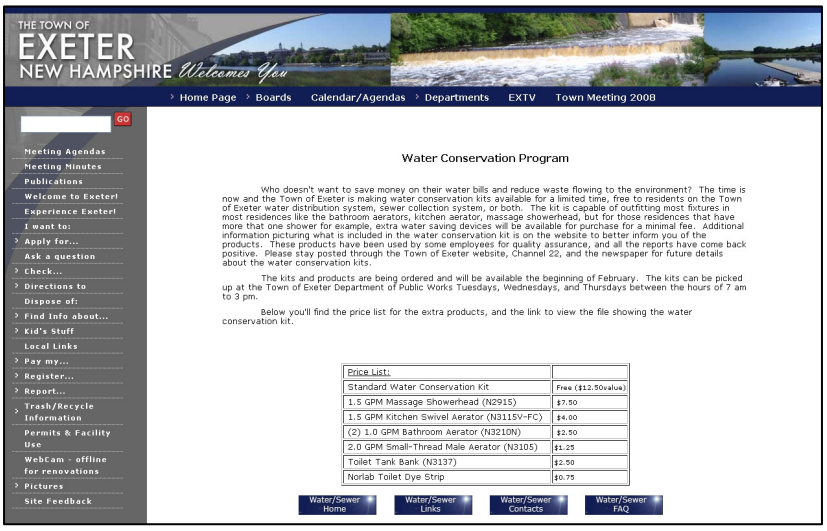
Town of Exeter, New Hampshire

Water Efficiency and Management Plan

May 2011 (DRAFT)

Preserving, Enhancing,

Community & Environment



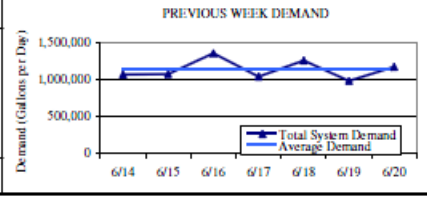
Water Supply Management Report - Town of Exeter, New Hampshire

Resource Status

Date:	06/21/10		Operator:	1/0/1900
Haigh Gage Flow	30.0 *(CFS)*	*13,464 (GPM)*		*19.39 (MGD)*
Flow at River Intake	51.1 *(CFS)*	*22,929 (GPM)*		*33.02 (MGD)*
Reservoir Level	2.0 *(feet)*	*16.00 (MG)*	*Usable Storage*	

System Demand

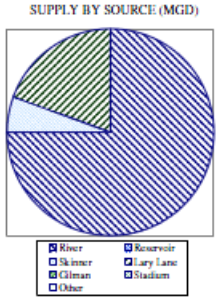
Date	Total System Demand (GPD)
6/14	1,072,608
6/14	1,080,424
6/15	1,364,342
6/17	1,046,220
6/18	1,264,051
6/19	987,067
6/20	1,179,291
7-day Average	1,142,000



Water Supply by Source

Source	Withdrawal (GPD)	Supplied (GPD)
River Intake	1,368,000	1,106,832
Reservoir	0	0
Skinner Springs	98,640	79,808
Lary Lane	288,000	288,000
Gilman	0	0
Stadium	0	0
Other	0	0
River to Reservoir	72,000	72,000
Total Withdrawal	**1,826,640**	
Total Supplied		**1,474,640**
Total Demand		**1,142,000**
Demand as % of Supply		**77%**

Demand is satisfied.



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1 - Introduction

This water efficiency and management plan continues the development of the Town of Exeter's (Town) comprehensive water supply management program. A previous draft, entitled "Water Conservation Plan" accompanied the Town's Preliminary Hydrogeological Investigation Report prepared by Weston & Sampson Engineering for the potential reactivation of the Town of Exeter's Stadium and Gilman Park Wells, located in Exeter, New Hampshire. This report was submitted to the New Hampshire Department of Environmental Services (DES) in November 2008. Subsequently, the plan continued its development as part of the scope of work Weston & Sampson performed for the Town as part of the Water Supply Alternatives Study, completed in October 2009. This version combines portions of both of these previous reports and builds on the overall water efficiency concept for the Town to utilize for planning and management purposes of their water supply system.

The following graphic provides a summary of the requirements per the New Hampshire Department of Environmental Services (NHDES) that a water system implement a conservation program in accordance with New Hampshire RSA Chapter 485-C:21 V-b for all new sources (or in the instance of the Gilman and Stadium wells; reactivation) of water supply:

Requirements for All Large Community Water Systems and All New Small Community Water Systems Developing New Sources of Water

1. Install and maintain meters for all water withdrawals and service connections.

2. Implement a water audit, leak detection and leak repair program in accordance with the "Manual of Water Supply Practices, Water Audits and Leak Detection", document identification number AWWA M36, American Water Works Association, 1999.

3. When applicable, development and implementation of response plans to reduce unaccounted for water to less than 15%.

4. Implement a rate structure that encourages efficient water use.

5. Implement a water conservation educational outreach initiative.

per: **http://www.des.state.nh.us/pdf/summary_of_water_env-ws_390.pdf**

The following management measures address this guidance. They have been, or will be, implemented by the Town of Exeter water system.

1.1 Water System Demand History

The following graphic shows the actual water use data for the Town of Exeter's public water system from 1950 to 2008. This data was obtained from previous engineering studies, Annual Town Reports and operational data. A few gaps occur due to the lack of available data however, a fairly clear picture of water supply demands for this 58 year period is evident. As it shows, water demands have leveled off in the last 10 years, holding steady at an average of approximately 1 million gallons per day.

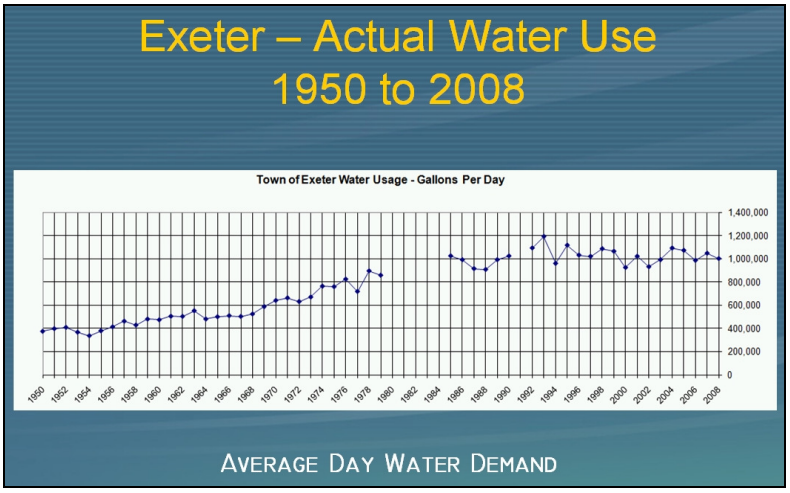


Figure 1.1 – Actual Water Use, 1950 to 2008

Daily water system production for a two year period (October 2006 to September 2008) reveals the following demand pattern in the Exeter water system:

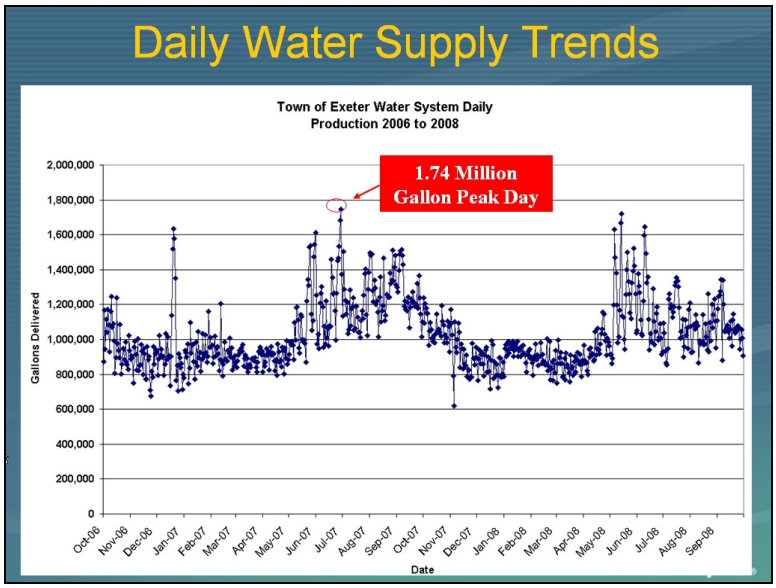


Figure 1.2 – Daily Water Supply Trends, Oct. 2006 to Sep. 2008

This data shows the seasonal nature of Exeter's water demand. This is a fairly typical pattern for most water systems in New Hampshire with summer demands being higher than winter demands. This can be attributed to the use of town water for irrigation, the filling of swimming pools and other outside water use. This data also shows a peak system production of 1.74 million gallons. The following graphic and table summarize the demand data over this same period of time:

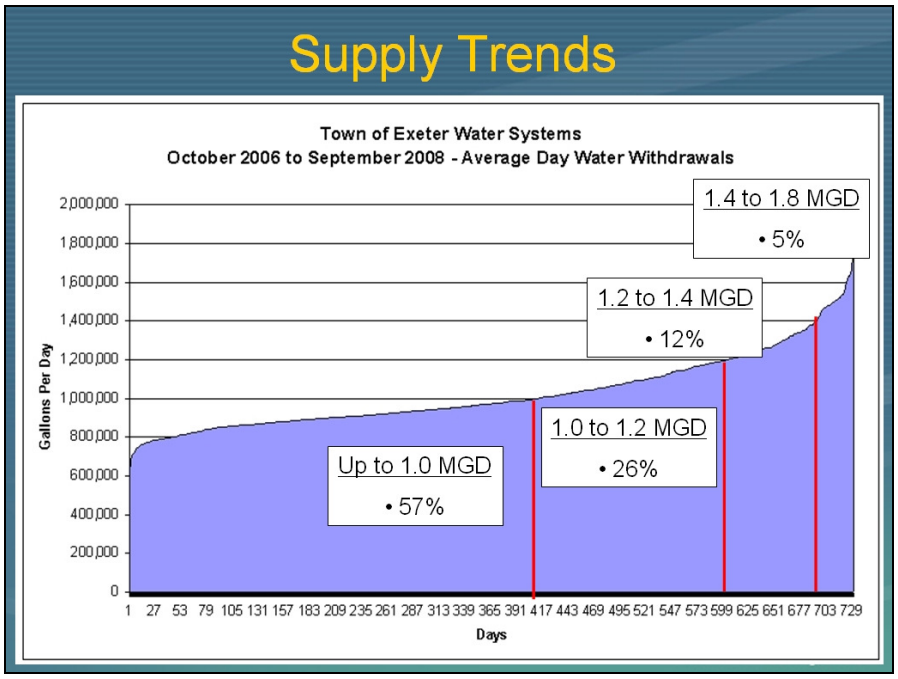


Figure 1.3 – Average Day Water Withdrawals, Oct. 2006 to Sep. 2008

Water Demand (MGD)	Number of Days	Percentage of Days
Up to 1.0	417	57%
1.0 to 1.2	190	26%
1.2 to 1.4	88	12%
1.4 to 1.8	37	5%

Table 1.1 – Water Demand Trends

Source: Water Treatment Facility Operating Records - Based on 731 days of data (October 2006 to September 2008)

As this data shows, most of the water system demands are below 1.2 MGD (83%) and only 5% of the demands are above 1.4 MGD. From the perspective of planning for future water supply needs it is useful to see that Exeter's demands are not growing at a considerable rate, nor are their peak days excessive.

1.2 Water Use Demographics

The Town of Exeter currently serves 3,330 customers via their municipal water system. Weston & Sampson met with the Town of Exeter's water and sewer billing department and obtained two years worth of water user data from the Town's billing database. After reviewing the data it was agreed that utilizing one year of data for the period of October 2007 through September 2008 would be appropriate to determine water usage patterns. In review of that data we determined that some of the accounts had information that did not transfer correctly into the Excel format. This data was then corrected by doing follow-up with Town staff. This process was complicated by several factors: 1) water bills are issued quarterly, 2) water bills are staggered – approximately one third of users receive a bill each month, and 3) water meters are not always read on the first of a month. In order to fairly compare water usage rates among users, water usage records were transformed through a series of steps to account for these complicating factors. The following table reveals the following breakdown of water usage patterns for the Town of Exeter by customer accounts:

Water Use Range (GPD)	Number of Accounts	Sub Total	Percent of Accts
Over 20,000	2		
10,000 to 20,000	5		
5,000 to 10,000	10	17	0.5%
2,500 to 5,000	18		
2,000 to 2,500	16		
1,500 to 2,000	16		
1,100 to 1,500	44	94	2.9%
500 to 1,000	108		
250 to 500	449	557	16.9%
150 to 250	876		
100 to 150	693	1569	47.7%
50 to 100	663		
25 to 50	266	929	28.2%
5 to 25	123	123	3.7%
	3289		

Table 1.2 – Water Use Demographics by Account

As shown by this table, approximately 80% of the water users on the Town of Exeter's municipal water system average between 5 to 250 gallons per day. There are many ways one might interpret this data in respect to normal water usage. To gain some perspective we referred to the May 6, 2008 press release from the United States Geologic Service (USGS) regarding their recently published study "Methods for and Estimates of 2003 and Projected Water Use in the Seacoast Region, Southeastern New Hampshire" summarized their findings for water use in the region. It stated that:

"Water demand for homes accounts for more than 70 percent of all water use in the region, whether those homes have private wells or are part of community water supply systems," said USGS hydrologist, Marilee Horn, lead author of the study. "We also found that each person in the region used about 75 gallons per day, although this value was highly variable from town to town," said Horn. "This amount increased to 92 gallons per day in the summer due to lawn and garden watering, car washing and other outdoor uses." Horn added that "the type of housing development significantly affected the amount of water use. For example, homes in less urbanized areas with extensive lawns consumed a much greater volume of water than homes in areas with a higher population density and limited needs for outdoor watering."

By utilizing the USGS's study findings and then referring back to the Town of Exeter's water usage records reveals that the Town's customers are fairly efficient with their water use. The median customer in Exeter uses approximately 140 gallons per day. It is most likely that this demographic of customer is a single family residential unit, as most of Exeter's customers are. If this is the case and US Census data of 2.59 persons per household in New Hampshire is utilized, then the average usage per person would equal 54 gallons per day or 25% below the average identified in the USGS study.

1.3 Large Water Users

Weston & Sampson then investigated the water usage records for the top 25 water users on the Town of Exeter's municipal system. By knowing the usage demographics of these larger customers, the Town could hope to reduce its overall water demand by working with them to improve efficiencies.

Through our review of account information in order to identify the high water users in the system, we realized that we needed to combine a number of accounts into one customer. For example, the Phillips Exeter Academy (PEA) is the Town's largest water user, averaging 63,335 gallons per day of usage. However, they own a lot of property. These separately metered accounts range from large halls in the center of campus to student dormitories, to houses and condos that house teaching staff. Combined, they have 80 different accounts that include big users such as:

- Jeremiah Smith Hall – 16,998 GPD
- Main Street Hall – 2,907 GPD
- PEA Gym – 2,501 GPD

They also have 15 accounts that average between 1,000 to 2,000 GPD and many other accounts that range between 100 to 1,000 GPD, including:

- Boat House – 364 GPD
- Sleeper House – 212 GPD
- Kerr House – 113 GPD

Overall, these 80 PEA facilities use a combined average of 792 GPD per facility. According the PEA website, the school has an enrollment of approximately 1,000 students and employs approximately 650 people which include "hundreds of employees who support [PEA] in offices, dining services, facilities and other areas of the campus." Combined, this totals 1,650 people

associated with PEA. Breaking their water use down on a per-person basis would equal a usage of 38 gallons per person per day on average. It must be noted however that the number goes up and down on a daily basis depending on when school is in session and that many of these people may only be on campus a portion of the time.

Similar multiple account users were identified and combined for this analysis. They include the Exeter Hospital and Exeter Health Care, Riverwoods, the Mills (condos, apartments and townhouses), and the Exeter School District. Additionally, there are a number of accounts that are served by one master meter that have multiple users. These include; Altid Enterprises, which is the business park located in Stratham that includes Timberland and the Lindt candy factory, Exeter Hampton Co-op, Sherwood Forest and Deep Meadows Mobile Home parks, Sterling Hill, Exeter West Condos, Exeter Housing Authority, 27 Ernest Avenue Condos.

The following table provides further detail of the Top 25 water users in Exeter:

Town of Exeter, NH - Top 25 Water Users Based on One Year of Water Use Data (Oct '07 to Sept '08)

Rank	Primary Account #	Number of Accounts	Total Usage (gallons)	Usage/Day (gallons)	Usage/Day per Acct	Account Name
1	343465900	80	23,180,444	63,335	792	Phillips Exeter Academy
2	121241900	15	14,664,422	40,149	2,677	EXETER HOSPITAL
3	131374550	1	10,677,130	29,172	29,172	ALTID ENTERPRISES
4	212105901	16	6,359,323	17,375	1,086	RIVERWOODS CONDO
5	131379000	2	5,335,184	14,607	7,304	SUNBRIDGE HEALTH& REHAB
6	121237230	5	4,459,517	12,184	2,437	OSRAM SYLVANIA
7	131374650	1	3,862,440	10,553	10,553	EXETER HAMPTON COOP
8	212127125	1	3,123,977	8,535	8,535	DEEPMEADOWS MHP
9	242474000	1	2,937,786	8,027	8,027	SHERWOOD FOREST
10	323216970	1	2,843,956	7,770	7,770	CONTINENTAL MICROWAVE
11	111108550	13	2,271,370	6,206	477	THE MILLS
12	131371650	2	1,923,370	5,663	2,832	BROOKS PROPERTIES
13	313105125	1	1,910,203	5,219	5,219	EXETER SCHOOL DISTRICT
14	212102929	1	1,483,168	4,052	4,052	BLUE RIBBON CLEANERS
15	121237222	1	1,479,804	4,043	4,043	EXETER WOODS/ CLARK PROPERTY MGMT CO.
16	212102398	1	1,446,567	3,952	3,952	THE RINKS AT EXETER INC.
17	212106210	1	1,431,868	3,912	3,912	INN OF EXETER LLC
18	323216681	1	1,125,567	3,075	3,075	SIGARMS
19	323216555	1	1,097,803	2,999	2,999	BURNHAM DRY CLEANERS
20	121229000	1	1,039,796	2,827	2,827	FLYNN'S CAR WASH
21	121238125	11	920,267	2,514	229	EXETER HEALTH CARE
22	131376135	1	875,859	2,393	2,393	STERLING HILL
23	212102400	1	868,893	2,374	2,374	EXETER WEST CONDO
24	212128200	1	864,450	2,362	2,362	EXETER HOUSING AUTHORITY
25	212102350	1	833,004	2,276	2,276	27 ERNEST AVENUE CONDOS

Table 1.3 – Top 25 Water Users (based on Oct. 2007 to Sep. 2008 billing data)

It was envisioned that by addressing inefficiencies in the water usage of these top water users, the Town could significantly reduce its daily water demand. These Top 25 water users represent approximately 25% of the Town's total daily demand; reducing the volume of water used by these accounts by only 8% would represent a 2% or 21,000 gallon reduction in daily water demand. However, a review of the top users has revealed that perhaps these top users are already relatively efficient in their water usage. According to our research, these users do not appear to

be heavy users of irrigation during the summer. In fact a lot of them do not irrigate at all. Most of these accounts service residential facilities such as apartments, trailer parks, and condominiums or medical facilities, such as hospitals, dentists, and physical therapy centers. The remaining accounts are generally schools, Town facilities, or commercial in nature. While there are certainly opportunities to improve the efficiency of water usage among these top users, particularly the few Town facilities and commercial properties, these top users are perhaps less capable of reducing the Town's total demand than previously envisioned. Therefore, the next step in the process would be to determine what type of retrofits and/or programs would improve overall water efficiency in the Town. The following sections of this plan explore those options further.

