In Pursuit of Conservation:
A Study of Community Experiences with Outdoor Water Conservation Ordinances

COLUMBIA UNIVERSITY

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Introduction

The Client

Rockland County has the uncommon situation in which the private company United Water New York serves 90% of water customers in the county. Although the Hudson Valley contains abundant water resources, Rockland County has experienced water shortages during regularly recurring drought conditions in the past few decades. Members of the Rockland County Legislature would like to investigate potentially cost effective methods to reduce demand.[1]

Alden Wolfe, chairman of the Rockland County Legislature Environmental Committee and Vice-Chairman of the Rockland County Legislature has asked the Fall 2012 Columbia Sustainable Development Workshop to investigate community experiences with non-emergency outdoor water ordinances in the country. The results are intended to provide support for Rockland County's efforts to enact legislation in this area.

Project Background

This project is the culmination of work done by seven Columbia University undergraduates in the Fall 2012 Sustainable Development Workshop. The Undergraduate Workshop gives students the opportunity to work with a client on an applied project to gain real world sustainable development experience. Throughout the semester, students work in teams to develop skills relating to analysis, communication and problem solving while experiencing the type of work challenges they will encounter following graduation.

Project Purpose

In the spring of 2012, the Columbia Sustainable Development Workshop took on a project looking at the savings, costs, and benefits of various potential water savings activities for the Rockland County Bureau of Water. One of the seven water savings activities that last semester's group analyzed was outdoor, non-emergency water ordinances, but the research documenting specific savings from these ordinances was less robust than what was available to document savings from other activities. As a result, Rockland County approached the Workshop directors in Fall 2012, looking for a more in depth examination of water ordinances.

Our semester began with an introduction from Dan Miller, and a special advisor, Stuart Braman. Our group focused on creating a series of case studies throughout the continental U.S. regarding community experiences with non-emergency outdoor water conservation ordinances. Our aim was to better understand the ordinances, investigate their successes and failures, and examine the details of implementation. The hope is to provide the legislature with a strong base upon which to determine an appropriate response.

A second purpose was added to the project after the first two weeks: to conduct a sensitivity analysis of the results from last semester's project. New ranges of conservative

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[1] Braman, Stuart, and Simon Gruber. "Water Conservation and Long-Term Water Supply Planning in The Hudson Valley: A Rockland County Case Study." *Center for Research, Regional Education and Outreach*. State University of New York at New Paltz. Summer 2012.

and optimistic estimates of water savings and participation rates were analyzed for the five measures shown to be cost effective in order to assess the stability and volatility of last semester's results. The sensitivity analysis results are provided in a separate report.

Problem Statement

How can the legislature effectively implement non-emergency, outdoor water conservation ordinances?

Methodology

Our primary aim was to identify areas that would provide interesting and useful case studies for Rockland County concerning outdoor, non-emergency water conservation ordinances. Before we conducted interviews, we formulated a specific methodology in order to understand potentially complex and broad ordinances.

At the start of the project, Stuart Braman identified several areas of interest along with some contacts in these locations. We identified five basic categories we wanted to tackle:

1. Identify the type of ordinance reviewed
2. Look at the background on the passage (i.e. the local situation)
3. Look at the implementation (staffing, budget, enforcement)
4. Look at the results from both a quantitative and qualitative perspective
5. Identify the similarities to Rockland and come up with a set of concrete recommendations.

A sample framework is shown in Figure 1.

Our methodology was primarily driven by a desire to achieve a comprehensive view of each community studied with a focus on the entire conservation program rather than simply the non-emergency, outdoor water conservation ordinances.

After developing a framework, the group collaborated to come up with a list of questions to base our interviews upon. These are included in the Appendix (Appendix 3).

We conducted interviews with public works directors, conservation managers, public relations officers, city engineers, lawyers, hydrogeologists and irrigation specialists, among other professionals from counties, cities, towns and villages across the United States. We specifically focused on counties and municipalities in New York, New Jersey, Massachusetts, North Carolina, Florida, California, New Mexico, and Washington

After our interviews were conducted we also developed a Case Study Framework so that we could coordinate across communities and between ordinances. This was driven by a desire for uniformity and ease of comparison.

Sample Framework:

1. Types of (non-emergency) Ordinances Reviewed:
    1. Water waste ordinance
    2. Landscape watering restrictions
    3. In-ground irrigation
    4. Rain sensor
2. Background
    1. Water shortages
    2. Type of water supply (private/public)
    3. Economic output
    4. Population
    5. Consumption Pattern (residential vs. agricultural/industrial)
    6. Local Situation
    7. Foundation for passage
    8. Legal challenges
    9. Community response
3. Implementation Details
    1. Staffing
    2. Legal Details (language within ordinance) & Philosophy
    3. Budget
    4. Community Partnership/Education
    5. Dissemination/Awareness
    6. Enforcement
    7. Potential revisions in ordinance (incl. reviews)
4. Results
    1. Quantitative results (reduction in water use)
    2. Qualitative results (uptake by community)
    3. *Cost-Benefit Analysis from previous report & potential comparisons? TBD*
5. Similarity to Rockland and Recommendations

Figure 1: Sample Framework

Nassau County, NY

Type of Ordinance Reviewed

While legislators passed countywide ordinances in Nassau in 1987, they do not enforce them actively, especially due to financial constraints and personnel shortages, according to Loretta Dionisio, a hydrogeologist in the Nassau County Department of Public Works. Its cities, towns, villages and water districts have adopted some of these original ordinance provisions, while water districts, such as Port Washington, even took the lead and adopted their own ordinances decades before Nassau did so as a county.

Another major reason why Nassau County has not recently enforced its ordinances actively is because of Section 6, part B, which reads: "In those instances where local water purveyors have established limitations more restrictive than provided in this Ordinance, said more restrictive provisions may be locally imposed as an exception to this Ordinance if the Commissioner of Public Works authorizes such local limitations after an application made by such local water purveyors."

Each community that we studied passed more restrictive ordinances locally, and thus must enforce their own restrictions if they so choose. The passing of local restrictions often meant that the country restrictions were less powerful and prevented a sense of unity from forming among policymakers and enforcement officers in the region. In many cases, we even found there to be a lack of awareness about the county ordinances.

Nassau County Ordinances, passed June 8, 1987

- Section 1: Overview
- Section 2: Sprinkling
  - No sprinkling lawns/vegetation between 10 a.m. 4p.m.
  - Sprinkling every other day based on odd/even house number
- Section 3: Air Conditioning Systems
  - Must have recycling water system
  - Each city/town/village enforces
- Section 4: Car Washes and Fleet Maintenance
  - Car washes must have water recycling systems
  - Each city/town/village enforces
- Section 5: Water Hydrant Usage
  - Water purveyors (city/village/town/special district) monitor fire hydrants
- Section 6: Exceptions and Variances
  - If conditions worsen in a certain area, Commissioner of Public Works may authorize local shift in interpretation of water ordinances
  - Local water purveyors may pass more restrictive water ordinances as an exception to this ordinance
- Section 7: Enforcement
  - Nassau County Police Department or the police department of a certain city will enforce the ordinance

- Section 2 violation: $50 up to $500
- Section 3 violation: $500 up to $1,000 fine

Glen Cove Ordinances (Chapter 270, added 6-23-1987, amended 8-9-1988)

- Sprinkling only allowed between 5-9a.m., 4-12p.m. (Section 270-35)
  - Residents in even-numbered homes may water on even days and vice versa
- Installation of rain sensor device to shut off sprinklers during precipitation (270-38)
- Hoses must have shut-off valve (270-39)
- Air-conditioners must have water-recycling devices (270-42)
- Plumbing must have pressure regulator valve (270-43)
- Car washes must recycle water; restaurants must not give out water unless customer requests it (270-45)
- Violating an ordinance regarding sprinkler systems (Article V) will result in a $500 fine and/or 15 days in jail
- Violating an ordinance regarding water conservation measures (Article VI) will result in a $1000 fine or jail up to a year

Port Washington Water District *(Passed in 1985, updated in 2003)*

- Article II: Metering
  - Meters must be installed on buildings
- Article III: Application for Water Service
  - "No person or corporation will be permitted to use the water of the District for any purpose without having first obtained permission from the Board of Commissioners or its duly authorized representative."
- Article XXIII: Lawn Sprinkler System Permits
  - Sprinklers limited to 10 gallons/minute
    - All sprinklers must have pressure regulating valve, rainfall sensing equipment
  - Applications must be sent to the Board for a new sprinkler system with:
    - Copies of the plan, location of rain sensing/soil moisture devices
    - Table with flow capacity of sprinkler heads
    - Sketch of pressure regulating valve
    - Manufacturer's information about rain sensing, soil moisture detection devices
  - Board must inspect the location and application and grant approval before customers may install and use sprinkler systems
- Article XXV: Existing Lawn Sprinkler Systems
  - Former irrigation systems must be updated to fit current criteria
- Article XXVII: Notification of Violation
  - Board sets time for violator to correct offense
    - If violator does not comply, his/her water supply may be cut off

    - Board may also fine the violator $100 for each offense
- Port Washington also follows the Nassau County ordinance regarding no lawn watering between 10p.m.-4p.m. and even numbered houses water on even days, vice versa.

Oyster Bay Ordinances

- Passed by the Board of Water Commissioners of Plainview Water District, Town of Oyster Bay on February 28th, 2012
- Approval is required from Water District to install any underground sprinkler system, and in certain cases may require a Double Check Valve or Reduced Pressure Zone Device (Section 5.27)
- No fire sprinkler system that uses water from the District shall be operated, installed, continued or maintained without approval of Superintendent of Water District (Section 5.28)
- Lawn/shrubbery/garden sprinkling is prohibited between 10 a.m. to 4 p.m. every day (Section 8.21) and sprinkling permitted every other day based on house number (Section 8.22-3)
- Prohibit washing down driveways and sidewalks with garden hoses (Section 8.2)
- Car washing permitted only with shutoff valve at discharge end (Section 8.2)
- Use of water prohibited in outdoor fountains, spray ponds and similar facilities when recirculating in excess of five-gallons per minute (Section 8.3)
- Jetting, puddling and other methods of soil compaction that use water are prohibited (Section 8.4)
- All car and fleet vehicle wash establishments must have recirculating facilities (Section 8.5)

Garden City Park Water District *(Created in 2004)*

- Drinking Water Quality Report contains reminder of non-emergency Water Ordinance
- Follows Nassau County Lawn Sprinkler Regulations of Odd-Even Watering Days
- Increases the Nassau County restrictions by prohibiting irrigation from 6 a.m. to 6 p.m.

Local Situation & Background

There are two cities, three towns and 64 villages in Nassau County with a population of 1,344,436 people (2011 census). Citizens' mean income level is $93,613 (2006-2010). All of Nassau County relies on groundwater for its water source. While there are three main aquifers in the county, there are concerns about a falling water table and increasing saltwater intrusion. While precipitation continues partially to replenish groundwater stores—44 inches of precipitation falls on county each year— large amounts of water are going to wastewater treatment facilities instead of reentering the aquifers naturally. At the

same time, residents use about 375 million gallons of water each day (USGS, 2000).[2] The communities for this Nassau County case study are: Glen Cove, the Port Washington Water District, the Plainview Water District and the Garden City Park Water District.

A source of controversy has been surrounding which level of government is in charge. During a conversation with William Archambault, Public Works Director in Glen Cove, he spoke about this tension between the state and county levels of government. The state Department of Environmental Conservation (DEC) implemented water pumpage caps in 1987, for example, which was one of the catalysts for the unanimous support for Nassau County's 1987 ordinance. On the other hand, many communities said that the caps were arbitrary and limited economic growth. The DEC also wouldn't allow one small community that does not use as much water to give some of its extra water credits to other villages or towns. The DEC also asks each community to resubmit a water conservation plan each year, but the participation rate is low. Other sources for this case study did not even mention a state role in their local decision-making.

As a current events note, Legislator Judi Bosworth co-hosted two town halls in the past several months about groundwater conditions and concerns. There are worries about saltwater intrusion, contamination and overuse of water sources. Community members, business groups and environmentalists have been coming together to talk about the possibility establishing a new agency to look after water resources, according to Lora Gellerstein, Chief Legislative Aide of the Suffolk County Legislator William Spencer.

Officials and water conservation specialists interviewed in each district expressed the most concern about conserving water resources used when residents water their lawns with sprinkler systems. While none of these entities are currently experiencing a period of drought, they are all taking precautions to monitor water use and conservation.

