Town of North Kingstown MANAGE Summary

Method for Assessment, Nutrient-loading, And Geographic Evaluation of watersheds

University of Rhode Island Cooperative Extension (URI CE) Water Quality Program and the Department of Natural Resources Science; MANAGE analyses completed by Dorothy Q. Kellogg, Ph.D. Candidate, Dept. of NRS.

Introduction and Background

The URI CE Healthy Landscapes Program and the Town of North Kingstown have been working together over the last 2 ½ years to address water resource quantity and quality issues as they are affected by residential landscaping practices.

North Kingstown is 44 square miles in size with an estimated population of 24,000 people. The Town is located in southern RI and borders the Atlantic Ocean with 31 miles of coastline. Two-thirds of the Town is characterized as rural, with over 59% of land use in agriculture, forest, and wetlands (RIGIS 1995). The Town has experienced a 14% growth rate since 1990. The North Kingstown Department of Water Supply, a municipally owned and operated public water supply, operates 10 wells within the Hunt-Annaquatucket-Pettaquamscut (HAP) Sole Source Aquifer system. Approximately 45% of the Town overlies the recharge area to its drinking water resource.

The water supply services primarily residential customers and supplies 94% of its population with water. The water supply system draws an average of 3.5 million gallons per day (mgd), with the capacity to withdraw 7.8 mgd. Outdoor residential water use is a concern within the Town, especially during peak summer demand. Peak demand doubles in the summer with a maximum water use recorded in July 2000 at 7.7 million gallons per day; in August 2001 at 6.7 million gallons per day; and, in July 2002 at 7.4 million gallons per day.

As part of the URI CE Healthy Landscapes Program, we have applied the MANAGE model to estimate the potential impacts of residential landscape best management practices (BMPs) on water quality and quantity in the Town of North Kingstown. Using several "what if" scenarios, we have applied MANAGE to estimate impacts from fertilizer use as well as water consumption based on adoption of recommended BMPs. For more information about MANAGE visit the following website, http://www.uri.edu/ce/wq/mtp/html/manage.html.

We evaluated two study areas: one being the entire Town of North Kingstown; and the other being the land area in North Kingstown that overlies the Hunt-Annaquatucket-Pettaquamscut (HAP) groundwater recharge area. Within the HAP study area, we also included the wellhead protection area for the Annaquatucket wells #1, 2, 4, and 5, which extends outside the HAP and the Town's boundaries.