2 - Water Metering and Billing

2.1 Sources of Supply and Customer Meters

Existing Sources: All sources that distribute potable water into the water system are currently metered. This metered information is recorded daily (as gallons-per-day) by the water treatment plant operators. These sources include:

- Water treated at Exeter's Water Treatment Plant
- Water obtained from the Skinner Springs and treated at the Water Treatment Plant
- Water obtained from the Lary Lane well (currently utilized only as an emergency water source)

New Sources: All new sources of supply, such as the reactivation of the Stadium and Gilman Park wells, will be metered appropriately prior to being put into service.

Customer Meters: All of the water users on Exeter's water system are metered. The age and condition of the meters varies, however, Exeter has been working on replacing and right-sizing the larger customer meters to improve the accuracy of their metered water. Exeter has been has also upgrading their water system meters to a radio-read system for a number of years. Currently, approximately 20% (705 of 3500) of the meters on the system have advanced radio-read capability. Additionally, 975 metered services have the ability to be converted to radio-read with the installation of transmitters.

In order to expedite the complete conversion of all meters to radio-read units the Town submitted a State Revolving Loan Fund (SRF) application to the DES in July 2010. This project was intended to finance the complete transition of these services to advanced radio-read metering and will also replace another 1859 meters in the system. Once completed, the entire system, totaling approximately 3500 services, will have advanced radio-read capability. This will enable the town to improve meter reading efficiencies, perform more frequent analysis of lost water to determine if leaks are occurring in the system and provide more accurate feedback to water and sewer system customers regarding their water use. Unfortunately, this project failed to receive the necessary warrant article votes during their 2011 Town Meeting. Therefore, the Town will most likely apply for SRF funding again in 2011 and attempt to put it before their voters again in March 2012.

2.2 Meter Sizing

The water system's source meters are sized in accordance with manufacturer recommendations. According to water system operational staff these meters are calibrated annually and this effort will continue in the future. An analysis performed in July 2010 at the Portsmouth Avenue surface water treatment facility of the existing metering of the source and treated effluent meters revealed only minor inaccuracies in these meters. With this information the treatment facility operations personnel are able to adjust final flow figures to account for this differential. Additionally, new mag meters were installed and calibrated in August 2010. The intent of the system is to continue performing calibration on their metering at least annually.

Photo of Meter Testing at the Surface Water Treatment Facility – July 2010

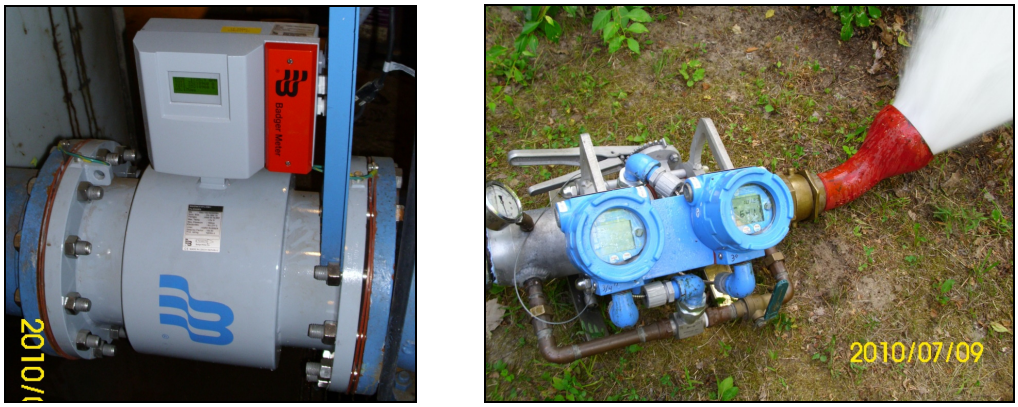


Photo of New Mag Meter at River Pumping Station and Testing the Meter in July 2010

2.3 Meter Reading and Billing

Currently the Town reads and bills all customer services four times a year. Water customers receive a combined water and sewer bill. The billing is performed by the Town quarterly. Bills are mailed out by the Town according to this schedule. Customers may pay their water bill either by mail or in person at the Town's Public Works office.

3 - Water Audit and Leak Detection Program

3.1 Water Audit and Leak Detection

The town recently purchased advanced leak detection equipment to assist with locating hard to find leaks. And they were recently awarded a grant from the DES to have a comprehensive leak detection study performed on their entire system in the coming months. It is anticipated that this work will be performed either in the the fall of 2011. The study will enable a good baseline of data for the system to identify and manage problem areas in their distribution system.

Potential system leaks and demand trends can also be tracked by the water system operators based on source pumpage and distribution tank trends. The Town is currently upgrading their water system with a new supervisory control and data acquisition system (SCADA). Once in place, this system will enable operators to monitor and track water system demand trends for demands that are beyond the norm (such as main breaks). They will also be able to set alarm points to alert them quickly about these conditions.

The Town's water system operating staff currently responds to and tracks individual water main breaks and leaks. The Town's foreman collects this data and maintains a spreadsheet to track the information for operating and maintenance purposes. This procedure will continue to be adhered to and updated as necessary.

3.2 Tracking Unaccounted-for Water

We compared water system pumpage records with metered billing records for the Town over a period of one year. We also queried town staff regarding water that is used but not metered. This use includes water used for hydrant flushing and other purposes. The town performs hydrant flushing twice a year and logs the amount of water used to flush each hydrant. They also track known water leaks in the system and estimate the volume. The following table shows these totals for the period of October 2007 to September 2008:

	Total Gallons	Gallons per day
Total System Pumpage	381,876,702	1,075,709
Total Metered Use	328,285,582	924,748
Annual Flushing	11,172,000	31,470
Identified Leaks	200,000	563
Other Use	645,000	1,817
Unaccounted-for Water	41,574,120	117,110
Percentage Unaccounted-for	10.9%	10.9%

Table 3.1 – Unaccounted-for Water

Notes

355 Days of Metered Data (October 2, 2007 to September 22, 2008)

As Figure 3.1 shows; the Town's unaccounted-for water for the period between Oct. 2007 and Sep. 2008 was approximately 11%. This is below the NHDES threshold recommendation for water systems to maintain a 15% or less unaccounted for water in their system. It is also relatively good considering that the town has pipes in the system over 100 years old. According to the American Water Works Association's M36 Manual for Water Audits and Loss Control Programs, "It is recognized that leakage in any water distribution system can never be totally eliminated; and there is no reasonable expectation that such is possible."

The water system will continue to utilize all of these tools to track their leaks, unaccounted-for water and overall water system efficiencies. If the unaccounted-for water exceeds 15% of the total volume of water introduced to the water system the water system shall prepare and submit a correction plan to the department within 60 days. The correction plan shall identify how the water system intends to reduce the percentage of unaccounted-for water to below 15% within 2 years, except for known leaks that have been identified by any water audit or leak detection program. If such a plan is required, the water system will implement the correction plan in accordance with the above schedule upon receiving approval from the department.

3.3 Water System Pressure

According to the DES's water conservation guidance:

> The water system shall implement pressure reduction within one year of obtaining approval of a new source of water when:
>
> (1) Technically feasible;
> (2) Consistent with water system industry standards and regulations; and
> (3) Consistent with other public health and safety considerations.

According to the Town's water operations staff, the typical operating pressures in the water system range from approximately 100 psi at the water treatment plant to 30 psi at the highest elevations along Hampton Road. The Town relies mostly on pressure supplied by water delivered from their treatment facility on Portsmouth Avenue and supplemental water from the Lary Lane well. System pressure and operating set points are based on the new Epping Road elevated storage tank. System operators are able to gage system needs by their on-line tank level

monitor and thus, avoid over pressurizing the system. System operators are also trained on proper valve and pump operations to avoid system water hammer.

An additional measure that Exeter is exploring is the potential utilization of an automated pressure relief valve which would either be located at their Hampton Road or Kingston Road water storage tanks. The Overall pressure relief/regulation is planned for the entire distribution system by electro-mechanical means at the Hampton Road Tank. This proposed system would sense slight increases of pressure over a pre-set maximum normal pressure and be bled in to the tank, which would act as a surge tank, while simultaneously sending a radio telemetry signal to the three finished water pumps at the water treatment plant to decrease speed accordingly. This system would compensate for the increase in water pressure due to sudden distribution valve closings for main breaks, flushing etc. This pressure relief would help mitigate potential system leaks and water loss in portions of the distribution system that contain old and fragile water mains, valves and service lines.