Implementation, Results

County Level

There are few educational or enforcement programs at the county level, as we learned from e-mail correspondence with Dionisio. The County Department of Public Works is not an enforcement agency or a water supplier. Due to budget cuts, funding and personnel are very limited at the county level. While the Department of Public Works used to take water samples, for example, the budget for this ended after September 2011. While the County's Water Resources Board has made several attempts to rewrite the original 1987 water ordinance, they have thus far failed to reach a consensus and have not convened in several years.

The Nassau County Police Department does enforce the ordinances, however, when a resident calls to complain. This is primarily with the odd/even watering ordinances. Police officers usually issue warnings first to let residents know about the ordinance and then issue summons if the resident is a repeat offender. County officers do not usually

[2] "Long Island Aquifers." - *NYS Dept. of Environmental Conservation*. Web. 27 Nov. 2012. <http://www.dec.ny.gov/lands/36183.html>.

issue fines, because towns and villages have different fines listed in their ordinances, and so officers issue general warnings and summons to offenders.

Thus, it is perhaps best to look at Nassau County's water ordinances from the perspective of the city, town and village levels, while remembering the original role that the county played.[3] Ordinances differ based on location and local decisions to enforce. William Archambault, Public Works Director in Glen Cove, said that the State Health Department makes rules, which the Nassau County Health Department uses as well. All local municipalities in Nassau County can increase restrictions but cannot lessen restrictions below those of the level of the state.

***Glen Cove- City*:**
Glen Cove is one of two cities in Nassau County. The city has conservation ordinances in place that the Public Works Department hesitates to enforce, especially because the penalties appear to be much higher than in other municipalities (for example, violating the water conservation ordinance can result in a $1000 fine or a year in prison, according to the ordinance). Nevertheless, the city has had consistently high water tables. The Public Works Department serves a population of approximately 27,000 customers.
In general, Glen Cove Public Works Director William Archambault said that the proliferation of in-ground sprinkler systems in the city is putting a major demand on the system.[4] At night, it is difficult for facilities with storage tanks to refill their systems. Also, the city is planning a lot of new development projects in the coming years, which will reduce water supplies as well. Economic growth and population growth are both placing new demands on the system.

The city does not often fine residents who disregard the water ordinances, as Archambault says that would be a political nightmare, and there would not be local support for this decision to enforce. He said, however, that if a Public Works department staff member notices that someone is violating the ordinances, such as watering while it's raining, the staff member will issue a warning and then give two notices first.
Penalties for not following the water ordinance in section V about lawn irrigation include payments up to $500 or up to 15 days in prison. Penalties for disobeying section VI about water conservation include fines up to $1000 and prison time up to one year, although Archambault said that the Public Works Department has not issued a fine in many years.

The Director said that despite new development projects and an increase in irrigation systems, the city has been successful in reducing water use. The biggest water savings are through the time of day water and odd/even restrictions, which cut the irrigation watering in half, according to Archambault. Also, the area has seen more rain than usual, particularly in the summers, which has raised water levels.

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[3] Dionisio, Loretta. Nassau County Hydrogeologist. "New York Case Study: Nassau County Ordinance." E-mail interview. 24 Oct. 2012.
[4] Archambault, William. Public Works Director, Glen Cove. "New York Case Study: Nassau County Ordinance." Telephone Interview. 2 Oct. 2012.

The Public Works Department also increases awareness by sending our mailers each year and informational newsletters. All of the water ordinances and tips about water conservation are on the back of all of the water bills.

Port Washington Water District:
The Port Washington Water District's ordinances are notable because the district set a precedent in the area and created successful ordinances well before Nassau County implemented water ordinances and before New York State Department of Conservation implemented pumpage caps in 1986. The district put in place alternate day lawn irrigation rules in 1953, 34 years before the Nassau County legislature wrote its ordinances.

In 1986, a year before Nassau County implemented ordinances, Port Washington also required no lawn watering between 10 a.m. and 4p.m., limited irrigation time to two hours per day, asked for no spraying public sidewalks or water jetting that would cause soil compaction and said that the area of irrigation should be no more than 40% of the total area. Also, they required they all irrigation systems have rain sensing equipment and a timer device. A resident could only install an irrigation system after receiving permission from the district. These 1986 changes were largely in response to a New York State Department of Environmental Conservation decision to impose pumpage caps. Nassau County implemented its water ordinances in 1987, but they did not immediately apply to the water district, because its regulations were already more stringent.[5]

Another interesting part of the case study is that the water district does not have zoning or legislative authority, but this rests with the villages and town. Some taxes collected in the municipalities are paid to the water district, but there is at times a disconnect between the local government and the district, which relies on the zoning boards to prevent contractors from building until they first check on water availability from the district itself.

Since 1913, the Port Washington Water District has supplied water to several villages and the portions of the town of North Hempstead. These communities include Port Washington North Plandome Manor, Baxter Estates, Manorhaven, Flower Hill and some unincorporated portions of the town of North Hempstead. The Water District employs 13 wells and two storage tanks to supply water for 30,000 people in this corner of Nassau County. The population growth has leveled out at this time, as has the water use.

Despite predictions decades ago that the water district's water use would increase to many millions gallons of water per day, the amount has remained at around 10,000 gallons per day. The ordinance was first passed in 1953 due to an increase in population during the 1940s, 1950s, and 1960s and a corresponding water pumpage rate increase. Since Port Washington is on a peninsula, there were significant concerns about saltwater intrusion, which was less of a concern for other regions in central Nassau County, although this is also important on the south shore of Nassau County as well.

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[5] *Port Washington Water District Water Conservation Plan*. Rep. N.p.: n.p., 2012. Print.

The water district now has a system of education and enforcement. It educates the public using newsletters, in-school programs and supply brochures. It also has an information hotline, representatives make phone calls and personal visits and oral presentations around town. There is an effort to make water conservation more personalized in the local setting. The district will also provide water audit information when residents apply for a new irrigation system. Also, after a resident inventories his or her home water use as part of a water audit, the water district will provide a copy of water records and sample calculations. The education program targets homeowners, the government, local businesses, the media and schools among other entities. In North Hempstead (the town), there is also a "Recycle the Rain" program in which the town sells 50-gallon barrels at $50/barrel. When used, residents can save up to 1,800 gallons of water/season that they use to water their gardens/lawns.

Also, water district zoning boards do not give out building permits or allow for the installation of irrigation systems without receiving statements of water availability and evidence that the irrigation systems will be water efficient. The water flow can be no more than 10 gallons/minute/zone. According to Dennis Realmuto, President of IANY, this process costs $100/review and is a lengthy process.[6] In the case that residents do not follow the requirements of the ordinance, the boards charge $100 for each violation. If the owner fails to follow instructions, then the Board may turn off the building's water. Since the water district estimates that one-third of daily water consumption is through lawn watering, this is an important part of the ordinance. The local police department does not play a role in enforcement, only the water district.

Due to these restrictions, the average water use for domestic, commercial and industrial uses decreased from 584.7 million gallons/year in 1980-1984 to 558.9 million gallons/year in 1992-2002, according to information provided by Italo Vacchio, Superintendant of the Port Washington Water District.[7] Lawn irrigation has increased at the same time, however, particularly due to an increase in automatic sprinkler systems and dry summers. Water use also spikes each summer despite the restrictions, perhaps showing a need for increased enforcement or different ordinances in the summertime. Of course, outdoor water use increases in the majority of areas around the U.S. in the summertime, even when residents are efficient about their water use.

Even though all people and organizations are required to apply for irrigation systems, demand is increasing nonetheless and residents are still watering their lawns heavily, which is undermining other efforts to reduce water use. Despite the implementation of odd/even lawn restrictions since 1953, this still has not become part of the local culture. The water district has responded by implementing more stringent restrictions on building irrigation systems unless homeowners or contractors demonstrate a plan to reduce water use, although the efficiency of these methods are yet unknown.

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[6] Realmuto, Dennis. President of the Irrigation Association of New York. "New York Case Study: Nassau County Ordinance." Telephone Interview. 9 Oct. 2012.

[7] Vacchio, Italo. Superintendent at Port Washington Water District. "New York Case Study: Nassau County Ordinance." Source for Port Washington information.

Plainview Water District:
Plainview Water District services more than 10,500 accounts, providing water to about 32,000 residents.[8] According to a representative of the Plainview Water District, there is no official enforcement of the ordinance. The Water District mobilizes public education through using: a quarterly newsletter, regularly updated website, and employees passing out community notices, free low flow shower heads, water saver kits and rainfall gauges for irrigation. Furthermore, to control the increasing water use from in-ground sprinkler systems, the ordinance required approval by the Water District, before any such system can be installed. Certain in-ground sprinkler systems are also required have a Double Check Valve and Reduced Pressure Zone Device, and the final installation is subject to inspection by the Superintendent, or other representative, of the Water District.

The representative explained that employees who work in the field for the Water District will also unofficially "patrol" the neighborhood, and if they happen to catch any violators the employee fills out a form for the Water District and places a written warning letter in the violator's mailbox. The Water District staff includes 15 employees in the field and about 8 office employees. The police are only involved in water conservation ordinance enforcement during a declared water emergency. The Water District believes that these measures are effective and have little interest in Nassau County enforcement of water ordinances. The main community interest is in lowering water and electric bills, which reinforces compliance.[9]

Garden City Park-Water District:
Garden City Park Water District is a small district that is basically self-sufficient, is about 95% residential, and services about 7100 accounts. According to District Superintendent Michael Levy, peak demand occurs during the summer months, largely driven by excessive lawn irrigation, so that before the ordinance the district was forced to use stored water reserves. The Water District found the County-level restriction of sprinkling from 10 a.m. to 4 p.m. insufficient, and so extended the hours to 6 a.m. to 6 p.m. within the Water District Ordinance, allowing enough time for the water supplies to recoup and handle the demand.[10]

Superintendent Levy said that the District has about seven servicemen out for the water district every day, who are also tasked with giving out tickets that serve simply as reminders to those not complying with the ordinance. However, during a prolonged heat wave, the Water District will give out increasing fines (placed in the water bill) for offenders, and a more concerted effort is organized, in which employees actively drive out to check for compliance. Superintendent Levy believes there is no problem with the enforcement of the ordinance.

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[8] "About Us." *Plainview Water District*. Web. 5 Dec 2012. <http://www.plainviewwater.org/About Us.html>.
[9] Plainview Water District Employee. Phone Interview. 10 Oct 2012.
[10] Levy, Michael. Garden City Park District Superintendent. "New York Case Study: Nassau County Ordinance." Phone Interview. 19 Oct 2012.

Currently they are in the process of replacing all the water meters in households, so that the readings will come every hour, three times a week over radio to the main office. Superintendent Levy explained that this would allow the water district to remotely monitor when people are watering their lawns. At this time there is no plan to use this for stricter enforcement, but this will allow the water district to reallocate the employees that were previously monitoring the water meters. Although the capability of the Water District is about 10 million gallons a day, the average use is estimated around 5 million gallons a day during the summer, and the District is running at most at 75% total capacity to meet demand. [11]

Lessons for Rockland County:

Based on Nassau County's experience, some relevant lessons for Rockland County include:

Incentives to improve water efficiency in lawns: Sprinkling irrigation is the easiest part of the ordinance to enforce, and it also uses up the most water in the community, according to Archambault. Dionisio also called sprinkler limitations "the most important element of the Ordinance's outdoor, non-emergency restrictions. The impact of lawn irrigation on water withdrawal rates is becoming more and more profound."

Enforcement must be tailored to local context: Glen Cove, Garden City Park and Plainview's use of warnings rather than imposing fines immediately seems to be a beneficial and politically safe move. Look to Garden City Park for advice regarding enforcement. Furthermore, Glen Cove's penalties for failing to follow the ordinance are so strict that the Public Works Department hesitates to enforce it, meaning that the penalties for lack of compliance should increase following warnings and small penalties to begin with.

Use of odd/even watering restrictions: Odd/even watering restrictions are not necessarily useful in reducing water use unless there are other methods to reduce lawn water use, such as requiring homeowners to submit applications for installing new sprinkler systems that are more water efficient. Even though Port Washington started to limit water use in 1953 through implementing an odd/even restriction, the most recent report showed that this in itself has not been successful with reducing lawn irrigation water use.

Education is an extremely effective enforcement tool: It is important to think of creative ways to get the community involved, which will engage the communities in new ways. For example, North Hempstead started a rainwater barrel program, which the water district supports, and which encourages residents to save water rather than requiring them to do so. These positive programs start to incorporate water conservation into the communities' cultural fabric.

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[11] Garden City Park District Superintendent Michael Levy. Phone Interview. 19 Oct 2012.