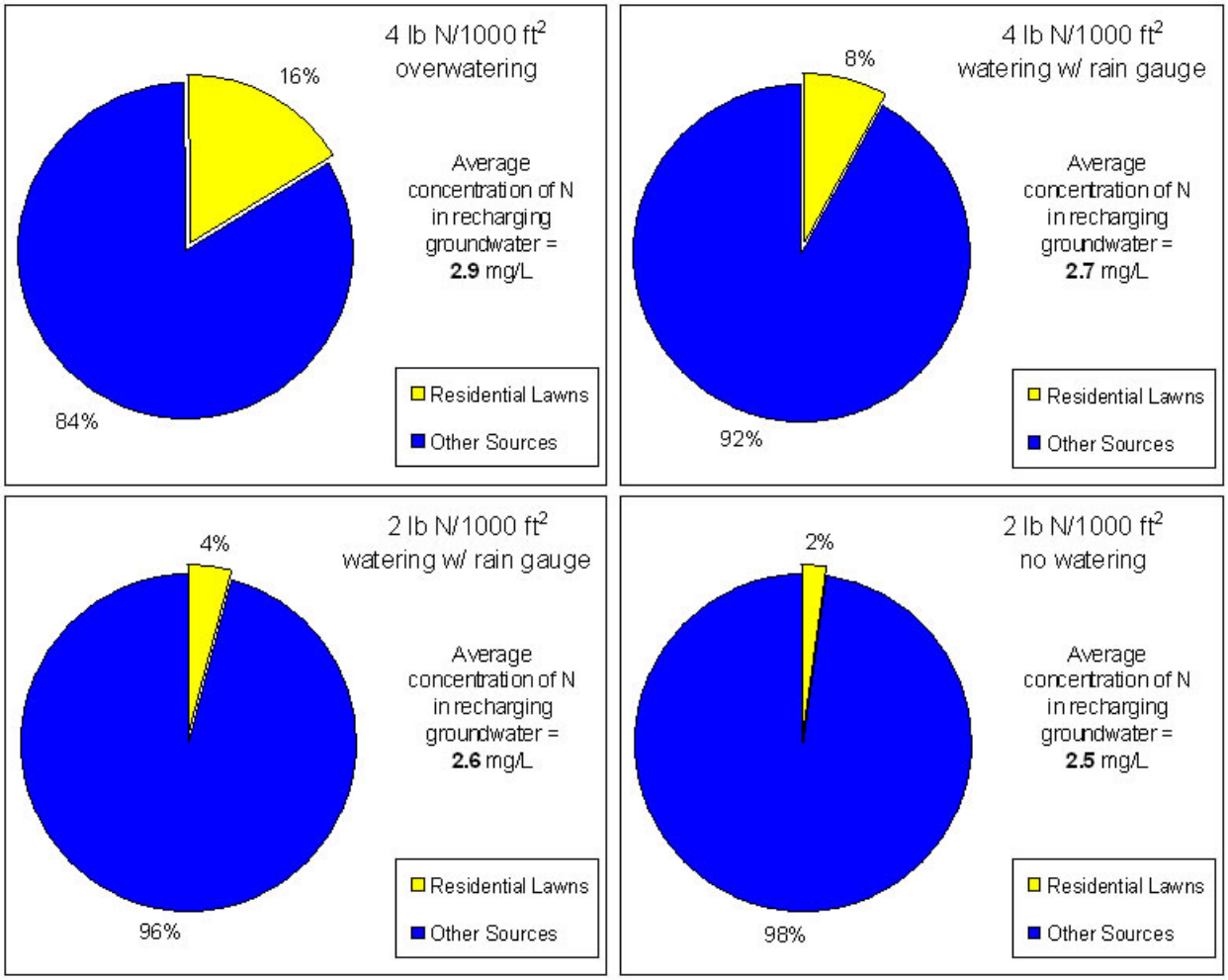
Table 1 summarizes total land area, residential land use area, and estimated lawn area for each study area.

	Town of North Kingstown	HAP Area
Total area (acres)	28,187	12,840
Total residential area (acres)	5,964	2,673
Estimated residential lawn area (acres)	2,574	1,233

Fertilizer Management and Nitrate-Nitrogen Impacts to Groundwater Recharge

Figure 1 below indicates the average concentration of nitrate-nitrogen in recharging groundwater based on fertilizer application rates to home lawns and different watering regimes.