4 - Water Rates

The Town of Exeter's customers pay for their water via a combined water/sewer bill that goes out four times a year (quarterly). The rates were adjusted by the Town's Board of Selectmen when they adopted them on May 17, 2010. The rate structure of all customers is the same for all classes and go up with increased usage (referred to by Tiers), which will encourage water conservation for the largest users. The American Water Works Association's manual M34-Alternative Rates, refers to this type of rate structure as "Marginal-cost" pricing. According to the manual, "marginal-cost pricing is based on the economic theory that a consumer should pay for the next increment of cost, or marginal cost, to provide service. Marginal-cost pricing attempts to promote the efficient use of the resource." The following excerpt is from Exeter's Town website regarding their current water rates, effective June 1, 2010:

WATER

Adopted Rates (to be effective 3/11/11):

Tier	Water Usage (gallons per quarter)	Rate
Tier 1	"1'o 29,999 gallons	5.45 per 1,000 gals
Tier 2	From 30,000 to 194,999	5.91 per 1,000 gals
Tier 3	195,000 gals and up	6.35 per 1,000 gals

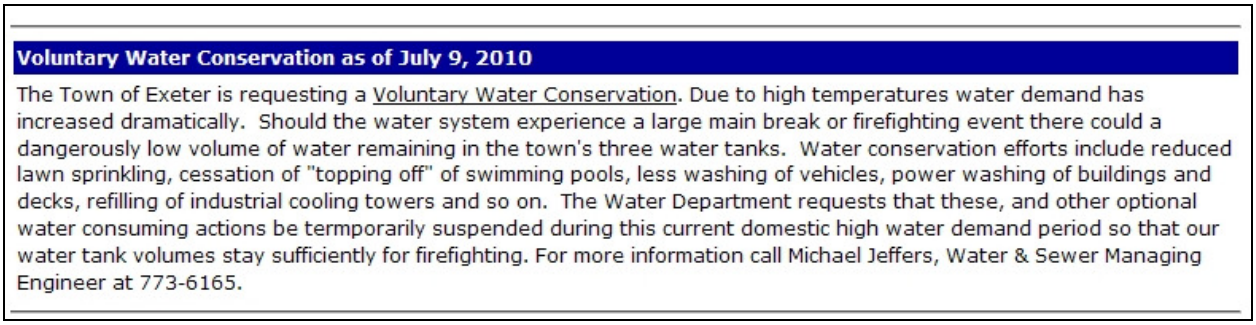
Table 4.1 – 2011 Town of Exeter Water Rates - Per a vote of the Board of Selectmen on November 22, 2010

5 - Water Conservation Outreach

The water system has been very active with water conservation outreach and intends to continue with the addition of the Stadium and Gilman wells into the system. The following conservation steps have and/or will be implemented by the water system.

5.1 Providing water supply status information on their website:

The following figure is a screenshot of the Town's website on August 9, 2010. It shows notification to all of the Town's water users that the extended dry period has prompted the Town to request voluntary water conservation measures.



Voluntary Water Conservation as of July 9, 2010

The Town of Exeter is requesting a Voluntary Water Conservation. Due to high temperatures water demand has increased dramatically. Should the water system experience a large main break or firefighting event there could a dangerously low volume of water remaining in the town's three water tanks. Water conservation efforts include reduced lawn sprinkling, cessation of "topping off" of swimming pools, less washing of vehicles, power washing of buildings and decks, refilling of industrial cooling towers and so on. The Water Department requests that these, and other optional water consuming actions be termporarily suspended during this current domestic high water demand period so that our water tank volumes stay sufficiently for firefighting. For more information call Michael Jeffers, Water & Sewer Managing Engineer at 773-6165.

Figure 5.1 – Voluntary Water Conservation Message on the Town's Website

5.2 Water Conservation Outreach Via the E-Newsletter:

The Town of Exeter started publishing an "E-Newsletter" in the Fall of 2009. This publication is designed to inform and promote the Town's public works and environmental programs. The following graphic shows the cover and page two of this publication:

Volume 1, Issue 1
FALL 2009

TOWN OF EXETER
DEPARTMENT OF PUBLIC WORKS

ECO Exeter E-Newsletter

Now Available - Curbside Recycling Carts

With the onset of the new solid waste contract and the collection of plastic food containers # 1 through # 7, the volume of recyclables has increased, making it difficult for large families to find room to store all recyclable materials (see back cover for list of all recyclables).

These 65 gallon recycling carts are a great way to place all of the recyclables in one container. The wheels make it easy to get it to the curb and the lid helps keep recyclables from becoming litter.

The Department of Public Works (DPW) has 100 carts available and will purchase more as funds are available. The carts are $45 each. Please call 773-6157 for availability. Due to size and storage requirements, the carts are available from DPW only - DPW is located at 13 Newfields Road. 7:00am - 3:00pm.

The small blue recycling bins (14 gallon) are available at the Town Office, 10 Front Street, between the hours of 8:00am and 4:30pm. The cost for the small bin is $8. Small bins are also available at DPW.

For those purchasing the 65 gallon carts and would like to dispose of the small bin, it can be dropped off at the DPW or the

Single Stream Recycling provides the opportunity to place all recyclables together in one container.

EPA proposes new Stormwater Phase II Permit for Small MS4s—including Exeter

In 2003, Exeter was designated (by the EPA) as having a small municipal separate storm drainage system (MS4) which required a permit to discharge our stormwater to local waterways.

The 1987 amendments to the Clean Water Act, required implementation in 2 phases, of a comprehensive program to address stormwater discharges.

Phase I, around 1990, cities with populations of 100,000 or greater & Phase II, 2003, smaller communities including Exeter were required to apply for permits.

A new permit with additional requirements will be implemented by the end of 2009.

If you are interested in helping to develop the new Stormwater Management Plan, please contact DPW- 772-1345 www.town.exeter.nh.us

Inside this issue:

TOWN OF EXETER FOUNDED 1638 NEW HAMPSHIRE

Preserving, Enhancing, Community & Environment

INFILTRATION & INFLOW— Don't Waste Money by Treating Clean Water

Infiltration and Inflow (I & I) is clean water that gets into the sewer system and is treated at the Wastewater Treatment Facility. Since it is clean water, not sewage, it doesn't really need to be treated like sewage (dirty water) does. Treatment costs money and treating clean water is a waste of money. We need to address the ways "clean water" is entering the sewer system and remove it.

Where it comes from:

Infiltration – Groundwater that enters the sewer system through cracked or broken pipes.

Inflow - Stormwater and groundwater that enters the system through direct connections such as:
-Sump Pumps
-Basement Drains
-Roof leaders/drains

Check to see if your home is contributing to I & I.

Remove clean water connections to the sewer:

Discharge sump pump water to your yard or Town storm drain (with permission)

Discharge roof drains to your yard or to a rain barrel and use for irrigation

Basement floor drains should be replumbed to a proper sump pump connection or to the Town storm drain (with permission).

Town Ordinance—Chapter 15 –Sewer Regulation

Prohibits the connection of roof drains, foundation drains, area drains or other surface runoff or groundwater to the Town's sanitary sewer system.

Household Hazardous Waste Collection Day— Saturday- Oct. 3rd

Attention: NO ELECTRONICS THIS YEAR

Now is the time to dispose of your outdated household hazardous waste. Many household products contain hazardous chemicals that cannot be properly disposed through regular disposal methods. Hazardous wastes cannot be placed in the regular trash or disposed to the sanitary sewer system.

WHEN MAKING FUTURE PURCHASES AVOID products containing: Benzene, Toluene, Naphthalene, Trichloroethylene, Tetrachloroethylene, Methylene, & Carbon Tetrachloride

From the YARD: *Pesticides, Insect Sprays, Rodent Killers, Pool Chemicals, Muriatic Acid, No-Pest Strips, Lead Sinkers—flashing, Creosote*

From the GARAGE: *Motor oil, Antifreeze, Brake Fluid, Engine Degreasers, Carburetor Cleaner, Wax & Polish, Auto Batteries and other cleaners.*

From the HOUSE: *Drain & Oven Cleaners, Furniture Polish, Metal Polish, Nail Polish, Shoe Polish, Photo Chemicals, Mercury Thermometers & Thermostats, Fluorescent & Compact Fluorescent Bulbs*

From the WORKBENCH: *Solvents, Paint Thinners, Oil Based Paints, Degreasers, Wood Preservatives*

SATURDAY, OCTOBER 3RD
8:30 AM to 11:30AM
13 Newfields Road
DPW Complex

Water Conservation Kits—FREE

Water Conservation Kits are available **FREE** to Exeter residents on town water and/or town sewer. DPW 773-6157

A family of four uses 400 gallons of water every day (EPA).

Kits include a massage showerhead, kitchen aerator, bathroom aerators & tank bank

More steps you can take:

- Turn off water while brushing teeth
- Repair all leaks & Replace old fixtures
- Wash only full loads-dishes & laundry
- Buy high-efficiency appliances & plumbing fixtures
- Plant native plants -water early in day
- Control sprinklers—don't waste water on sidewalks & streets

Page 2 ECO EXETER E-NEWSLETTER

Figure 5.2 – The Town's First E-Newsletter

The Town utilized this first newsletter to promote the availability of free Water Conservation Kits. It also included other tips for Town water customers to become more water efficient.