Relationship between different levels of government: The local level of government (water districts, villages) can be much more effective at passing and enforcing water ordinance legislation than at the county or state levels. While Nassau County does not enforce its county legislation, local water districts, such as Port Washington, can play a larger role in terms of enforcing and educating. However, this does not mean that Rockland County should not enforce ordinances that it passes. It would be much more effective for Nassau County to enforce its ordinances to conserve water rather than relying on differing levels of compliance from its cities, towns and villages. The ordinance should also specify that the county will enforce the ordinance, rather than assigning power to many different levels of government. Also, it would be best to write a document that unifies the county while also communicating clearly with each level of government what the ordinance entails.

Works Cited

"2011 Consumption." *Port Washington Water District*. Web. 5 Nov. 2012. <http://www.pwwd.org/conservation_consumption.php>.

Archambault, William. Public Works Director, Glen Cove. "New York Case Study: Nassau County Ordinance." Telephone Interview. 2 Oct. 2012.

Barbato, Jane. Information Specialist at Jericho Water District. "New York Case Study: Nassau County Ordinance." E-mailed Information. 22 Oct. 2012.

Braman, Stuart. Resident of Port Washington and Research Scientist at Lamont-Doherty Earth Observatory. Source for materials. 5 Nov. 2012.

"City of Glen Cove, NY Code." *City of Glen Cove, NY Code*. Web. 5 Nov. 2012. <http://www.ecode360.com/GL1564>.

Dionisio, Loretta. Nassau County Hydrogeologist. "New York Case Study: Nassau County Ordinance." E-mail interview. 24 Oct. 2012.

Gellerstein, Lora. Chief Legislative Aide. Office of Suffolk County Legislator William Spencer. "New York Case Study: Nassau County Ordinance. E-mail information. 3 Oct. 2012.

Levy, Michael. Garden City Park District Superintendent. "New York Case Study: Nassau County Ordinance." Phone Interview. 19 Oct 2012.

"Long Island Aquifers." - *NYS Dept. of Environmental Conservation*. Web. 27 Nov. 2012. <http://www.dec.ny.gov/lands/36183.html>.

"Nassau County, Long Island New York." *Nassau County, Long Island New York*. Web. 5 Nov. 2012. <http://www.nassaucountyny.gov/>.

"Ordinances." *Plainview Water District*. 28 Feb 2012. Web. http://www.plainviewwater.org/Ordinances.html.

Plainview Water District Employee. "New York Case Study: Nassau County Ordinances." Phone Interview. 10 Oct 2012.

Port Washington Water District Water Conservation Plan. Rep. N.p.: n.p., 2012. Print.

Realmuto, Dennis. President of the Irrigation Association of New York. "New York Case Study: Nassau County Ordinance." Telephone Interview. 9 Oct. 2012.

Scully, Jack. Chief Plant Operator of Long Beach. "New York Case Study: Nassau County Ordinance." Telephone Interview. 5 Oct. 2012.

Vacchio, Italo. Superintendent at Port Washington Water District. "New York Case Study: Nassau County Ordinance." Source for Port Washington and Nassau County information

Dix Hills Water District, Suffolk County, New York

Type of Ordinance Reviewed

Ordinance adopted by the Town Board of the Town of Huntington July 6, 2010, in order to conserve the quantity of good quality district water.[12]

Odd-Even Day Watering Mandate: even numbered addresses can use irrigation systems on even numbered days, while odd numbered addresses irrigate on odd days. This is in effect from May 1st through September 30th. This part of the ordinance has been in effect in Dix Hills Water District since 2004, and was adopted into the Town Code in 2010. Violations result in a written warning for first offense; up to $100 penalty for second offense; and up to $500 penalty for any subsequent offenses. The Department of Public Safety enforces this mandate.

Water Conservation Penalty Charges: exceeding the water usage limit in a billing cycle, results in a property owner paying a higher rate for the excess water used, established in the excess water usage rate structure in District Consumer Handbook.
Water Sensors required since 2004 in any new in-ground irrigation system.

Local Situation & Background

The water situation in Suffolk County and Rockland County is similar and different in several ways. In the 2 major counties on Long Island, Nassau and Suffolk, the water is entirely groundwater supply. This is similar to Rockland County, which obtains 63% of its water supply from groundwater. Suffolk has more than 1 million more residents than Rockland County, and the former is roughly three times the size of the latter. The Suffolk Water Authority serves about 1.1 million customers, and it differs from Rockland in that it has lots of supply sources that are redundant and relatively close to home. [13] The Town of Huntington is located in the western end of Suffolk County, adjacent to the Nassau and Suffolk County boundary in Long Island. It covers an area of about 93 square miles, and contains four incorporated villages along with many unincorporated areas.[14]

Dix Hills Water District is a municipal water district, created and administered by the Town Board of the Town of Huntington, Suffolk County, New York.[1] Economically, Dix Hills customers are part of a primarily wealthy demographic, meaning its customers are above the median income level of the county and the area itself is highly developed and "upscale," with an average plot size of over 1 acre. Dix Hills Water District does not service the entire Town of Huntington, but the Town Board and Town Code serve as the commissioners for the Water District. The per capita demand and use of water in Dix

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[12] "Chapter 99. Dix Hills Water District." *Town of Huntington, NY Code*. Web. 20 Oct. 2012. http://www.ecode360.com/14686865#14
[13] Ponturo, Paul. Phone interview. 19 Oct. 2012.
[14] "About Us." *Town of Huntington, Long Island, NY*. Town of Huntington Government, 11 Dec. 1998. Web. 20 Oct. 2012. http://www.huntingtonny.gov/about_toh.c

Hills Water District has led the county for the last fifteen years, indicating that average usage is quite high. [15]

The Dix Hills Water District is responsible for delivering water to about 8500 homes and businesses within the Town of Huntington. The Water District controls seventeen wells, with each well producing about 1300 gallons of water per minute. Previously the issue within Dix Hills was that in the past 15 years that area has led the countywide adoption of in-ground irrigation systems in residences and businesses with lawns. As all these irrigation systems began turning on at similar peak demand times, in addition to regular water demand, it led to the depletion of the district water tanks and the tapping of storage resources meant to remain in reserve for emergencies.

This massive demand continuously peaked during summer months, straining the Water District's supply, so that in 2002 it was one of the highest per capita summer water users in the country, pumping an average of 17 million gallons per day in the summer. Dix Hills and Suffolk County did not face a supply issue, because the aquifer is well supplied, and, while not limitless, it remains adequately recharged by yearly rainfall. Thus, Dix Hills Water District faced a demand issue, which the district addressed by enforcing life style adjustments in its customer's water use habits. [16]

Implementation

This was a relatively non-controversial issue within the Dix Hills Water District and Town of Huntington. An interview was conducted about implementation of the ordinance with Paul Ponturo, the Senior Water Resources Engineer of H2M Engineering Firm (a consultant for the District), who previously worked within the Suffolk County Health Department in the Office of Water Resources, and thus dealt with Dix Hills from a regulatory standpoint. According to Mr. Ponturo, it was a cooperative effort to pass the ordinance with the Water District Superintendent aided by members of the H2M Engineering Firm, both of whom brought on board the Citizens advisory committee for the district, which acts as a liaison between the citizens and the government. According to Mr. Ponturo, Dix Hills Water District implemented ordinances enforcing an Odd/Even Sprinkling Mandate and water sensors on in-ground irrigation systems since 2004, and these District Ordinances were adopted into the Town Code in July 2010. Mr. Ponturo observed that from an enforcement standpoint, this made the ordinances fairly easy to enforce since Dix Hills is a town run district, so the Town of Huntington had a viable enforcement mechanism in the Building Department of the Township. The ordinances on in-ground irrigation are enforced by the Plumbing Department within the Building Department and the Town Plumbing Code.

Furthermore, if people violate the Dix Hills Water District Ordinance, the enforcement is handled by the Department of Public Safety, which is a town-wide organization that

[15] Ponturo, Paul. Phone interview. 19 Oct. 2012.
[16] Ponturo, Paul. Phone interview. 19 Oct. 2012.

enforces ordinances in general, and is funded and operated separately from the daily operations of the water district.

There are constant educational programs. Since no one in the district wants a constantly adversarial situation, Dix Hills is strongly grounded in the continuing education of the public. The ordinances and water conservation suggestions are included in the annual water quality report, as well as the billing statements leading up the irrigation-use high point of the year. The Water District also employs an aggressive rate structure, which is geared towards discouraging excessive water use by increasing the monetary value of excessive water use. It is also important for Rockland County to note that, as of 2012, Suffolk County does not have any water conservation ordinances at the county level. [17]

Results

The total capacity of the wells in Dix Hills today is about 33.35 million gallons of water a day, which Mr. Ponturo pointed out is enormously different from the current average daily demand for the district of about 6-7 million gallons a day[18]. Thus, according to these results the Water District currently has more than enough supply to satisfy demand. From 2008 to 2009 the pumpage decreased by approximately 10.4%, but such a significant decrease was determined to be mainly due to cooler and wetter conditions during the summer of 2009.[19] However, the Dix Hills Water District had no long-term results about the efficacy of the ordinances. Furthermore, as of 2012, the Water District maintains that there are no ongoing enforcement issues, although they were unable to provide quantitative results to support that conclusion.

Lessons for Rockland County:

Use of odd/even watering restrictions: It is critical to assess the drivers of the water situation. As in this case the water demand was the problem, so the district addressed its customers water use habits. In order to accomplish this, the Water District implemented odd/even water restrictions, as well as limited hours, to lawn sprinkling, forcing customers to adjust wasteful watering practices.

Enforcement must be tailored to local context: The Dix Hills Water District found enforcement of the ordinance to be more successful when added to existing infrastructure. In this case, the Town Building Department, Plumbing Department, and Department of Public Safety enforce the various components of the ordinance. This strategy lends established authority to the ordinance and guarantees that there is adequate time and manpower to ensure compliance within the community.

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[17] Ponturo, Paul. Phone interview. 19 Oct. 2012.
[18] Ponturo, Paul. Phone interview. 19 Oct. 2012.
[19] Town of Huntington, NY. Dix Hills Water District. *2009 Annual Water Supply Statement/Consumer Confidence Report and Supplemental Data Package*. Published May 2010. Revised June 2011 Web.

Education is an extremely effective enforcement tool: Education can be a tool to reduce adversity within the community, and ensure the population has confidence in the necessity of the water conservation ordinances. Again, since the ordinance addresses water use habits, education can be a non-confrontational and long-term method for changing people's perspectives on water conservation.

Works Cited

"About Us." *Town of Huntington, Long Island, NY*. Town of Huntington Government, 11 Dec. 1998. Web. 20 Oct. 2012. http://www.huntingtonny.gov/about_toh.c

"Chapter 99. Dix Hills Water District." *Town of Huntington, NY Code*. Web. 20 Oct. 2012. http://www.ecode360.com/14686865#14

Ponturo, Paul. Senior Water Resources Engineer of H2M Engineering Firm. Phone interview. 19 Oct. 2012.

Town of Huntington, NY. Dix Hills Water District. *2009 Annual Water Supply Statement/Consumer Confidence Report and Supplemental Data Package*. Published May 2010. Revised June 2011 Web

Town of Yorktown, Westchester County, New York

Type of Ordinance Reviewed

Chapter 280 Water, Article II. Water Conservation was adopted into the Town of Yorktown, NY Code on July 5, 1988.[20]

- Restriction on Consumption uses an odd/even address on odd/even day mandate for watering lawns, shrubs, plants and gardens. This does not apply to plant nurseries and other commercial users that grow and distribute plants for sale.
- Swimming pools cannot be filled on weekends. (Amended April 8, 1992)
- Prohibits using water hoses to clean streets. (Amended April 8, 1992)
- Meant to be enforced by the police department of the Town of Yorktown
- Penalties include: $25-$100 for first offence, $100-$250 for second offense, and $250-$500 and/or imprisonment for no more than 15 days for each subsequent offence.

Local Situation & Background

The Town of Yorktown is located in Westchester County, NY. Westchester County is larger than Rockland County, covering an area of 450 square miles, and has a diverse population occupying 45 municipalities. Similarly to Rockland County, Westchester has a growing population that has grown from 923,459 to 949,113 people, an increase of 3%, between the 2000 and 2010 Census.[21] The Town of Yorktown has a population of about 36,081, and its Consolidated Water District, in existence since January 1, 1970, serves about 10,000 customers. The Consolidated Water District of the Town of Yorktown uses aboveground water resources, which is sourced mainly from the Amawalk Reservoir. Since Yorktown is in Westchester County it differs from Rockland County in that its other main source of water is the New York City Aqueduct from the Catskills, which Rockland cannot access. [22]

According to the Water Conservation Law in the Town Code, The Town of Yorktown was unable to meet the water demands of its residents during the peak periods of water consumption, which is what drove the passing of the law in the 1980s. However, according to a representative of the Consolidated Water District, Yorktown no longer faces issues with either water supply or demand.