Figure 1: *Residential lawn contributions of N to aquifer recharge area in North Kingstown



*Note: The Total Annual N in recharging groundwater decreases with each management regime as follows:

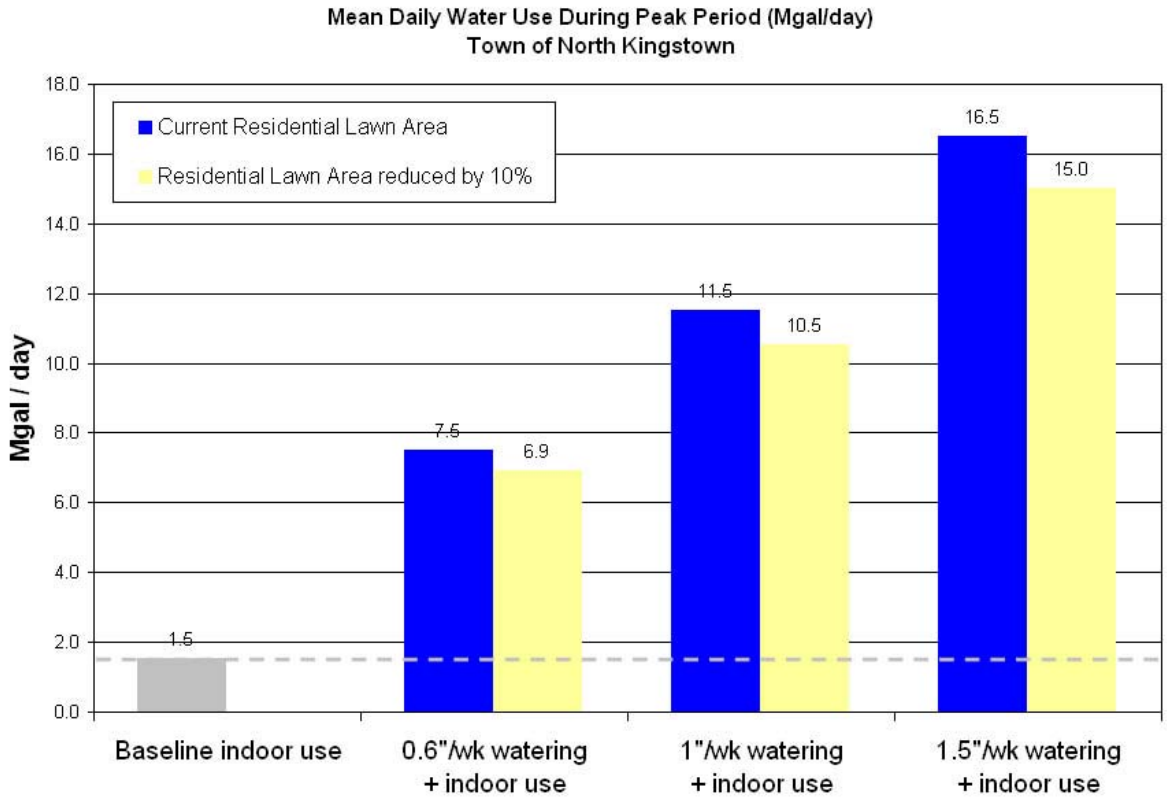
4 lb N/1000 ft^2 Overwatering: 178,000 Lbs.
4 lb N/1000 ft^2 Watering with rain gauge: 160,000 Lbs.
2 lb N/1000 ft^2 Watering with Rain Gauge: 155,000 Lbs.
2 lb N/1000 ft^2 No watering: 152,000 Lbs.