5.3 Water Conservation Kits:

As mentioned in the previous item, the Town is providing free water conservation retrofit kits to all residential services on the Town's water and sewer system. This program was implemented in 2008 and 500 kits were distributed in 2008 and 2009. The Town purchased 500 additional kits in the summer of 2010 and continues to make them available to their customers for pickup at their Public Works office. The following figure shows a screenshot of the Town's website which provides additional information about the kits:

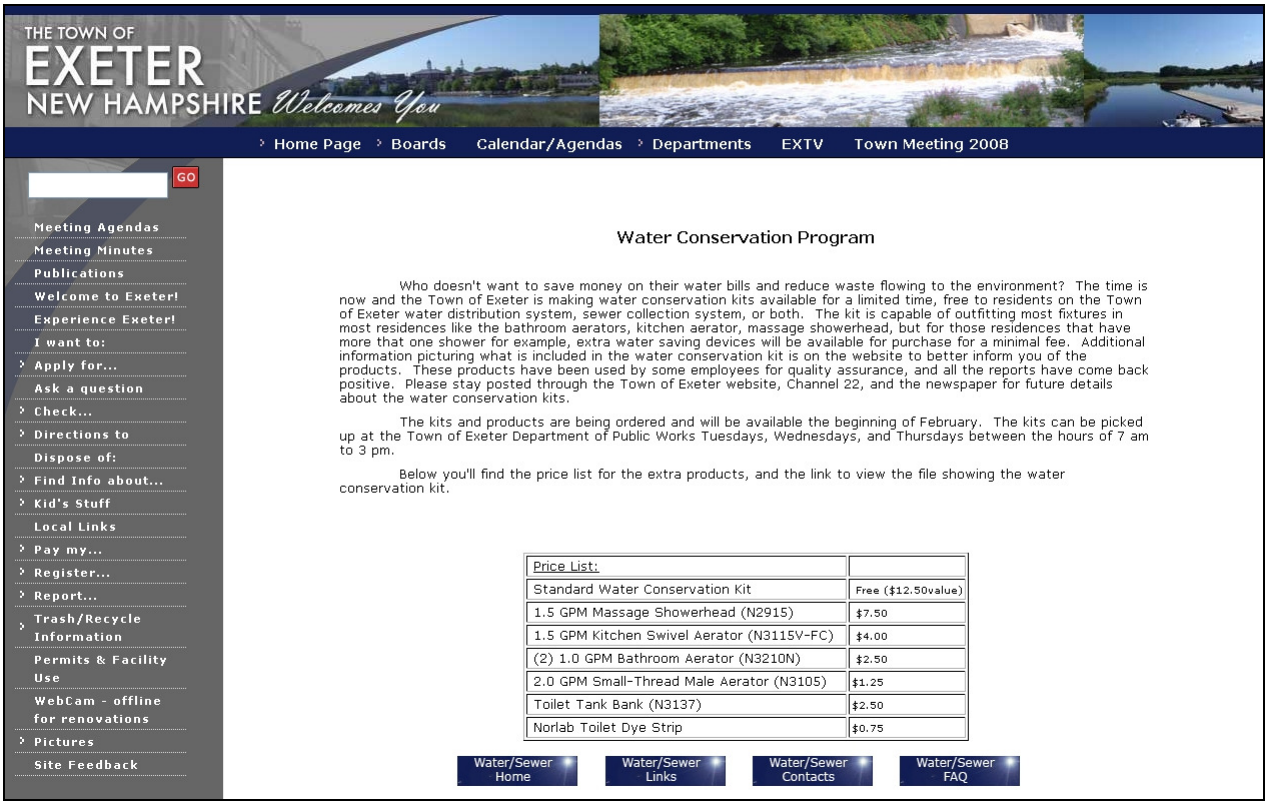


Figure 5.3 – Water Conservation Program Information on Town's Website

5.4 Low-Flow Toilet and Washing Machine Rebate Program

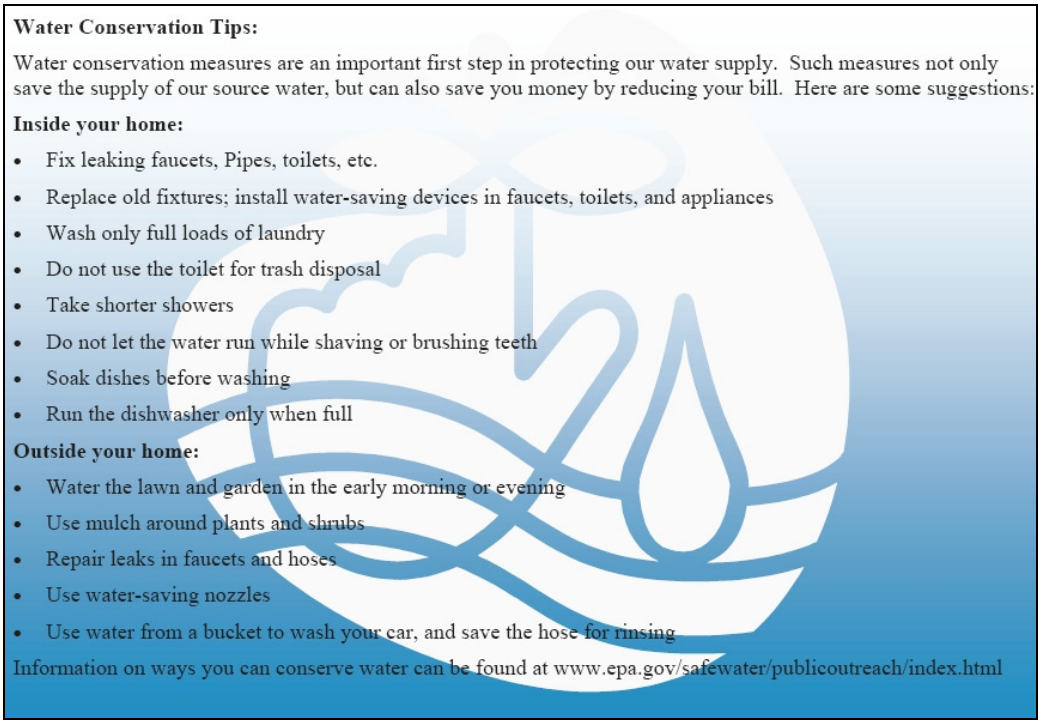
The Town is considering a program to offer rebates to customers that replace high flow toilets and washing machines with high efficiency units. The intent of this program is to provide up to 500 customers with a $100 rebate for replacing a high-flow toilet with a toilet that uses a maximum of 1.6 gallons-per-flush. The Town assumes that this program would be quite successful in Exeter because there is such a high number of residential dwellings that are older than 1980 and most likely still have high volume flushing toilets. According to the EPA's WaterSense website, the average home with 2.6 residents (the average in the U.S.) can save about 18,000 gallons per year using a WaterSense labeled toilet. Therefore, if 500 customers were to replace their toilets this could amount to a total of 9 million gallons a year, or 24,657 gallons a day (http://www.epa.gov/WaterSense/calculate_your_water_savings.html). This estimate may be somewhat on the high end because a study performed by the USEPA, published in 2005 (US EPA – Combined Retrofit Report) concluded that toilet replacements with high efficiency units averaged "25 gallons per day, or approximately 9,000 gallons per year per household." Regardless, instituting this program would continue to support Exeter's water efficiency program goals.

Exeter's is also considering offering up to 250 customers with a $200 rebate if they replace their old, inefficient clothes washing machine with a high efficiency unit. Calculating the water savings from this program is a bit more complex due to the variable nature that washing machines can and will be used (cycle selection, volume of loads, additional rinse options, etc.),

however, according to EPA's 2005 study, the water savings from the clothes washer retrofits range from 11.5 to 15.1 gallons per day, or approximately 5,000 gallons per year. Multiplying this total by 250 machines would equate to approximately 3,425 gallons per day or 1.25 million gallons per year. An additional benefit to the Town would be a reduction in detergent going into the Town's wastewater treatment system since high efficiency clothes washers use up to 2/3 less detergent, according to a California Regional Water Authority flyer.

5.5 Annual Water Quality Report

In addition to this effort, the Town also provides water system information and water saving tips distributed annually via their Water Quality Report. The following is an excerpt from their 2009 Report:



Water Conservation Tips:

Water conservation measures are an important first step in protecting our water supply. Such measures not only save the supply of our source water, but can also save you money by reducing your bill. Here are some suggestions:

Inside your home:

- Fix leaking faucets, Pipes, toilets, etc.
- Replace old fixtures; install water-saving devices in faucets, toilets, and appliances
- Wash only full loads of laundry
- Do not use the toilet for trash disposal
- Take shorter showers
- Do not let the water run while shaving or brushing teeth
- Soak dishes before washing
- Run the dishwasher only when full

Outside your home:

- Water the lawn and garden in the early morning or evening
- Use mulch around plants and shrubs
- Repair leaks in faucets and hoses
- Use water-saving nozzles
- Use water from a bucket to wash your car, and save the hose for rinsing

Information on ways you can conserve water can be found at www.epa.gov/safewater/publicoutreach/index.html

Figure 5.4 – Water Quality Report's Water Conservation Tips

5.6 Press Releases

The Town occasionally produces press releases regarding important events and programs. Past releases have included information about water conservation, water supply status and the water conservation kit program. The following figure provides an excerpt from a news article published by the Exeter Newsletter and online by Seacoastonline which describes the availability of the water conservation kits.