Implementation and Results

[20] "Chapter 280 Water: Article II. Water Conservation." *Town of Yorktown, NY Code*. Yorktown, NY. Web. 20 Nov 2012. http://ecode360.com/6853414.
[21] "Census and Statistics." *Westchestergov.com*. Westchester County, 11 2012. Web. 20 Nov 2012. http://planning.westchestergov.com/census-statistics.
[22] . "About the Water District." *Yorktown, New York*. Town of Yorktown. Web. 20 Nov 2012. http://www.yorktownny.org/water/about-water-district.

After speaking with two representatives from the Consolidated Water District of the Town of Yorktown, it became clear that these laws were outdated and largely ignored. Since the town adopted these ordinances twenty to thirty years ago, the current representatives of the Water District were unaware of the circumstances and process surrounding the passing of the Water Conservation and Water Emergency Articles within the Water chapter of the Town Code. In fact, the Water District appeared to be unaware that these separate ordinances existed, so that it was unclear in the interview, despite the Town Code, if the water conservation ordinances were implemented continuously or only in an emergency.[23] However, the Town Attorney Office for Yorktown clarified that both were in fact separate and current laws, even if the Consolidated Water District did not currently enforce them. [24] The only possible explanation I gathered from my interviews as to why the water conservation and water emergency ordinances remain unenforced is that the Consolidated Water District does not believe that water supply or demand is an issue in Yorktown and Westchester County, making both ordinances superfluous.

Lessons for Rockland County:

Writing flexible water ordinances that can evolve: The case study of Yorktown, NY clearly shows that these water conservation ordinances must plan for the future. It would be prudent to establish short- and long-term plans for conservation within the county, as well as setting up a precedent for reviewing the ordinances within a certain period of time. This could prevent the non-emergency ordinances that are passed in Rockland from becoming obsolete, as seen in Yorktown. Overall, the Yorktown Case Study demonstrates that the ordinance is only one part of a larger conservation program, and that, on its own, an ordinance will not be effective in maintaining water conservation within a community.

Education is an extremely effective enforcement tool: Education and awareness of the water conservation ordinance could prevent the situation that is found today in Yorktown. The Water District could educate customers on the detail of the laws and why they were passed, as well as placing reminders of relevant ordinances on websites and in water bills.

Works Cited

"Census and Statistics." *Westchestergov.com*. Westchester County, 11 2012. Web. 20 Nov 2012. http://planning.westchestergov.com/census-statistics.

"Chapter 280 Water: Article II. Water Conservation." *Town of Yorktown, NY Code*. Yorktown, NY. Web. 20 Nov 2012. http://ecode360.com/6853414.

“Chapter 280 Water: Article IV Water Emergencies.” *Town of Yorktown, NY Code*. Yorktown, NY. Web. 20 Nov 2012. http://ecode360.com/6853788.

[23] Two Representatives of the Consolidated Water District of the Town of Yorktown. Phone Interview. 2 Oct 2012.
[24] Representative of Town Attorney Office for the Town of Yorktown. Phone Interview. 13 Oct 2012.

Representative of Town Attorney Office for the Town of Yorktown. Phone Interview. 13 Oct 2012.

Two Representatives of the Consolidated Water District of the Town of Yorktown. Phone Interview. 2 Oct 2012.

The Town of Mahwah, NJ

Type of Ordinance Reviewed

Overview
According to Kathrine Coletta, the Township Clerk at Mahwah, the township of Mahwah has several non-emergency outdoor water related ordinances.[25] This includes an ordinance for water (Chapter XVI of Mahwah General Ordinances), sewer (Chapter XVII), and storm water control (Chapter XXIX).[26] The ordinances have been additionally revised since 2011. Additionally, the Board of Health has also imposed water supply regulations (Chapter BH: XIV).[27] This case study focuses on the outdoor water conservation oriented Chapter XVI ordinance, as well as permit requirements issued by the Board of Health.

1. **Outdoor watering restrictions (amended through 2012):**
    - Definition: **Outdoor watering** means watering outdoor areas in the Township of Mahwah.
    - The outdoor watering restriction period runs from May 1 to September 30, inclusive. Outdoor watering restrictions for Sundays and specific street addresses on odd/even days also apply.

2. **Rain Sensors (2012)**:
    - Expanded automatic lawn sprinkler systems are to be equipped with an automatic rain sensor device or switch for water conservation.

3. **Penalty**
    - First offense: $50.00 plus court costs
    - Subsequent offenses can range from fines not exceeding $100 to $1,250, imprisonment up to 90 days, and community service up to 90 days.

Local Situation & Background

Mahwah:
The Town of Mahwah, like Rockland, is experiencing population and economic growth. Specifically, the population is currently at 26,318, a 46% increase from 1990, and 8% increase from 2000.[28] Economically, the average household income was estimated to be $121,653 in 2010, more than two times the US average, and a 53% increase from 2000's

[25] Katherine Coletta, Township Clerk, Interviewed November 29, 2012.
[26] "Mahwah NJ Revised General Ordinances, 2012," Coded Systems, accessed November 18, 2012, http://clerkshq.com/default.ashx?clientsite=Mahwah-nj
[27] Mahwah NJ Revised General Ordinances, 2012
[28] "Mahwah, New Jersey Census Data & Community Profile," accessed November 18, 2012, http://clerkshq.com/default.ashx?clientsite=Mahwah-nj http://www.americantowns.com/nj/mahwah-information

$79,500.[29,30] The economic growth is partially driven by a low income tax (2.45% vs. U.S. average of 4.50%) and unemployment rate (7.2% vs. U.S. average of 8.6%), as well as job growth (1.50% vs. U.S. average of 0.35%).

Water Situation:
Mahwah relies on ground water supplies as a primary source of drinking water. There are 17 Public Community Water Supply wells and 10 sub-watersheds located in the Township. Currently, Mahwah purchases 30% of its water from United Water.[31] The Township manages main decisions concerning its water supply, but the overall allocation amount is set by the state of New Jersey. Mahwah's water ordinances aim to preserve high quality water as well as curb water demand.

In terms of curbing the water demand, Paul Scherer, Superintendent of Mahwah Water states that, "The water ordinances were originally implemented to conform to the New Jersey conservation plan at the state level."[32] The conservation plan includes the requirement of Water Utilization Forms from all public water systems (serving 1000+ people) to report measurements of water transfer and balances, and special permits for excess water use above 100,000 gallons of water/day. Most importantly, the conservation plan includes water allocation permits that limit the supply of water, incentivizing legislatures from the county and town levels to compose water ordinances to keep the demand below the allocated supply.

Implementation

Regarding enforcement, according to superintendents Paul Scherer and Mike McClanahan, "there is no specific budget allocated to enforcing the water ordinances."[33] As a result, enforcement is periodic and sporadic rather than regular. Enforcements occur between May and September during the outdoor water restriction periods. Surveillance is usually done at night, when residents are more likely to violate the restrictions. However, due to abundant rainfall in the recent years, superintendent Paul Scherer states that major enforcements have not been done since 2010.

[29] "Mahwah income household statistics," accessed December 8, 2012, http://www.clrsearch.com/Mahwah-Demographics/NJ/Household-Income.
[30] "Mahwah, NJ," accessed November 18, 2012, http://www.zipareacode.net/mahwah-nj.htm
[31] Russo, Peter, "Mahwah: A Case Study in Sustainable Cities," accessed November 24, 2012, https://dl-web.dropbox.com/get/Fall%202012%20SDEV%20Workshop/East%20Coast/Mahwah-Shelly/Mahwah%20Ordinance%20%284.4%29.pdf?w=30caea34
[32] Paul Scherer, Superintendent, Interviewed November 29, 2012.

[33] Paul Scherer, Superintendent, Interviewed November 29, 2012.

In terms of the enforcers, both the Township Clerk as well as the Mahwah Police Department may ask its employees to perform surveillance duties. Typically, during a drought, depending on the level of seriousness, appropriate numbers of police officers will work overtime to catch violators.
Finally, whereas education plays a key role in the implementation of ordinances in numerous other areas, education in regards to water conservation and sustainability is virtually nonexistent in Mahwah.

Results

As previously stated in the local situation & background section, the Mahwah water ordinances were first proposed to address New Jersey's allocation limit. From this perspective, Mahwah's water ordinances have been successful in keeping the demand from surpassing the limited supply, even with population growth. Specifically, according to Superintendent Paul Scherer, the allocation limit has remained rather constant at 5.49 million gallons/day, peak monthly limit of 164.702 million gallons/month, and 1,421.466 million gallons/year. With Mahwah's water ordinances, despite the 8% population increase since 2000, the Township of Mahwah has been able to keep its demand below the allocation limit.

Yet, in terms of the specific quantification of water demand, although Mahwah has an elaborate set of water ordinances in place, not many detailed studies have been done to measure the actual impacts of the ordinance. However, the ordinances have been long standing and are generally accepted by the residents of Mahwah.
Despite general acceptance, the Mahwah Police Department has pointed out that some residents—particularly wealthy residents— would rather pay fines than conform to outdoor watering restrictions. The common public complaint is that water restrictions hurt private landscapes and the aesthetics of the lawns.

Lessons for Rockland County:

Mahwah's population and economic growth make the Township an appropriate parallel to Rockland. Based on Mahwah's experience, relevant lessons for Rockland County include:

Curbing water demand is possible even with growing population and economy: Like Rockland, Mahwah has seen rapid population growth for over 20 years. Mahwah is also continuously growing economically. However, while Rockland—without non-emergency water ordinance—is struggling to keep its water demand under water supply, Mahwah implements multiple non-emergency water ordinances and does not face such a problem.

Relationships with the state level government may encourage the passage of water ordinances at lower levels: Although the Mahwah water ordinances were proposed at the Township level, it was initially incentivized by New Jersey state requirements.

Specifically, New Jersey state government's imposed water supply limits played a vital role in the drafting of Mahwah's outdoor watering restrictions.

Use of odd/even watering restrictions: Mahwah follows the norm of implementing odd/even watering day watering restrictions, so that odd-numbered houses water every other day and vice versa. This allows for easy enforcement by the Mahwah Police Department.

Education may be an extremely effective enforcement tool: For Mahwah, education should be incorporated to supplement the ordinances in curbing water demand. The main complaint regarding the water ordinances at Mahwah is that outdoor watering restrictions may compromise the health of landscapes and lawns. If, like the Township of Sharon, Mahwah also provided educational materials on how to have healthy waterless lawns, such complaints may decrease.

Writing flexible water ordinances that can evolve: The Mahwah water ordinance has been amended at least twice since 2011. The amendments include zoning laws for surface water protection in 2011 and a $1.1 million sum appropriated for water utility improvements in 2012.[34] This flexibility allows conservation restrictions to respond to shifting climate and demand, and helps to keep Mahwah's water demand below the supply limit.

Works Cited

"Mahwah income household statistics," accessed December 8, 2012, http://www.clrsearch.com/Mahwah-Demographics/NJ/Household-Income.

"Mahwah NJ Revised General Ordinances, 2012," Coded Systems, accessed November 18, 2012, http://clerkshq.com/default.ashx?clientsite=Mahwah-nj

"Mahwah, New Jersey Census Data & Community Profile," accessed November 18, 2012, http://clerkshq.com/default.ashx?clientsite=Mahwah-nj http://www.americantowns.com/nj/mahwah-information

"Mahwah, NJ," accessed November 18, 2012, http://www.zipareacode.net/mahwah-nj.htm

"Township of Mahwah Ordinance No. 1697," accessed December 8, 2012, http://www.mahwahtwp.org/documents/ord_1697.pdf.

"Township of Mahwah Ordinance No. 1708," accessed December 8, 2012, http://www.mahwahtwp.org/documents/ordn_1708_2012_water_util_imprv.pdf.

[34] "Township of Mahwah Ordinance No. 1697," accessed December 8, 2012, http://www.mahwahtwp.org/documents/ord_1697.pdf.
"Township of Mahwah Ordinance No. 1708," accessed December 8, 2012, http://www.mahwahtwp.org/documents/ordn_1708_2012_water_util_imprv.pdf.

Katherine Coletta, Township Clerk of Mahwah, Interviewed November 29, 2012.

Paul Scherer, Superintendent of Mahwah Water, Department of Public Works, Interviewed November 29, 2012.

Russo, Peter, "Mahwah: A Case Study in Sustainable Cities," accessed November 24, 2012, https://dl-web.dropbox.com/get/Fall%202012%20SDEV%20Workshop/East%20Coast/Mahwah-Shelly/Mahwah%20Ordinance%20%284.4%29.pdf?w=30caea34

The Town of Sharon, MA

Type of Ordinance Reviewed

In terms of non-emergency outdoor water ordinance, Sharon's legislation includes measures for irrigation and outdoor water use restriction.