Outdoor Water Use

Peak water use in the summer months can stress the Town's water delivery capability. The Town has initiated a utilities ordinance that restricts outdoor watering from June 1 – August 30 to help reduce stress on the system. The ordinance is better known as odd/even watering in which watering is allowed every other day based on street address. Proper watering and the reduction of overall residential lawn area are two management practices that can conserve outdoor water use. We applied three watering scenarios to both the current lawn area within the Town as well as to a scenario of 10% reduction in lawn area.

Figure 2 below estimates daily water use during peak summer demand comparing these three water use strategies: the application of 0.6, 1, and 1.5 inches of irrigation water per week. A baseline for indoor water use was estimated and is based on an approximate total of 12,767 septic systems in the Town of North Kingstown, including residential, commercial, municipal, etc. land use types. MANAGE estimates indoor water use based on discharge to septic systems and land use type. MANAGE assumes indoor water used and discharged to a residential septic system is 50 gallons per person per day based on 2.4 people per household, or a total of 120 gallons.

Figure 2: **



**Assumes all watering takes place on the same day. Divide these values in half for an approximate mean daily water use during peak summer demand with the odd/even watering ordinance in practice.

Figure 3: Annual water use in million gallons per year.

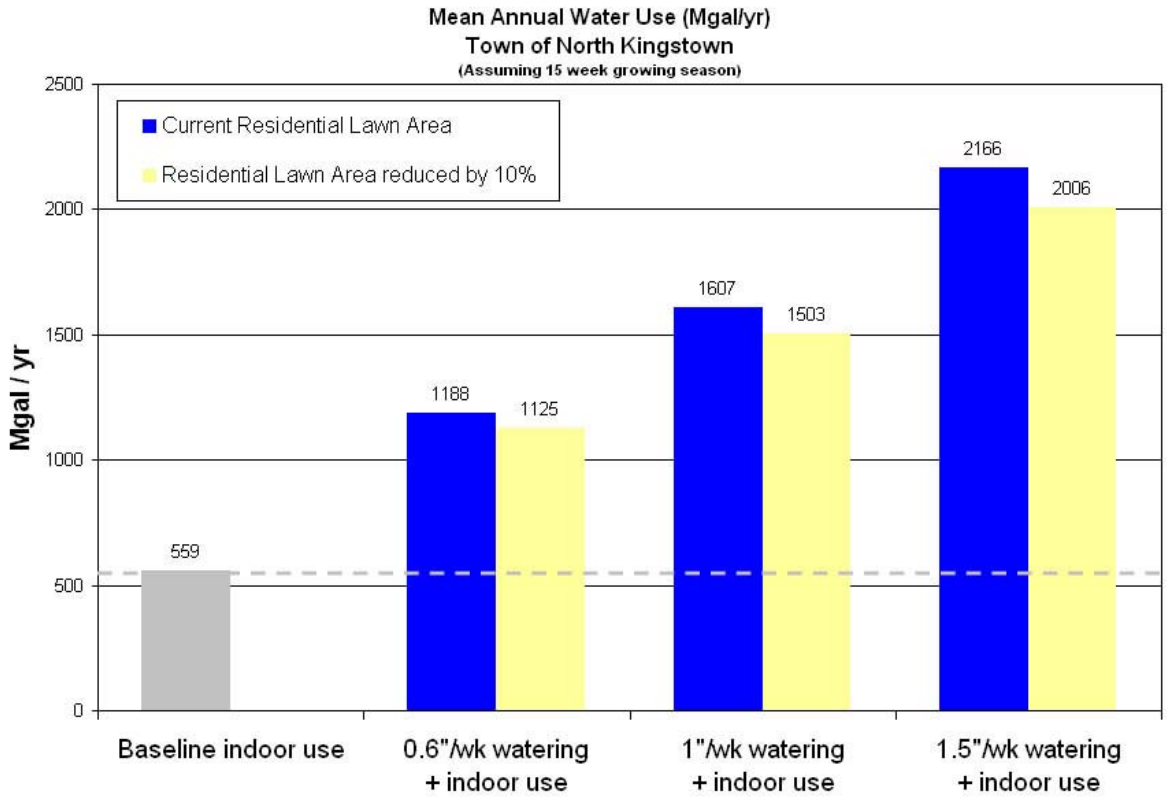


Figure 4 below illustrates water use in million gallons per year by residents within the aquifer recharge area in North Kingstown. Indoor water use estimates are based on an estimated 4,674 residential septic systems in the aquifer recharge area. Indoor water use estimates 50 gallons per person at 2.4 people per residence. The "watering with a rain gauge" is assumed to be 0.6 inch per week. This is based on Morton, et al. (1988)

Figure 4:

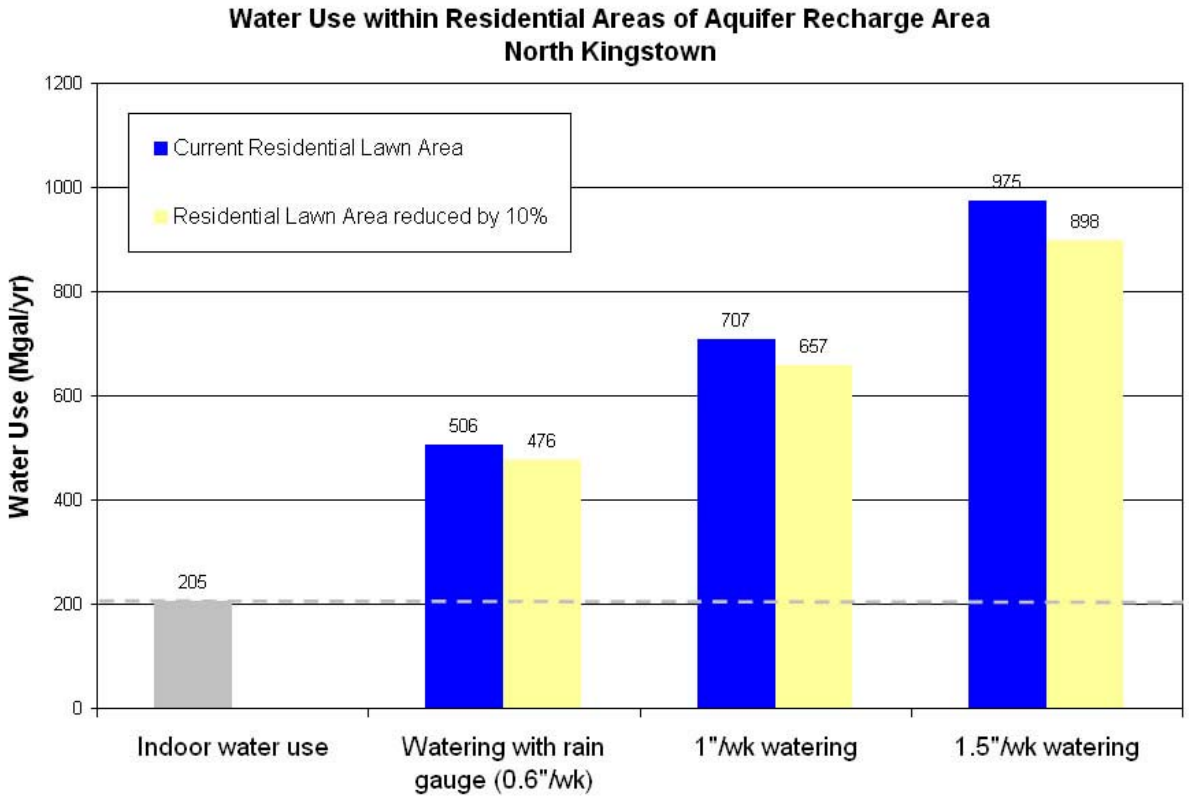
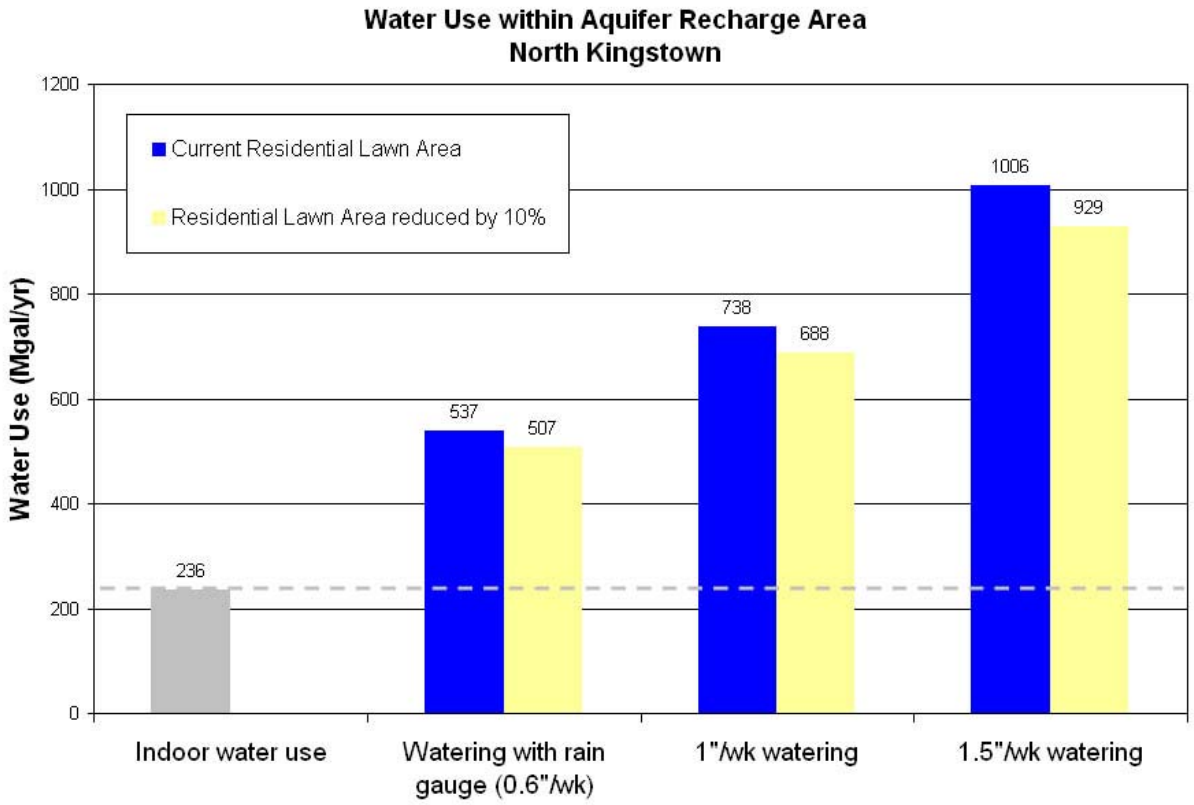


Figure 5 below illustrates total water use by all land use types with septic system inputs (including commercial, municipal, etc.) to the aquifer recharge area in North Kingstown. The lawn irrigation strategies were applied only to the residential land use acreage.

Figure 5:



For more information about the Healthy Landscapes Program visit our website at www.healthylandscapes.org or call (401) 874-5398.

Morton, T.B., A.J. Gold, and W.M. Sullivan. 1988. Influence of Overwatering and Fertilization on Nitrogen Losses from Home Lawns. *Journal of Environmental Quality.*17:124-130.

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