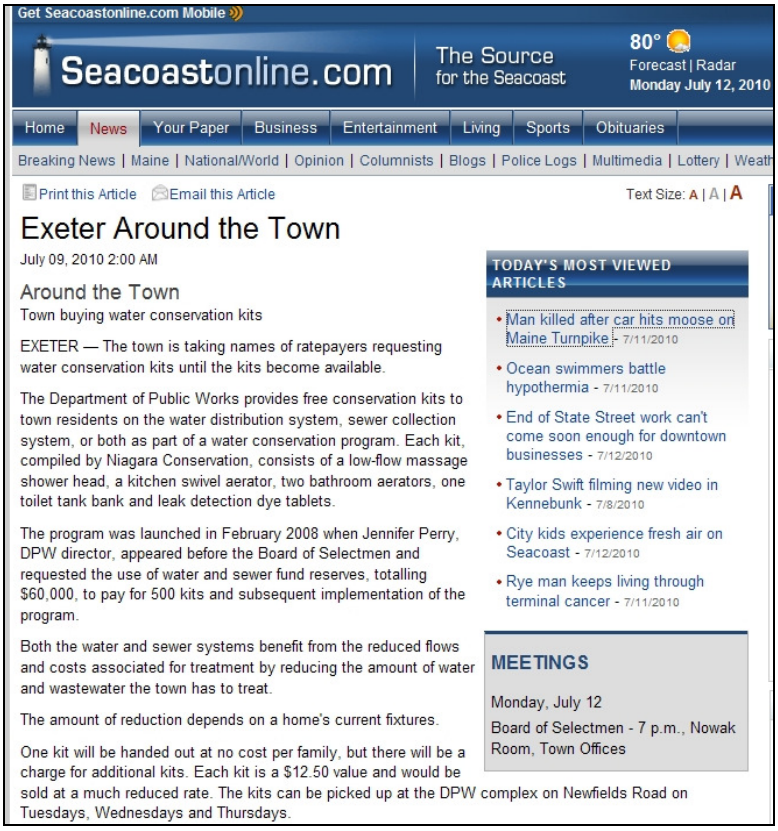


Figure 5.5 – Seacoastonline (Exeter Newsletter) Article on Water Conservation

5.7 EPA's WaterSense Partnership Agreement

The Town signed on to become a utility member of the EPA's WaterSense program in 2009. As a member, they now have access to public outreach materials, including:

- Ideas for promotional items, including bill stuffers, magnets, and stickers.
- Templates for a press release, letter-to-the-editor, and opinion-editorial column.
- Guidelines for using the program and partner logos and the promotional labels, as well as electronic versions of these marks.

The water system will utilize this information to augment their current outreach efforts, in print, on their website and through bill-stuffers.

5.8 - Additional Water Conservation Measures

In addition to the items already mentioned in this plan, the water system will explore other options for improving water efficiency. These might include:

- Water audits focused on helping high-use customers identify areas where they can improve efficiencies.
- Adopting seasonal water rates or drought rates to implement during high-demand or drought situations.
- Requiring new irrigation systems to be installed by landscape irrigation professionals who are certified by EPA's WaterSense program to implement water efficiency best practices.
- Requiring new water use applicants to project water demand for both indoor and irrigation water use. These applications will also promote best practices for utilizing water efficiency measures with new construction.

It should also be noted that intended improvements to recycle clarifier and backwash water at the existing surface water treatment facility on Portsmouth Avenue in 2011 may significantly reduce the amount of water that the treatment facility currently sends to waste. Current estimates predict that approximately 41.5%, or 53 million gallons a year, of this water can be recycled. Additionally, if the Town brings more groundwater into the system, including the approximate one million gallons a day from the combined yield of the Gilman and Stadium wells, that this system will also improve the Town's source water efficiencies. With recycling of backwash water from groundwater treatment it is estimated that this system may be 98% efficient, which is much higher than the current surface water treatment facility that experiences efficiency that ranges from 80 to 90% depending on source water quality.

6 - Implementation

The water system shall implement the applicable public notification and outreach requirements to municipal governments within its service area in accordance with Env-Ws 390.11; and the water system would continue to implement an educational outreach initiative for its customers to promote water conservation immediately upon obtaining approval for the reactivation of the Stadium and Gilman wells. These activities shall be completed by Exeter water system personnel under the supervision of a certified operator, in this case, the Town's Managing Water and Sewer Engineer, pursuant to Env-Ws 367.

Upon submission of this draft Water Conservation Plan, a letter will be sent out to the following to the Rockingham County Regional Planning Commission to inform them of the program and providing an opportunity for comment. The Plan will also be brought forward to the Town's Board of Selectmen for their comments and adoption. An example of that cover letter follows.

6.1 Sample Water Conservation Plan Letter

(This letter will be produced on Town's letterhead)

(Date)

Subject: Water Conservation Plan for The Town of Exeter New Hampshire Water System

Dear Rockingham County Regional Planning Commission:

Applicants applying for approval of new drinking water sources for Community Water Systems (in this case, the reactivation of a drinking water source) and applicants for Large Withdrawal Permits are subject to the requirements of Env-Ws 390, *Water Conservation Rules*. As part of the reactivation of Exeter's Stadium and Gilman Well application process we must complete a water conservation plan for this reactivation and submit it for review by the New Hampshire Department of Environmental Services (NHDES). We must also perform the following Public Notification task:

- Provide copies of a summary of Env-Ws 390 and the proposed water conservation plan for the water system to the governing board of the municipality in which the water system is located and the regional planning commission established for the area where the water system is located.
- Request that the governing board of each municipality review the water conservation plan for consistency with Env-Ws 390 and amend the local site planning requirements to promote water conservation landscaping practices within the service area of the new water system.
- Request that the regional planning commission review the water conservation plan for consistency with Env-Ws 390 and promote water conservation landscaping and other conserving water use practices among its member towns.

We are requesting that you review the enclosed materials, comment on the water conservation plan, and promote water conservation practices within your jurisdictional area. You have twenty-one (21) days to review and provide comment to NHDES on the water conservation plan. This 21-day period commences upon the receipt date of certified mailing of this correspondence. Please communicate your comments in writing to NHDES at your earliest convenience and address all comments to:

Derek Bennett
NHDES-DWGB
P. O. Box 95
Concord, N.H. 03302

Please contact the above NHDES staff at (603-271-6685) or NHDES' Public Information Center (PIC) at 271-8808 or http://www.des.state.nh.us/PIC . Thank you for your time and cooperation.

Sincerely,
(Your name and title)

References:

- http://quickfacts.census.gov/qfd/states/33000.html - This information was utilized to determine the number of people per household. According to this data, New Hampshire has 2.59 persons per household.

- Manual of Water Supply Practices – M36, Third Edition. American Water Works Association. 2009.

- Horn, M.E., et. all. Methods for and Estimates of 2003 and Projected Water Use in the Seacoast Region, Southeastern New Hampshire. United States Geological Survey.

P:\Exeter NH\2070533 - GW System Prelim Design\Report - Exeter GW System\Exeter Water Efficiency and Management Program - October Draft.doc

INTEGRATED MANAGEMENT TOOL

MAY 2011 (draft)

Weston&Sampson®
100 International Drive, Suite 152
Portsmouth NH 03801
Phone 603-431-3937 Fax 603-433-4358
www.westonandsampson.com

Memorandum

To: Paul Roy – Town of Exeter

CC: Michael Jeffers and Jennifer Perry – Town of Exeter

From: Brian Goetz and Andrew Walker

Date: 5/24/2011

Re: Exeter Water Supply – Integrated Management Tool Draft

Attached electronically is our latest draft of the Integrated Management Tool ("IMT" or "the Tool") for the Town of Exeter's water supply system. This Tool has been developed to provide a model that would track current water demands as well as provide predictors for water supply trends given current system and watershed conditions.

To aid the Town in maximizing the utility of their multiple water supply sources, the IMT incorporates all of the Town's currently active sources: the Exeter River, Exeter Reservoir, Skinner Springs, and the Lary Lane well. The IMT also includes Gilman & Stadium wells if and when they are reactivated. Lastly, the Integrated Management Tool incorporates the Town's ability to transfer up to 2.5 MGD from the Exeter River to the Exeter Reservoir.

The spreadsheet-based Integrated Management Tool has a number of individual tabs with varying responsibilities, including documentation, accepting user input, converting and analyzing that input, and providing useful output based on those analyses. Tabs include:

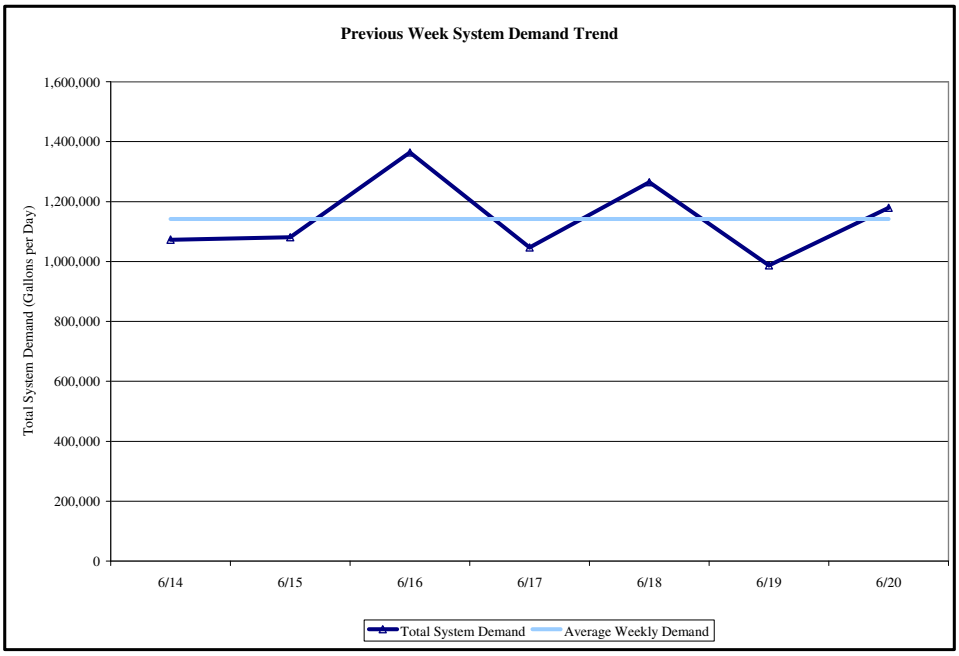
Tab Name	Purpose	Specific Tasks
Instructions/Documentation	Documentation	Provides a summary of the Tool and brief instructions
Supply Forecasting	Documentation	Summarizes forecasting techniques and capabilities
Previous Week Trends	User Input	Previous week's delivery rates and tank levels
Water System Setpoints	User Input	Anticipated withdrawal and treatment rates
Exeter River	Analysis	Forecasts Exeter River streamflow
Dearborn Brook	Analysis	Forecasts Dearborn Brook inflow to Exeter Reservoir
Reservoir Volume	Analysis	Correlates Reservoir water level and storage volume
Simulator & Demand Mgmt	Analysis	Forecasts changes in supply availability and system storage
System Demand Trend	Output	Graphic of recent trends in system demand
River Forecast	Output	Graphic of forecasted Exeter River streamflow
Reservoir Forecast	Output	Graphic of forecasted Reservoir level and volume
System Forecast Summary	Output	One page table/graphic summary of current resource status, demand trends, and forecasted supply trends by source