3. **Irrigation (amended through 11/2011):**[35]
    - Irrigation must conform to Irrigation Management Plan.
        - Definition: **Irrigation well** is defined as any on-site source of groundwater not certified as a potable water supply.[36]
        - Definition: "An '**Irrigation Management Plan**'…incorporates staged drought management provisions…may provide for non-municipal water and treated effluent application to turf in recreation facilities to the extent allowed by regulatory agencies having jurisdiction. On-site well water may be used, but drawdown affecting adjacent water supply wells should be minimized."[37]
    - Potable water from the Sharon public water distribution system cannot be used for irrigation.
    - No piped irrigation system is allowed in natural vegetation areas.

4. **Outdoor water use restriction (4/2012):** [38]
    - Outdoor residential water use is subject to the 2-hour, 2-day per week restriction.
    - Specifically, unattended outdoor water use is restricted for odd numbered homes 6:00-8:00 pm on Monday/Thursday and for even numbered homes 6:00-8:00 pm on Tuesday/Friday.

Penalty: water use violations entail the following according to Article 24, General By-Laws of the Town of Sharon:[39]

- 1st offence: written notice demanding compliance within 30 days
- 2nd offence: $50 fine
- 3rd offence: $100 fine
- Each subsequent offense: $300

[35] "Town of Sharon, Massachusetts Zoning By-Laws as Amended through November, 2011," Town Meeting Articles, accessed October 22, 2012, http://www.townofsharon.net/public_documents/SharonMA_WebDocs/ByLaws/PBZoningBy-Laws.pdf
[36] "Board of Health Department or the Department in accordance with M.G.L. c.111, § 122A and 160 or 310 CMR 22.00," accessed November 20, 2012, http://www.mass.gov/dep/service/regulations/310cmr15.pdf
[37] "Town of Sharon, Massachusetts Zoning By-Laws" http://www.townofsharon.net/public_documents/SharonMA_WebDocs/ByLaws/PBZoningBy-Laws.pdf
[38] "Town of Sharon," accessed October 22, 2012, http://www.townofsharon.net/Public_Documents/index
[39] "Water Division Rules and Regulations," Town of Sharon Public Works Department, accessed October 21, 2012, http://www.townofsharon.net/Public_Documents/SharonMA_DPW/WaterRegs_June_2012.pdf

Two other measures restraining non-emergency *indoor* and residential water use are also effective and worth noting:

1. **Rebate program for high efficiency toilets and washing machines**[40]
    - At Sharon, toilets and washing machines make up 48% of the indoor water use. To increase efficiency in these two main sources of water use, Sharon's rebate program grants a $200 rebate to any individual installing a high efficiency toilet or washing machine. The requirements for the high-efficiency standard is as follows:
        - Toilet: 1.28 gal/flush instead of 3.5 gal/flush for regular toilets
        - Washing machine: water factor <4.5 (installed by Sharon energy staff)
2. **Water rates**
    - Sharon, like Rockland, has had increasing block water rates for residential water users for an extended period of time. In the past decade, Sharon has amplified the complexity and difference between the lowest and highest rates to further discourage excessive water use. (See Figure 1). In terms of complexity, while Rockland only has 3 levels (see Figure 2), Sharon incorporates 5 levels of water rates to punish increasing levels of water use. In terms of the gap between low and high levels of water use, Sharon discourages water use by attaching the highest rate to the highest amount of water use. For Rockland however, the lowest rate for non-residential water use is actually attached to the highest amount of water use. This discrepancy may contribute to lower water demand in Sharon and excessive water use in Rockland.

Sharon Water Rates, effective 1/1/2012

	Winter Rate*	Summer Rate*
Base Fee	$15.00	$15.00
0-7,500 gallons	$3.00	$4.00
7,500-15,000	$6.00	$7.00
15,000-22,500	$8.00	$9.00
over 22,500	$12.00	$13.50
	*Winter: Oct - Mar	*Summer: Apr - Sep

Figure 1: Block water rate for Sharon – quarterly (rate for every 90 days in terms of $/1k gal)[41]

[40] "Water Department Rebates," accessed October 20, 2012, http://www.townofsharon.net/Public_Documents/SharonMA_WebDocs/DPW/irrigation%20rebates/

[41] "Sharon's Conservation-oriented Water Rates," accessed October 21, 2012, http://www.sharonfoc.org/interest/water_rates.html

Table II: Residential rates per ccf (per 100 cubic feet) in Rockland County rise as usage increases; non-residential rates don't for the biggest users.

RESIDENTIAL RATES	WINTER RATES	SUMMER RATES
1st 900 cubic feet per quarter per ccf (per 100 cubic feet)	$3.346	$5.033
For all over 900 cubic feet per quarter per ccf (per 100 cubic feet)	$3.997	$5.975
NON-RESIDENTIAL RATES	**WINTER RATES**	**SUMMER RATES**
1st 900 cubic feet per quarter per ccf (per 100 cubic feet)	$2.97	$4.183
For the next 269,100 cubic feet per quarter per ccf (per 100 cubic feet)	$3.40	$5.087
For all over 270,000 cubic feet per quarter per ccf (per 100 cubic feet)	$2.372	$3.545

Source: United Water New York 2012

Figure 2: Block water rate for Rockland County

Local Situation & Background

Sharon:
The Town of Sharon, like Rockland, is experiencing population and economic growth. Specifically, the population has grown from about 16,000 to 18,000 since 1990. Economically, the median household income of Sharon grew from $74,648 in 2000 to $94,985 in 2009, and was in 2009 ranked by CNN as the 11th best place to live in the US.[42]

In terms of its decision-making body, Sharon has a 9-person volunteer water committee called the Water Management Advisory Committee (WMAC), which makes recommendations. Sharon also has a paid Superintendent of the Sharon Water Department and 3 elected Selectmen. The Selectmen serve as Water Commissioners and make the major decisions.

Water Situation:
Firstly, Sharon has limited water resources, both in terms of quantity and quality. Like Rockland, Sharon also uses wells. Specifically, 75% the residential water use comes from groundwater through water/well pumping. There are six town wells in Sharon. Two of the six wells have inferior water quality. According to Paul Lauenstein, member of the Sharon Water Committee, "one of the wells has tint brown water with iron that stains

[42] "Sharon, Massachusetts," accessed November 6, 2012, http://www.city-data.com/city/Sharon-Massachusetts.html

laundry and is only used in the summer when water use spikes up as irrigation system use increases."[43] With these limitations in quantity and quality when water is in high demand, the 2 inferior wells must be used and water quality is compromised. A new well has been proposed at Sharon, but that is years away.

Compared to the new well, alternative sources of water are more expensive. Expensive water can be brought in from Massachusetts Water Authority. It would cost $6 million to set up the pipe, and $2.70 / 1k gal for use. This is about four times more expensive than the $0.70/ 1k gal from the Sharon wells. Thus, the water conservation program within Sharon is cheaper than importing water.

Implementation

In terms of enforcement, the Sharon Water Department periodically looks for violators. Specifically, 5 members are selected from the Water Department to survey the town for violators on 1 random day of the week for about 3-4 hours. Eric Hooper, Superintendent of the Sharon Department of Public Works states, "The surveying is usually done 2 hours after the residents are not supposed to be watering."[44] Beyond enforcement by the department, residents themselves report on each other regarding violations. According to Superintendent Eric Hooper, this is in fact the most important source to catch violators.

In terms of education, to decrease irrigation and outdoor water use, residents of Sharon are encouraged to use less water through education. For example, the Water Committee has voted for water bill inserts in all of the water bills to recommend reductions in water use. Later inserts frequently showed waterless lawns (See Figure 3).

Finally, Sharon implements monetary incentives to encourage water use reductions in irrigation. The town of Sharon provides subsidy on drought tolerant fescue grass seeds, and rebates for WaterSense irrigation auditors to encourage efficient irrigation water use.

[43] Paul Lauenstein, Sharon Water Committee member, Interviewed October 14, 2012.
[44] Eric Hooper, Superintendent of the Sharon Department of Public Works, Interviewed November 22, 2012.

Are you a heavy water user?

To find out how your water use compares to the suggested maximum of 65 gallons per person per day, see the handy lookup chart opposite.

If you use over 100,000 gallons per year, you should get a free water audit from Energy New England, courtesy of the Sharon Water Department. They will provide you with a customized analysis that will highlight the most cost-effective strategies for conserving water in your home. To schedule a free water audit for your home, call the Sharon Water Department at 781/784-1525.

Please do your part to help our community use water efficiently.

Sharon has a long and proud history of protecting and preserving our drinking water aquifers as well as the natural beauty of our town. Read about the sensible lawn care practices, and efficient toilets and clothes washers described in this pamphlet. Let's use our municipal well water efficiently. It will save money, improve our local ecosystem, and maintain our water independence.

Water Management Advisory Committee
Sharon Water Department
781/784-1525

Sharon Water Conservation Program

EPA WaterSense

Is your water use under 65 GPCD?

Gallons Per Capita Daily (GPCD)

Gallons used in 6 months (for annual gpcd, average your last 2 water bills)

	NO. OF HOUSEHOLD OCCUPANTS							
	1	2	3	4	5	6	7	8
4,000	22	11	7	5	4	4	3	3
6,000	33	16	11	8	7	5	5	4
8,000	44	22	15	11	9	7	6	5
10,000	55	27	18	14	11	9	8	7
12,000	66	33	22	16	13	11	9	8
14,000	77	38	26	19	15	13	11	10
16,000	88	44	29	22	18	15	13	11
18,000	99	49	33	25	20	16	14	12
20,000	110	55	37	27	22	18	16	14
22,000	121	60	40	30	24	20	17	15
24,000	132	66	44	33	26	22	18	16
26,000	142	71	47	36	28	24	20	18
28,000	153	77	51	38	31	26	22	19
30,000	164	82	55	41	33	27	23	21
32,000	175	88	58	44	35	29	25	22
34,000	186	93	62	47	37	31	27	23
36,000	197	99	66	49	39	33	28	25
38,000	208	104	69	52	42	35	30	26
40,000	219	110	73	55	44	37	31	27
42,000	230	115	77	58	46	38	33	29
44,000	241	121	80	60	48	40	34	30
46,000	252	126	84	63	50	42	36	32
48,000	263	132	88	66	53	44	38	33
50,000	274	137	91	68	55	46	39	34
52,000	285	142	95	71	57	47	41	36
54,000	296	148	99	74	59	49	42	37
56,000	307	153	102	77	61	51	44	38
58,000	318	159	106	79	64	53	45	40
60,000	329	164	110	82	66	55	47	41
62,000	340	170	113	85	68	57	49	42
64,000	351	175	117	88	70	58	50	44
66,000	362	181	121	90	72	60	52	45
68,000	373	186	124	93	75	62	53	47
70,000	384	192	128	96	77	64	55	48
72,000	395	197	132	99	79	66	56	49
75,000	411	205	137	103	82	68	59	51
80,000	438	219	146	110	88	73	63	55
85,000	466	233	155	116	93	78	67	58
90,000	493	247	164	123	99	82	70	62
95,000	521	260	174	130	104	87	74	65
100,000	548	274	183	137	110	91	78	68

Secrets of a Waterless Lawn

Figure 3: Water bill[45]

Results

In terms of water demand and cost reduction, the ordinance has been successful. At Sharon, population has increased 7% since 1995, while water use has decreased ~100 million gal/year (about 20%). There was a moderate drought in 2007, but overall water demand remained low, suggesting the effectiveness of the ordinance.[46] (See Figure 4) Furthermore, Sharon is saving about $70k/year in energy and treatment chemicals combined for water conservation.

