total
WRB Resource Protection Goal	0.56	1.39	0.48	2.43
Summer Use	0.72	1.77	0.61	3.10
Difference	**(0.16)**	**(0.38)**	**(0.13)**	**(0.67)**

As indicated in the table above and consistent with the HAP water suppliers agreement dated April, 2007, the HAP suppliers must coordinate their withdrawals in order to avoid exceeded the safe (sustainable) yield of the resource.

The following summary table depicts the situation in the Chipuxet.

Chipuxet Water Supplier - Pumping Capacities (mgd)

	Kingston	URI	United (Retail)	Narragansett	South Kingstown	Total
WRB Resource Protection Goal	.22	.07	.51	.25	.13	1.18
Pumping Capacities	2.7	2.21	7.42-2.8= 4.62	United Connection Capacity 2.3	United Connection Capacity .5	12.33
Difference	**(2.48)**	**(2.14)**	**(4.11)**	**(2.05)**	**(.37)**	**(11.15)**

Chipuxet Sustainable Yield vs. Current Peak Summer Withdrawal (mgd)

	Kingston	URI	United (Retail)	Narragansett	South Kingstown	Total
WRB Resource Protection Goal	.22	.07	.51	.25	.13	1.18
Summer Use	.37	.33	2.9	1.38	.75	5.73
Difference	**(.15)**	**(.26)**	**(2.39)**	**(1.13)**	**(.62)**	**(4.55)**

Recommendation: Require suppliers in the Hunt and Chipuxet basins to formally acknowledge that those aquifers contain limited resources and that pumping capacities are not an accurate measure of the sustainable (safe) yield of those resources. Furthermore, the sustainable (safe) yields of the groundwater resources for the Southern Region (where the HAP and Chipuxet basins are located) are the published resource protection goals detailed in the 2012 WRB strategic plan. Further refinements to these resource protection goals are underway and will include a more detailed analysis of the individual water suppliers and the municipalities that they serve.