The Integrated Management Tool forecasts future water availability within Exeter's water supply system by comparing historical patterns against current user-specified system and watershed conditions. The user first specifies the total daily inflow and outflow volumes to and from the treatment facility for the previous seven days, using the "Previous Week Trends" tab. Recognizing that system demand cannot be calculated simply from the net volume of water leaving the treatment facility, the user may also specify the previous week's daily water levels from each of the Cross Road, Hampton Road, and Epping Road tanks. Based on all these values, the IMT calculates the true total system demand for each of the previous seven days as well as an average demand over that period, as shown below. That average demand is used by the IMT to forecast delivery from the treatment facility and changes in system storage.

Weekly Water Supply Trends - Town of Exeter, New Hampshire

Date:	6/21/10	6/13/10	6/14/10	6/15/10	6/16/10	6/17/10	6/18/10	6/19/10	6/20/10
7:00 am readings		Sun	Mon	Tue	Wed	Thur	Fri	Sat	Sun
Operator:									
Raw Water to Treatment Facility	Gallons		1,372,000	1,443,000	1,489,000	1,489,000	1,487,000	1,421,000	1,410,000
Skinner Springs to Treatment Facility	Gallons		99,500	99,300	99,000	99,000	98,600	85,800	98,100
Total Raw Water to Treatment Facility	Gallons		1,471,500	1,542,300	1,588,000	1,588,000	1,585,600	1,506,800	1,508,100
Water Treatment Facility - To Distribution	Gallons		1,038,000	1,105,000	1,150,000	1,096,000	1,160,000	1,091,000	1,110,000
Water Treatment Facility Efficiency	%		71%	72%	72%	69%	73%	72%	74%
Lary Lane Well Pumpage	Gallons		0	10,067	93,089	2,187	86,729	0	0
Total Pumpage to System	MG		1,038,000	1,115,067	1,243,089	1,098,187	1,246,729	1,091,000	1,110,000
Cross Road Tank Level @ 7:00 am	Ft	75.0	73.0	75.0	68.0	71.0	70.0	76.0	72.0
Max Level (Cross Road) - previous day	Ft		81.0	80.0	78.0	80.0	81.0	80.0	80.0
Min Level (Cross Road) - previous day	Ft		67.0	69.0	70.0	69.0	70.0	74.0	69.0
Cross Road Current Gallons	Gallons	416,850	405,734	416,850	377,944	394,618	389,060	422,408	400,176
Kingston Road Flow Gallons	Gallons		0	0	0	0	0	0	0
Cross Road Gain/Loss	Gallons		-11,116	11,116	-38,906	16,674	-5,558	33,348	-22,232
Cross Road % Turnover			17%	14%	10%	14%	14%	8%	14%
Hampton Road Tank Level @ 7:00 am	Ft	75.0	73.0	75.0	68.0	71.0	70.0	76.0	72.0
Max Level (Hampton Road) - previous day	Ft		81.0	80.0	78.0	80.0	81.0	80.0	80.0
Min Level (Hampton Road) - previous day	Ft		67.0	69.0	70.0	69.0	70.0	74.0	69.0
Hampton Road Current Gallons	Gallons	882,300	858,772	882,300	799,952	835,244	823,480	894,064	847,008
Hampton Road Booster Flow Gallons	Gallons		0	0	0	0	0	0	0
Hampton Road Gain/Loss	Gallons		-23,528	23,528	-82,348	35,292	-11,764	70,584	-47,056
Hampton Road % Turnover			17%	14%	10%	14%	14%	8%	14%
Epping Road Storage Tank Level	Ft	37.0	35.0	33.5	35.0	37.0	37.0	38.0	35.0
Max Level (Epping Road) - previous day	Ft		36.0	35.0	36.0	37.0	37.0	38.0	35.0
Min Level (Epping Road) - previous day	Ft		32.5	32.0	32.5	33.5	35.0	35.0	32.5
Epping Road Current Gallons	Gallons	1,337,250	1,250,450	1,185,350	1,250,450	1,337,250	1,337,250	1,380,650	1,250,450
Epping Road Gain/Loss	Gallons		-86,800	-65,100	65,100	86,800	0	43,400	-130,200
Epping Road % Turnover			10%	9%	10%	9%	5%	8%	7%
Total Storage Tank Volume	MG	**1,299,150**	**1,264,542**	**1,299,185**	**1,177,932**	**1,229,899**	**1,212,577**	**1,316,510**	**1,247,219**
Total Storage Tank Gain/Loss	MG		-34,608	34,643	-121,253	51,967	-17,322	103,933	-69,291
Total System Demand	MG		**1,072,608**	**1,080,424**	**1,364,342**	**1,046,220**	**1,264,051**	**987,067**	**1,179,291**

Previous Weekly Summary	Gallons	GPM
Average Day	1,142,000	793
Max Day	1,364,342	947
Min Day	987,067	685



To forecast changes in system storage, the user must also specify anticipated withdrawals from the Town's various water supply sources and flow rates into the treatment facility, as shown in the figure below. On the "Water System Setpoints" tab, the user first specifies the treatment facility's anticipated "raw water setpoint," the rate at which water from the Exeter River and Reservoir are allowed to enter the facility. The user also specifies the anticipated rate of the variable speed pump at the Exeter River intake pump station. If the pump station setpoint exceeds the rate at which water is taken into the treatment facility, the excess is diverted to "top off" the Exeter Reservoir. As the IMT forecasts changes to water availability and system storage, the current flow rate in the Exeter River at USGS gage 01073587 and the starting water level in the Reservoir must be also be specified. Skinner Springs withdrawals are modeled separately from other surface water supply sources; the user may specify both the flow rate and number of hours per day that Skinner Springs provides water to the treatment facility. The IMT also recognizes that not all water withdrawn from surface water supply sources is delivered to the system, but rather some is lost through treatment inefficiencies. The IMT allows the user to account for those losses by specifying the number of anticipated clarifier flushes and filter backwashes. In contrast, while the user may specify groundwater withdrawal rates from Lary Lane, Gilman, and Stadium wells, treatment losses for those withdrawals are assumed to be minimal. Just as the Integrated Management Tool employed user input to forecast future outflows from the treatment facility, the IMT also applies user input to estimates future inflows to the facility.

Water Supply Management Program
Town of Exeter, New Hampshire

Date:	6/21/2010
Operator:	