[45] "Secrets of a Waterless Lawn," accessed October 10, 2012, http://www.sharonfoc.org/interest/lawntips.pdf

[46] "Sharon's Water Resources," Sharon FOC, accessed October 22, 2012, http://www.sharonfoc.org/water/water_2011.pdf

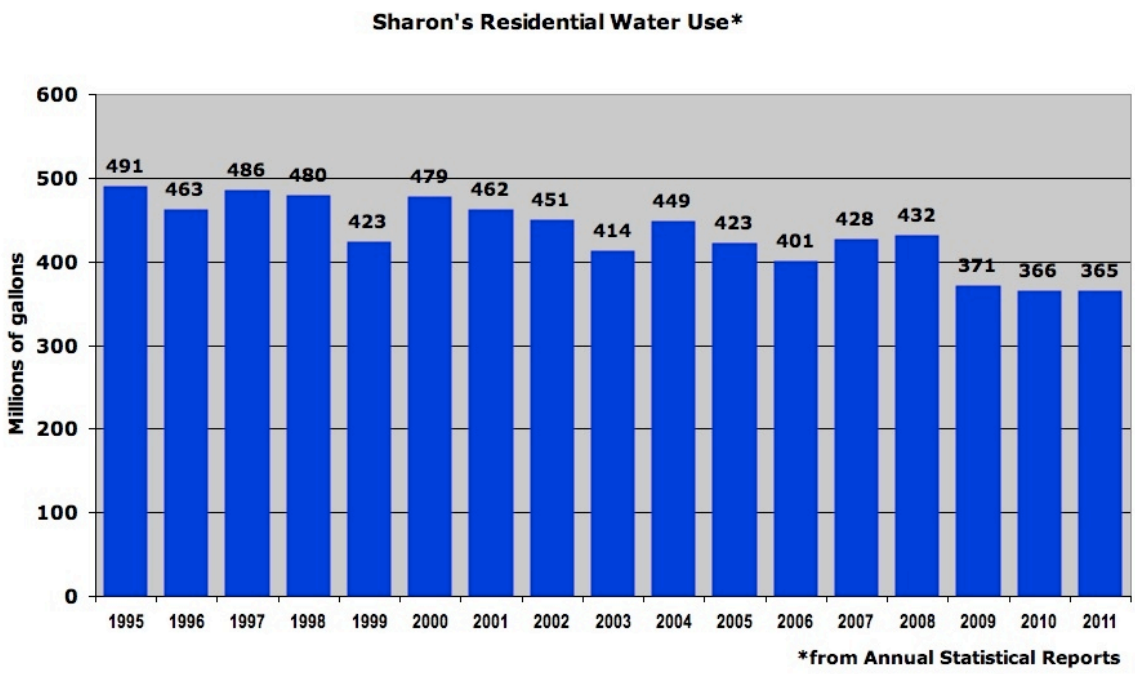


Figure 4

Enforcement of the ordinance however, may not be effective. The Water Department catches about 10-20 people a year—12 on average—for water use violations. As mentioned by Paul Lauenstein, member of the Water Committee, "People don't like being caught and the Water Department hates to do it."[47] In fact, to avoid being caught, some residents use water illegally at night (ex. Between 2-4am).

Public reaction is particularly negative toward the block water rate. While the block water rate is self-enforcing and is considered effective by some members of the Water Committee, it is widely unpopular among the public. The wealthy residents who typically consume more water are pushing for a single rate system. Regarding large families (6+ people), although the families are not paying particularly high rates (see Figure 5), large families see their higher block water rate as unfair. Almost half of the households with 6+ people pay at the highest rate block. (See Figures 6 and 7) The negative public reaction is evident in the lack of support for the petition to preserve the block water rate—only about 300 signatures are collected so far out of about 11,000 voters.

[47] Paul Lauenstein, Sharon Water Committee member, Interviewed October 14, 2012.

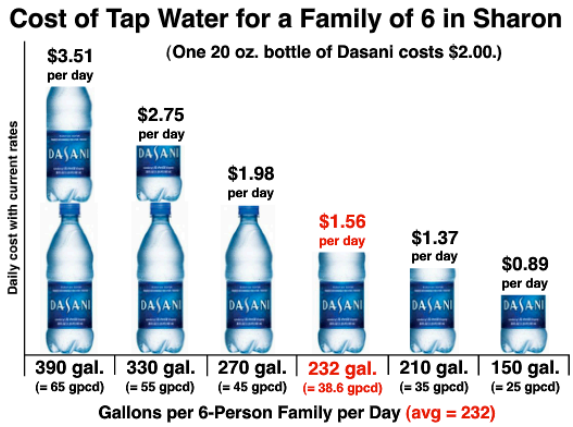


Figure 5: Water cost for large families[48]

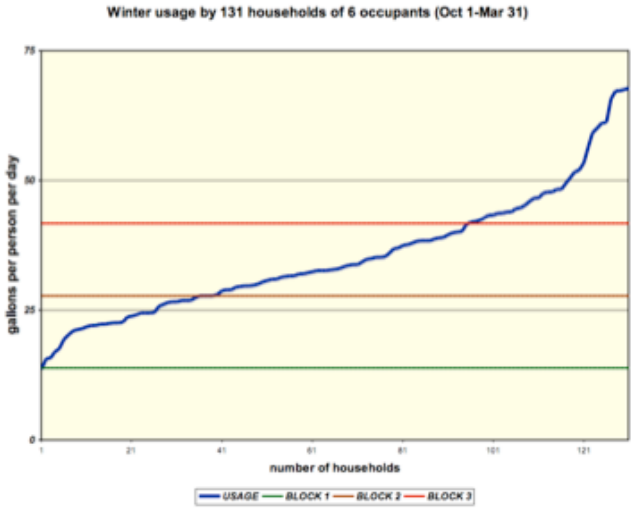


Figure 6: Winter water use (large households with 6 people) [49]

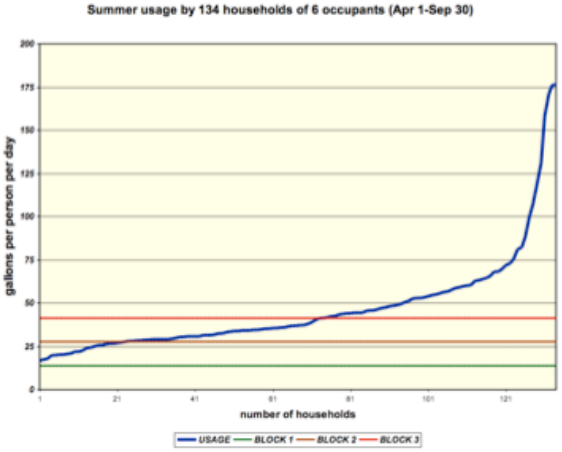


Figure 7: Summer water use (large households with 6 people)[50]

[48] "Conservation Water Rates," accessed November 20, 2012, http://sharon.patch.com/articles/letter-to-the-editor-conservation-water-rates

[49] Paul Lauenstein, Sharon Water Committee member, Interviewed October 14, 2012.

[50] Paul Lauenstein, Sharon Water Committee member, Interviewed October 14, 2012.

Lessons for Rockland County:

The town of Sharon and Rockland are similar in their growing population and economy, as well as in their implementation of the block rate water system. Therefore, Sharon's water ordinance and its impact are useful in forecasting the impacts and challenges that Rockland may experience if outdoor non-emergency water ordinance is put in place. Based on Sharon's experience, relevant lessons for Rockland County include:

Curbing water demand is possible even with growing population and economy: Despite growing population and economy like Rockland, the Township of Sharon is decreasing its water demand with an increasing population, while Rockland—without a non-emergency water ordinance—is seeing water demand that may surpass supply.

Education may be an effective enforcement tool: At Sharon, educational materials are spread through water bills. Information such as insights into the waterless lawn help to ease public complaint regarding water restrictions.
Use of odd/even watering restrictions: This is particularly useful at Sharon. As mentioned by superintendent Eric Hooper, "most violators of the outdoor watering restrictions are caught by their neighbors."[51] This is only possible with odd/even watering restrictions: as one household is allowed to water, the household knows that its neighbors are under restriction, and therefore can easily observe its neighbors' violations.

Forming partnerships with local leaders may be crucial: Sharon's block water rate's failure to compromise with the wealthy local leaders has resulted in its lack of popularity in the Township. As a result, the block water rate will likely be substituted by a single rate at Sharon by the end of 2012, despite being effective in curbing demand.

Works Cited

"Board of Health Department or the Department in accordance with M.G.L. c.111, § 122A and 160 or 310 CMR 22.00," accessed November 20, 2012, http://www.mass.gov/dep/service/regulations/310cmr15.pdf

"Conservation Water Rates," accessed November 20, 2012, http://sharon.patch.com/articles/letter-to-the-editor-conservation-water-rates

Eric Hooper, Superintendent of the Sharon Department of Public Works, Interviewed November 22, 2012.

Paul Lauenstein, Sharon Water Committee member, Interviewed October 14, 2012.

"Secrets of a Waterless Lawn," accessed October 10, 2012, http://www.sharonfoc.org/interest/lawntips.pdf

"Sharon, Massachusetts," accessed November 6, 2012, http://www.city-data.com/city/Sharon-Massachusetts.html

"Sharon's Conservation-oriented Water Rates," accessed October 21, 2012, http://www.sharonfoc.org/interest/water_rates.html

"Sharon's Water Resources," Sharon FOC, accessed October 22, 2012, http://www.sharonfoc.org/water/water_2011.pdf

"Town of Sharon, Massachusetts Zoning By-Laws as Amended through November, 2011," Town Meeting Articles, accessed October 22, 2012, http://www.townofsharon.net/public_documents/SharonMA_WebDocs/ByLaws/PBZoningBy-Laws.pdf

"Town of Sharon," accessed October 22, 2012, http://www.townofsharon.net/Public_Documents/index

"Water Department Rebates," accessed October 20, 2012, http://www.townofsharon.net/Public_Documents/SharonMA_WebDocs/DPW/irrigation%20rebates/

"Water Division Rules and Regulations," Town of Sharon Public Works Department, accessed October 21, 2012, http://www.townofsharon.net/Public_Documents/SharonMA_DPW/WaterRegs_June_2012.pdf

Type of Ordinance Reviewed

Cary's Water Conservation and Demand Management program established conservation as a tenet of municipal water policy in 1996. Subsequently, the Town Council passed three regulatory measures between 1997 and 2000, approving all ordinances based upon Staff reports (Cefalo 2012). Staff reports outlining water ordinances were approved first by the Operations Committee and then forwarded to the Town Council for passage. Three ordinances were spearheaded in March 1997 when Cary adopted a policy statement to reduce per capita municipal water consumption 20% by 2015, a goal that is on track to be met. However, total water demand continues to increase along with the town's growing population. All ordinances apply to residential and non-residential customers, with incremental fines following an initial warning:

Water Waste Ordinance:
The watering of impervious (concrete, blacktop, etc.) surfaces and the oversaturation of soil is prohibited year round. Repeat violators are fined $100 for the first offense, $200 for the second, $300 for the third, and $400 for the fourth and each thereafter. The negligent treatment of major leaks that deliver water inefficiently via hoses, pumps, etc. is also punishable by a fine. (Sec. 36-83)

Rain Sensor Ordinance:
Passed August 1997, residential and non-residential owners of automatic irrigation systems are required to install a .25" rain sensor to measure saturation beneath the soil in order to prevent wasteful use of municipal water during rain periods. As a retroactive measure, irrigation systems installed prior to August '97 must also be updated with a sensor. Violators are incrementally penalized after an initial warning; residential violators pay up to $1,000 for their fourth infraction and non-residential $2,5000.

Alternate Day Watering Ordinance:
Reduces stress on daily supply by allowing customers to irrigate on a schedule determined by their address and the day of the week.
Residential & Non-Residential Customers:

- Odd addresses can irrigate on Tuesday, Thursday and Saturday
- Even addresses can irrigate on Wednesday, Friday and Sunday
- Drip irrigation and watering, if utilized by hand, is always permitted. The customer must be in attendance and physically watering by hand.
- Mondays – automatic watering systems are prohibited for all addresses

Exceptions:

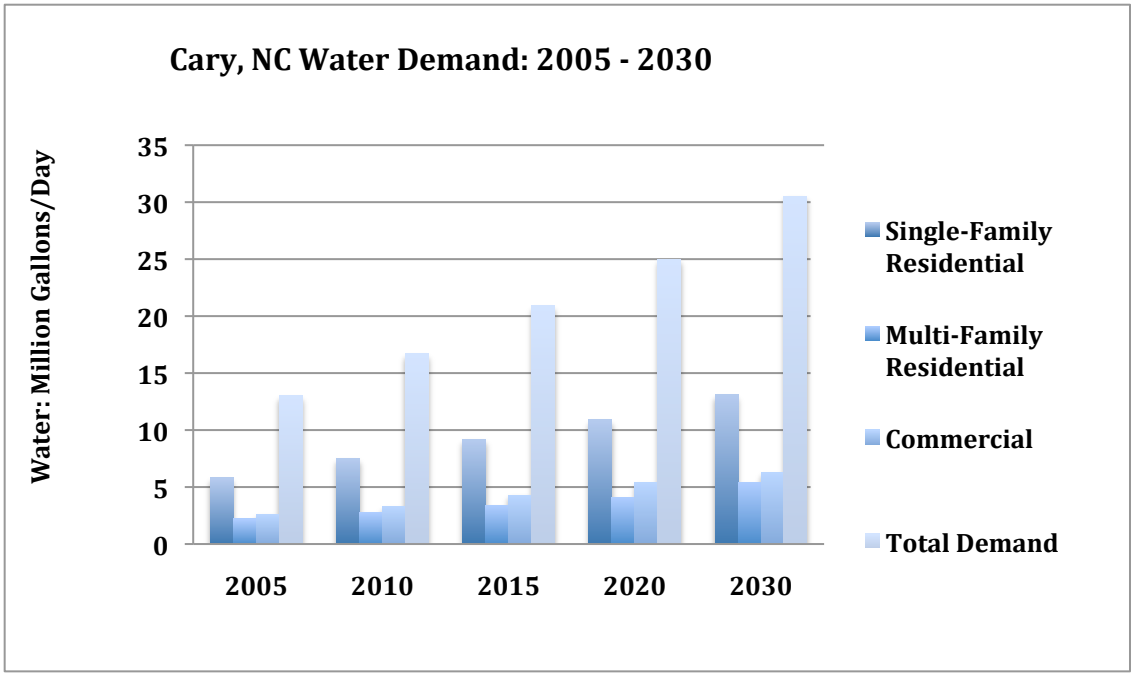
- The washing of personal property, such as cars, is permitted any day of the week
- A 45 day grace period for the nurturing of newly planted grass and seasonal reseeding is permitted with registration
- Unrestricted use of private well water and ponds (Sec. 36-80)

Local Situation & Background

Cary, NC Background - Cary, an affluent suburb of Raleigh, is located partly in both Wake and Chatham counties and is home to a growing number of out of state migrants, who make up the majority of the population. During 2000-2011 the town increased from 95,000 to 142,000 residents. Cary is an incorporated town with similar legal status to a city; its voters elect a Manager and Town Council members with legislative powers.

Water Constraints:
Water scarcity has become a primary concern for the local government, who manages the municipal supply and passed ordinances to affect consumption by regulating lawn watering and irrigation. The Town of Cary also expanded its water treatment facility to increase supply and is seeking an additional allotment of water from B. Everett Jordan Lake in the Cape Fear River Basin. Cary's sole water resource is Jordan Lake; the Town is permitted to process 24 million gallons per day (mgd). Water demand is projected to reach 26.7 mgd in 2028, a 300% increase from 8.6 mgd in 1998 when local conservation began.

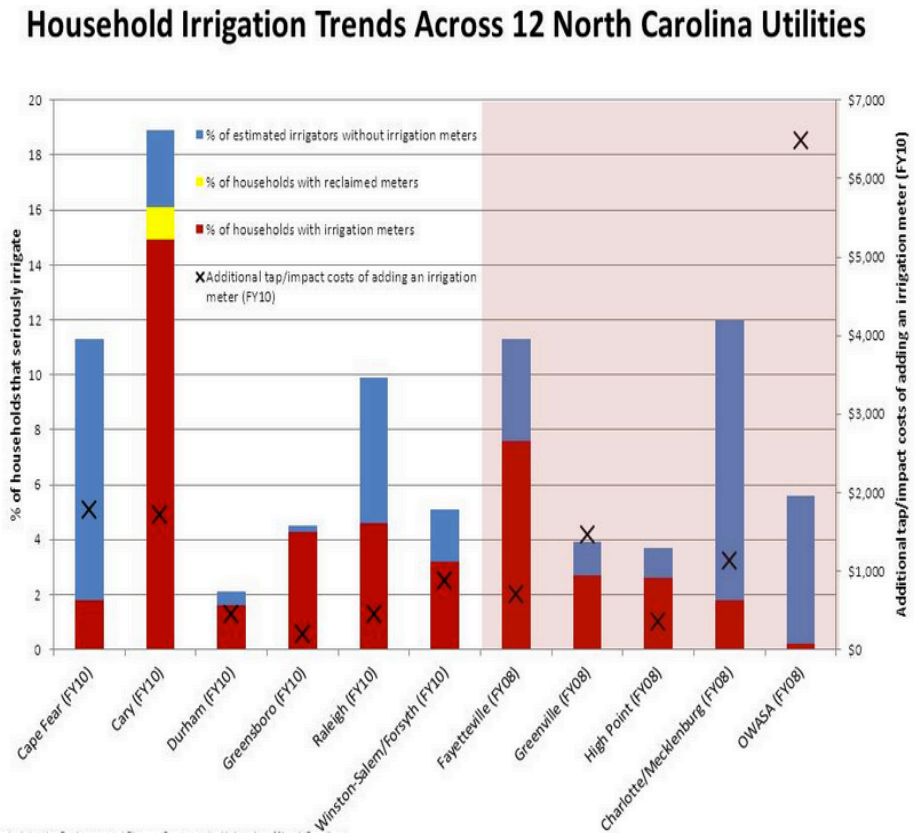
Figure 1:



Source: Marie Cefalo, Town of Cary Water Conservation Coordinator)

Chatham County:
Cary is a regional leader in water conservation, spurring similar measures in neighboring municipalities. Chatham County adopted year round water ordinances on February 7, 2008. The ordinances are the same as Cary's (Waste Water, Rain Sensor, Alternate Day) and apply to all municipalities within Chatham County.

Figure 2:



(Source: Environmental Finance Center; http://efc.web.unc.edu/)

The yellow portion in Figure 2 indicates the contrast of Cary's reclaimed water infrastructure in relation to its neighbors. Cary treats and reuses approximately 5 million gallons of water per day and became the first to supply reclaimed water in North Carolina. This effort reduced discharge into rivers and tributaries and provides water for commercial uses such as manufacturing.

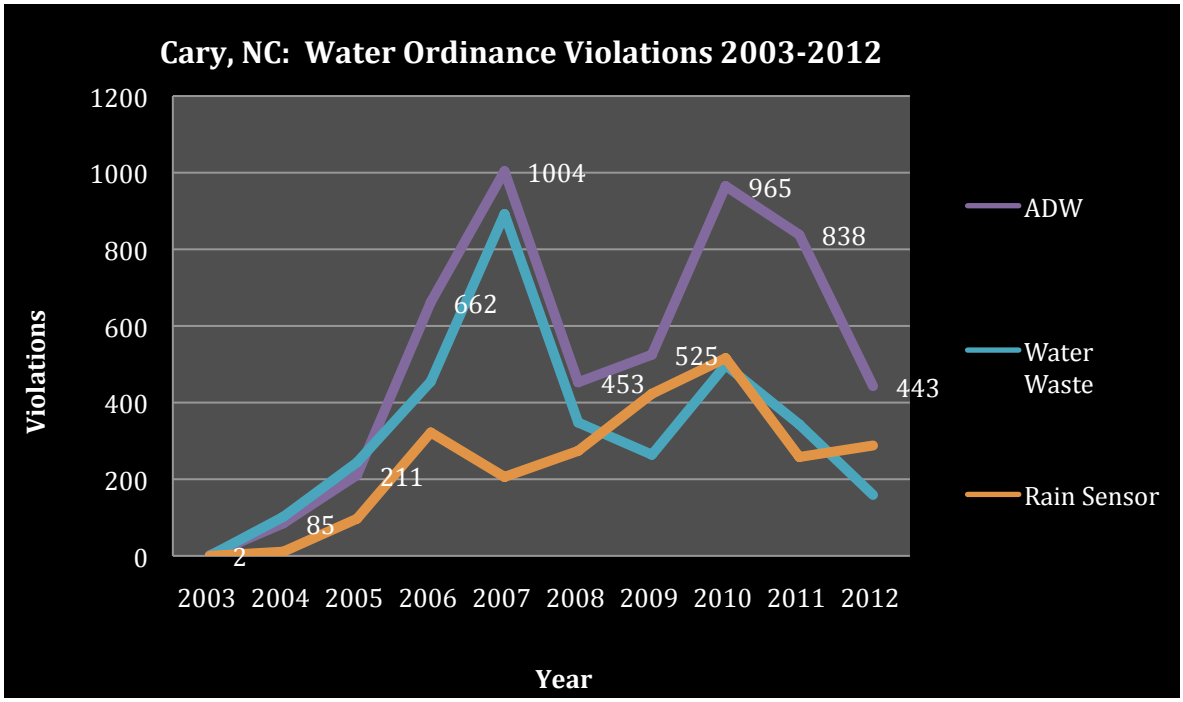
Implementation

Enforcement: The Town of Cary recently installed an Automated Meter Infrastructure (AMI) system; Town Council members are considering options regarding the use of daily meter data to aid enforcement with an anticipated policy decision by April 2013 (Cefalo 2012).

Currently, Two "Education Field Staff" patrol and enforce water ordinances during the early mornings (approximately 5 am – 8 am) of the irrigation season (April – October) weekdays. During drought episodes temporary 24-7 coverage is implemented. The focus

of the enforcement staff is education; however, repeated violations can result in fines. Two warnings are given through a Notice of Violation door hanger (residents) or letter (commercial customers) before a fine is considered.

Figure 3:



(Source: Marie Cefalo, Town of Cary Water Conservation Coordinator)

Adherence to Cary's water ordinances by the customers is considered to be strong. However, violators are only caught when the field officers are on patrol; during emergencies (drought episodes) officers patrol 24-7. The spike in violations during the last two major droughts is displayed in Figure 3, indicated by the increased violations.

Program Cost and Funding:

The Water Conservation Program budget includes an annual $185,000 for salaries for five administrative employees, and an annual $16,500 for supplies and associated equipment and indirect costs (AWWA, 2009). During a water shortage, employee overtime costs and potential temporary staff for added enforcement is factored into the budget.

Results

Water conservation and demand management programs began with all three components (regulatory, incentive, and educational), and Cary has not been able to conclusively determine the effect of the ordinances alone. An estimated 80% of residential customers

and 99% of commercial businesses comply with the rain sensor ordinance (Cefalo and Goodwin 2010). The amount of municipal water consumption has remained steady in spite of Cary's recent annual population growth rate of 5%.
The daily residential water consumption has reduced from 75 gallons/person to less than 60 gallons/person over the past 16 years. However, the total consumption continues to rise with the population (Cefalo 2012).

Cary delayed the expansion of two water-processing plants, but is constructing a reclamation plant, that will produce up to 1.58 million gallons/day to increase supply by 8% during peak usage. Reclaimed water will primarily be used for irrigation and is incentivized with a reduced rate for bulk purchases. According to EPA estimates, water conservation in Cary will reduce consumption by 4.6 mgd (16 percent) by the end of 2028.

With Cary's projected water demand growing from 50% of supply in 2010 to 78% in 2030, Jordan Lake will be strained to function as the primary source of water for Cary and the surrounding municipalities (EPA 2010). If the Automated Meter Infrastructure is utilized, adherence to water ordinances may increase significantly.

Lessons For Rockland County:

As a public utility, water is managed by Cary's Town Council and is easier for the local government to regulate than privately managed water would be. The Water Conservation and Demand Management program implemented by Cary in 1996 was successful in leading to ordinances, as the Town manages the public water supply. Rockland legislators face challenges in regulating water, which is managed by United Water, a public-regulated private entity that operates for an economic profit. Cary's ordinances were passed directly after enacting the demand management initiative.

Residential lawn irrigation accounts for 40% of Cary's total water demand on average each year, and is a great starting point for conservation. While indoor water usage is significant (dishwashing, bathroom usage etc.), outdoor usage is more easily regulated. Cooperation from local residents in Cary has been strong, however, Town officers regularly patrol to ensure compliance, especially during drought episodes. Compliance with the rain sensor ordinance is approximately 80% for residential customers and 99% for commercial (EPA 2010). Rain sensors conserve water by automatically turning off the water source during rain.

Cary's water ordinances were implemented in symphony with conservation education programs at the community level; residents are generally conservation-minded as a result. Elementary education programs at the 2nd and 3rd grade levels administered by Town representatives reach approximately 300 students a year (Cefalo and Goodwin 2010). "Block Leaders" are community volunteers that oversee conservation efforts at the neighborhood level, and reach approximately 5,000 residents/year. Direct mail outreach informs 32,000 customers/year (Cefalo and Goodwin 2010).

Enforcement of the water ordinances depends on the number of field officers and the hours they patrol; automated meters may increase the number of violations and/or decrease consumption. Over 1,000 tickets were issued to customers during the 2007 drought, when increased patrolling took effect (Cefalo 2012). Cary employs two fulltime officers that patrol for water ordinance compliance. A newly installed "automated meter infrastructure" (AMI) system in 2012 measures the water usage of every customer, although the frequency of monitoring has not been decided upon. Cary's legislators are now discussing policy regarding the implementation of AMI to enforce water conservation, which would reduce the need for officers and will accurately detect wasteful usage.