Water System Supply Availability and User-defined Operating Setpoints

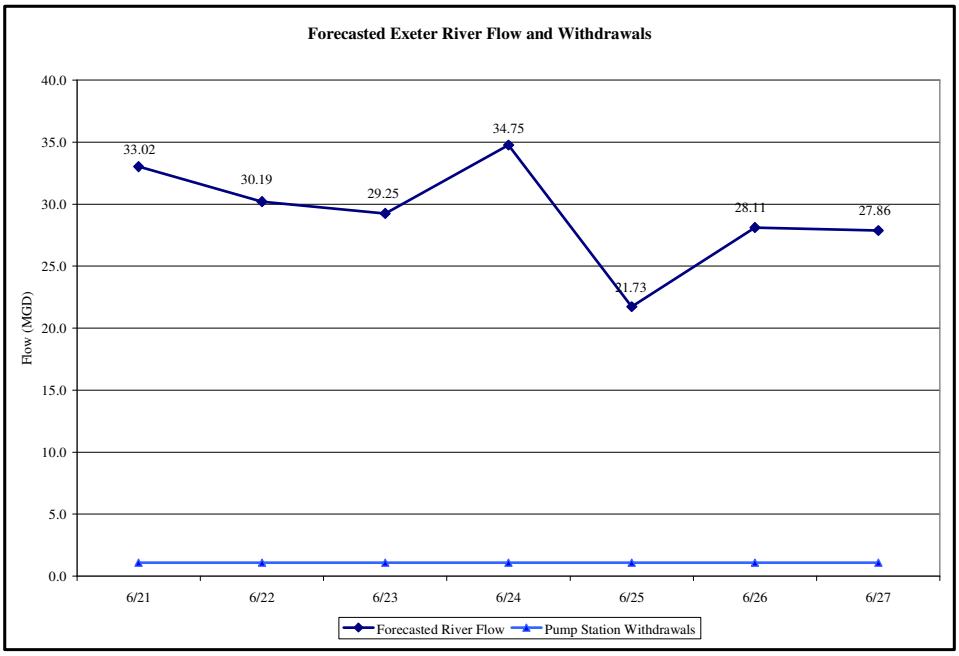
Surface Water Supply Capability			Notes/Reference/Link
Water Treatment Facility Raw Water Setpoint	**750**	GPM	
Water Treatment Facility Raw Water GPD	1,080,000	GPD	
Anticipated Clarifier Flushes	**8**		30,000 gallons per flush
Anticipated Filter Backwashes	**1**		40,000 gallons per backwash
Total Anticipated Flushing to Waste	280,000	GPD	
Current Treatment Facility Waste %	23.8%		Clarifier and backwash flushing
Skinner Springs Flow Setpoint	**69**	GPM	Flow to WTF filters
Skinner Springs Hours On	**24**	Hrs	24 hour max
Skinner Springs Daily Flow to WTF	98,640	GPD	
Total WTF Daily Pumpage to System	898,640	GPD	Treated water, including the Skinner Springs flow to the filters
Haigh Road USGS Gage	**30**	CFS	http://waterdata.usgs.gov/nwis/uv?site_no=01073587
Great Dam Flow	51.1	CFS	Calculated base on Haigh Road gage = 64 square miles of watershed, Great Dam = 109 square miles
Great Dam Daily Flow	33.0	MGD	1 CFS = 0.646 Million Gallons per Day
River Pump Station Setpoint	**1000**	GPM	Pump #1 VFD = 0.65 to 1.50 MGD, Pump #2 = 2.5 MGD
River Pump Station Daily Withdrawal	1,440,000	GPD	
Percentage of River Flow Withdrawn	4%		
Reservoir Elevation	**0.5**	Ft	Available feet above intake (2 ft is at top of flashboards, 0 feet is top of concrete spillway, 4 = top of dam - elevation 25ft)
Reservoir Withdrawal Setpoint	-250	GPM	Balance of water from River Pump Station (negative if station is pumping more than treatment facility is using)
Reservoir Daily Withdrawal	-360,000	GPD	Positive if water is being taken from reservoir for treatment, negative if more water is pumped from river than needed
Reservoir - Watershed Input (flow into Res.)	454,613	GPD	Calculated based on Haigh Road gage = 64 square miles of watershed, Exeter Reservoir = 1.5 square miles
Net Reservoir Daily Flow	814,613	GPD	
Available Treated Water to System	**898,640**	**GPD**	

Groundwater Supply Capability			
Lary Lane Well Capability	**200**	GPM	Generally run well from 175 to 255 GPM
Lary Lane Daily Well Capability	288,000	GPD	Assuming 24 hour runtime
Gilman Well Capability	**0**	GPM	Future source
Gilman Daily Well Capability	0	GPD	Future source
Stadium Well Capability	**0**	GPM	Future source
Stadium Daily Well Capability	0	GPD	Future source
GW Treatment Facility Waste	**0%**		Future GW Treatment
Available Groundwater Supply to System	**288,000**	**MGD**	

Total Available Supply	**1,186,640**	**GPD**	
Current System Demand	**1,142,000**	**GPD**	7-Day Average from previous week
Demand as % of Supply	**96%**		

The forecasting capability of the Integrated Management Tool stems from the basic principle of mass balance: inflow minus outflow equals change in storage. Armed with predicted inflow and outflow estimates based on user input, the IMT is able to forecast changes in Exeter's water supply sources.

To determine water availability in the Exeter River, the IMT first forecasts discharge rates in the Exeter River based on historical patterns and the current user-specified streamflow. The USGS has provided the 10th, 25th, 50th, 75th, and 90th percentile flow in the Exeter River at Haigh Road (USGS 01073587) for each of the 366 days of the year based on that gage's 14-year record. By comparing the user-entered real-time flow at Haigh Road with the five percentiles for that day of the year, the IMT determines what percentile flow the River is currently discharging. This comparison occurs in the "Exeter River" tab. The IMT then estimates that percentile flow at Haigh Road for each day of the year and extrapolates those values to the pump station location using the areal-weighted method to account for its greater watershed area (109.0 sq. mi. / 64 sq. mi.). In this way, by assuming that the flow percentile experienced in the River on the current day is typical of the River's hydrology in the near future, the IMT is able to forecast water availability at the Exeter River pump station, as shown in the figure below.

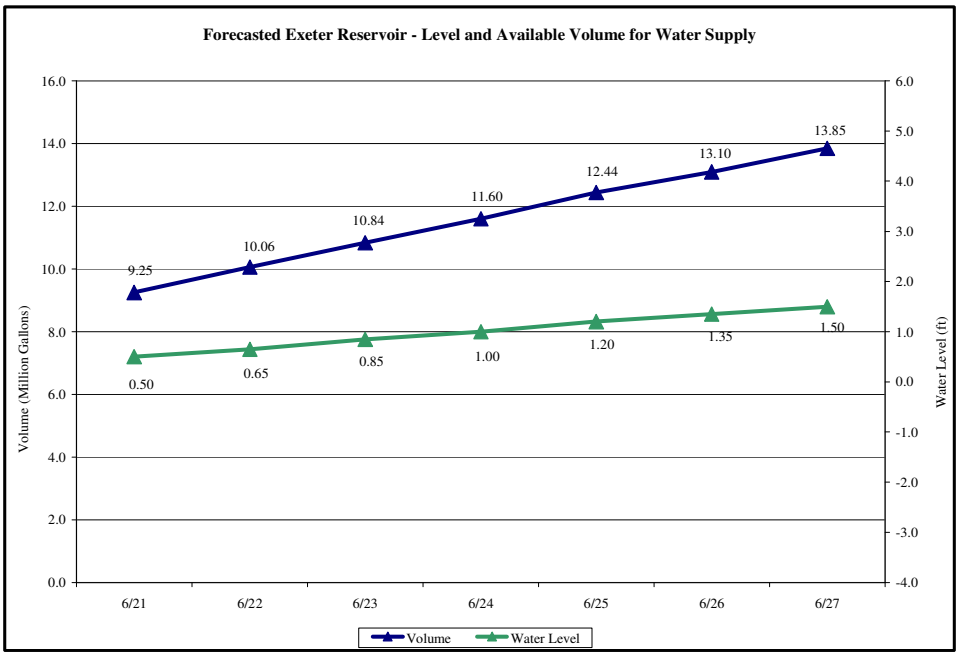


In contrast, water availability in the Exeter Reservoir is forecasted by summing the forecasted values of its multiple inflows and outflows. Inflows to the Reservoir include the River-to-Reservoir transfers as well as inflow from Dearborn Brook. As with the Exeter River, Dearborn Brook flow is calculated from the forecasted Haigh Road daily flow record. As Dearborn Brook is actually within the Exeter River watershed, it is assumed to experience the same percentile flow as the USGS gage and the pump station. Daily flow in the Brook is calculated on the "Dearborn Brook" tab through the areal-weighted method by multiplying forecasted flow at Haigh Road by the ratio of the Dearborn Brook watershed and the area of the drainage basin above Haigh Road (1.5 sq. mi. / 64 sq. mi.). The other significant inflow to the Exeter Reservoir, River to Reservoir transfers, is calculated simply by subtracting the pump station pumping rate from the treatment facility's "raw water setpoint" as discussed above.

Outflows from the Reservoir are limited to withdrawals to the Water Treatment Plant. If the treatment facility's "raw water setpoint" exceeds the pump station pumping rate, the remaining demand is met by the Exeter Reservoir. Other outflows common to Reservoir simulations are accounted for indirectly. For instance, Dearborn Brook's synthesized daily flow record accounts for evaporation from the Reservoir. Evapotranspiration takes place throughout the Exeter River watershed and is reflected in the River's discharge. By synthesizing Dearborn Brook flows from the Exeter River flow record, the impacts of evapotranspiration are already captured, particularly as the Reservoir represents such a small fraction of the Dearborn Brook watershed (approximately 2%). Discharge over the spillway is also dealt with indirectly. The IMT limits the maximum water level in the Reservoir to the height of the flashboards, assuming that all water above that level is lost and therefore unavailable for withdrawal. By subtracting the anticipated outflows from the anticipated inflows, the IMT forecasts the near-term change in storage of the Exeter Reservoir.

As with most reservoirs, change in storage is the important variable, and yet change in water level is easier to observe and measure. The IMT provides a forecast of both storage and water level. The "Reservoir Volume" tab contains a "lookup table" relating water level, as measured in

feet above the spillway crest, with active storage, as measured in millions of gallons above the treatment facility intake. Water level and active volume data pairs are interpolated at 0.05-foot intervals from a handful of data points published in previous reports. From this "lookup table," the IMT provides a graphical forecast of water level and storage volume in the Reservoir as shown in the figure below.



In summary, the attached Integrated Management Tool forecasts future water availability within Exeter's water supply system by comparing historical patterns against current user-specified system and watershed conditions. The spreadsheet-based IMT is intended as a tool with which to evaluate various operating schemes against variable hydrologic conditions. The Tool's output allows its operators to assess the effectiveness of those operating schemes with regard to future water availability, efficient use of system pumps, and effective use of the Town's multiple water supply sources.

As noted, the Integrated Management Tool has evolved based on feedback from the Town of Exeter, and it continues to evolve. Future adaptations may include: forecasting water quality and treatment/delivery costs in addition to forecasting water quantity, incorporating instream flow requirements, adjusting forecasting techniques to reflect a variable climate, and incorporating groundwater as a distinct supply source that rises and falls given hydrologic conditions and pumping rates.