Works Cited

American Water Works Association (2009). *Case Study: Town of Cary Department of Public Works and Utilities*, *Water Conservation Program, 2009*

Cary North Carolina Water Conservation Ordinances. *Available From: http://www.amlegal.com/pdffiles/Cary_pdf/code_CH36.pdf*

Chatham County, North Carolina Water Ordinance: Year Round Water Conservation Ordinance; Adopted February 7, 2008. *Available From: www.chathamnc.org/index.aspx?page=846*

Cefalo, Marie and Goodwin, Leila (2010). *Water Shortage Response Plan*, Town of Cary, North Carolina; Adopted June, 10 2009

United States Environmental Protection Agency (2002). *Cases in Water Conservation: How Efficiency Programs Help Water Utilities Save Water and Avoid Costs*: Cary, North Carolina; Pages 10-14, 2002

Town of Chapel Hill, North Carolina

Type of Ordinance Reviewed

The Orange Water and Sewer Authority (OWASA) is a pubic non-profit organization that manages the water supply of Carrboro and Chapel Hill, North Carolina. With support of the state Governor, OWASA was established in 1977 under the Water and Sewer Authorities Act, of the General Statutes of the State of North Carolina.[#] OWASA proceeded to consolidate the separate privately owned water companies in Carrboro and Chapel Hill. OWASA is a special purpose local government as determined by state law, and is separate from municipal and county governments. The appointed Board of Directors makes OWASA policy decisions.

Following a record drought in 2001-2002, non-emergency outdoor and indoor water conservation ordinances were enacted.[#] The ordinance proposed by OWASA received strong support from local governments and the public. A public forum was held in the fall of 2002 to incorporate the input of local residents for use in developing the new conservation standards. OWASA proposed standards that were adopted by the governing boards of the Towns of Chapel Hill and Carrboro and Orange County in the form of ordinances after discussions with OWASA and following a public process.

Exterior Use Water Ordinances (Sec. 23-64):

The alternate day water ordinance schedules when OWASA customers can irrigate their lawns. Lawn watering is permitted between 6:00 p.m. and 10:00 a.m. every other day according to address: Even numbered addresses on Sundays, Wednesdays, and Fridays, and odd numbered addresses on Tuesdays, Thursdays, and Saturdays.
All customers are limited to one inch of water for lawn irrigation per week. Rain sensors and shutoff nozzles must be installed on all irrigation systems. Outdoor water leaks have a 10-day grace period, after which leaks must be repaired in order to prevent waste. All hoses used for outside purposes must be equipped with a shutoff nozzle.

Exemptions: Customers using underground drip irrigation and hand watering mechanisms are exempt from the alternate day ordinance.

Residential and non-residential violators are given an initial notice followed by incremental fines; water service can be discontinued after fifth violation.

Local Situation & Background

Chapel Hill, NC Background – Chapel Hill is located within Orange and Durham counties in North Carolina, and is home to the University of North Carolina Chapel Hill. Population growth is considered manageable for the city today, but its population more than doubled from 1970-2012, growing to over 57,000 residents today. Extreme droughts in 2002-2003 and 2007-2008 tested the resiliency and effectiveness of conservation efforts. The current OWASA supply can provide 10.5 million gallons of water per day

(mgd). This is in addition to a 20% reserve rate for emergency drought situations (OWASA Long-term Plan 2010). The impact of the 2007-2008 drought was lessened with the supply of reserved water. OWASA supplies water from Jordan Lake, Cane Creek, University Lake, and Quarry Reservoir.

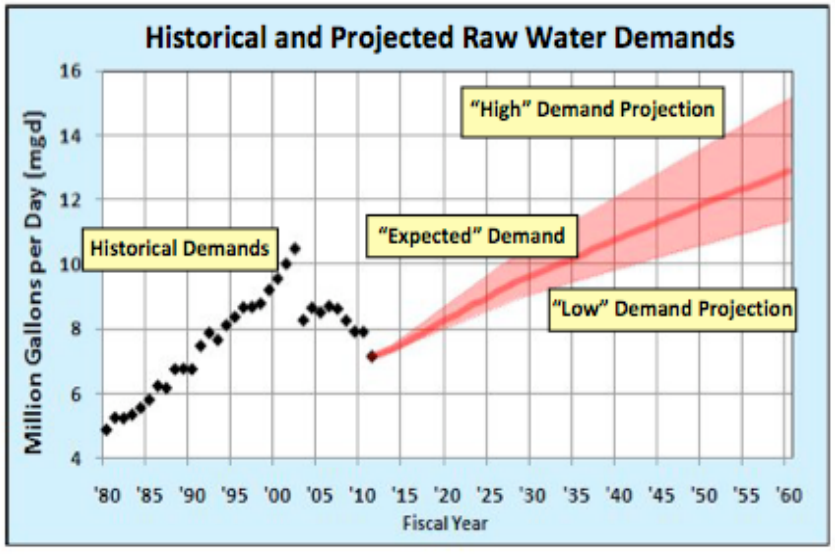
Implementation

Enforcement:
According to OWASA, enforcement is almost entirely implemented by contacting customers to make sure they are aware of the requirements and ask for compliance. There have been only two instances since 2003 when a police officer issued citations (Davis 2012). During normal work hours, employees watch for violations of the water use restrictions.

Results

A 30% reduction in total water demand from all OWASA customers since 2002 has been achieved (Davis 2012). OWASA does not have a way to assess the effectiveness of the ordinance or parts of it because of the 30% drop in demand since 2002 reflects factors including adoption of conservation water rates in 2002 (revised in 2007), rate increases and the community's very strong conservation values (Davis 2012). With this progress, OWASA calculates that Cane Creek, University Lake, and Quarry Reservoir will meet the required water through 2060. Still, OWASA is seeking to increase its available supply as a precautionary measure. In 2009, the surrounding municipalities of Jordan Lake created the Jordan Lake Regional Water Supply Partnership with the goal to scale up water allocation. OWASA is seeking to gain access to an additional 5 mgd of water through this partnership (OWASA Long-term Supply Plan 2010).

Figure 1. 50-Year Raw Water Demand Projections



(Source: OWASA Long-Term Water Supply Plan 2010)
Figure 1 demonstrates the OWASA's demand reduction following the enactment of conservation ordinances in 2002. The 30% reduction, if sustained, will secure the allotted

supply of 10.5 mgd through the year 2035 even in drought conditions (OWASA Long-term Plan 2010). However, OWASA is concerned that population growth and the risk of increased droughts may threaten the water supply past 2035. For this reason, OWASA is attempting to access 5 mgd additional water from Jordan Lake.

Lessons For Rockland County:

The Orange Water and Sewer Authority is a special purpose local government, which legally consolidated the various private water companies that existed prior to 1977. OWASA can directly manage and regulate water utilities in Carrboro and Chapel Hill under legal provisions, which were originally backed by North Carolina's Governor at the time. Rockland County may face challenges in regulating water usage, as water is public-private entity managed by United Water.

Indoor and outdoor nonemergency ordinances were enacted in unison; a calculated 30% reduction of total demand since 2002 has resulted. Water use restrictions on businesses have been successful in contributing to water demand reduction. For example, restaurants may only serve water to customers upon request and hotels are permitted to wash bedding for customers staying more than one night after receiving a request by the customer. However, exact demand reduction from the indoor ordinances has not been measured in Chapel Hill.

Public forums were held to involve communities in drafting ideas and methods for ordinances. Ownership is shared between OWASA and the local people as a result from the inclusivity of the process. The public forum held in the fall of 2002 had a strong turnout and followed the drought of 2001-2002. Water conservation became a concern not only for the local government, but for the residents as well (Davis 2012). Rockland County may consider engaging the public through similar forums.

On the ground enforcement has been lax, with only a few violations handed out by officers. Public awareness is key to the success in water demand reduction. OWASA employees cold call their customers on a monthly basis to offer reminders, resulting in strong compliance on the community level. According to Patrick Davis, Sustainability Manager at OWASA, only 2 fines have been issued for violations since 2003.

Works Cited

Town of Chapel Hill, North Carolina ARTICLE IV. WATER CONSERVATION STANDARDS AND REGULATIONS: http://townhall.townofchapelhill.org/agendas/2009/06/08/4c/4c-2009-06-08_o2.pdf

Orange Water and Sewer Authority Water Shortage Response Plan; November, 11 2010. Available from: www.owasa.org/client_resources/whatwedo/updated%20-%20owasa%20wsrp%2011%2011%2010%20approved%20final.pdf http://www.owasa.org/client_resources/whatwedo/updated - owasa wsrp 11 11

10 approved final.pdf

Orange Water and Sewer Authority Water Long Range Water Supply Plan; April 8, 2010. Available from: http://www.owasa.org/client_resources/whatwedo/lrwsp final report revised 042012 final.pdf

Tampa Bay, Florida

Landscape and Watering Ordinances

In May of 2001, following a severe drought emergency order of late 2000, Tampa Bay and its member governments sought to develop a model ordinance "to ensure efficient water use by establishing minimum standards for landscape and irrigation design, recognizing the Tampa Bay Watersheds' climate, soils, water resources, land use, and resource planning."[52] For this case study we conducted interviews with Mr. David Bracciano who is the Demand Management Coordinator for Tampa Bay Water as well as Mr. Christopher Dewey, who acts as a Landscape Program Coordinator for Pasco County (though he is paid by SWFWMD).

Individual counties have enacted their own versions of the ordinance along with watering restrictions specific to each locale. This report focuses on Pasco County. The key points of the ordinance are summarized below:

Applicability: Applicable to all new construction with irrigated landscape and turf areas (not existing developments)

Irrigation:

- Irrigation design and installation procedures are based on the Florida Irrigation Society (FIS) standards.
- The key restriction is that *only 50%* of the green space can use irrigation techniques other than micro-irrigation.
- Must also avoid overspray and runoff as well as have an automatic irrigation control and rain sensors installed.

Landscape:

- Landscape must utilize the concepts Xeriscape™.
- Related to the irrigation restriction, a maximum of 50% of greenspace can be planted with turfgrass (if configured with a permanent irrigation system).
- Identifications of all existing vegetation to be preserved, proposed turf, and other landscape areas necessary.

Maintenance & Management: System shall be maintained and managed to ensure water efficiency and prevent wasteful practices

Local Situation & Background

In the Tampa Bay area, there are three principal layers of government concerning water resources. At the highest level is the Southwest Florida Water Management District (SWFWMD), a regional agency mandated by state law to protect and preserve water resources. They are principally concerned with water supply and water quality, and their

[52] United States. Tampa Bay, Florida. Tampa Bay Water County. *Model Water Efficient Irrigation and Landscape Ordinance*. N.p.: Tampa Bay, Florida, 2001. Print.

funding comes from property taxes, state and federal funding. Under this, is Tampa Bay Water (TBW). TBW is Florida's largest wholesale water supplier and distributes water to member government utilities in a tri-county region in west-central Florida. It currently functions as a water wholesaler, selling water to the member governments who in turn sell to their own local retail customer base. TBW's principal responsibility is to coordinate and plan conservation efforts, specifically targeting the retail utility level. The third level of government lies at the county level and though they are mandated by the SWFMD to follow certain restrictions, they can, and sometimes do, enact more stringent restrictions.

In March of 2000, the Tampa Bay area entered into a prolonged and exceptional drought (NOAA designation). To give an example, following low water levels in the Hillsborough river reservoir during 2000, the City of Tampa Bay area purchased an annual quantity of 17.1 mgd from TBW, well above the 5 mgd anticipated. This occurred despite the water restrictions enacted by member governments in March of 2000.

Drought conditions continued through the spring of 2001 and after intense demands from various member governments, TBW exceeded its permitted withdrawal quantity.[53] This led to the declaration of a water shortage emergency by the SWFWMD. During this water shortage, a few mandates were passed, including the requirement of an ordinance for drought tolerant landscapes and efficient landscape irrigation for new developments.

Dave Bracciano commented that even in the initial period the focus was principally on single family residential.[54] This focus was further affirmed by the fact that despite water restrictions limiting irrigation to one day per week in communities, 25-30% of all potable water in the region was estimated to be for landscape irrigation use (specifically lawns). Additionally, after completing a survey in September of 2001, TBW concluded that approximately 70% of all single-family homes have automatic in-ground irrigation systems with around 30% of waste due to inefficient irrigation systems.[55]

Implementation

In May of 2001, TBW worked with its member governments to form a subcommittee and began the process of developing a model ordinance. The subcommittee was made up of representatives from the six member governments of Tampa Bay Water, the Southwest Florida Water Management District (SWFWMD), and conservation, irrigation and home development groups. Government staff primarily helped with local ordinance

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[53] United States. Tampa Bay Water. *Model Landscape Ordinance Development: From Start to Implementation*. By Kit Alexander, Dave Bracciano, and Mary Margaret Hull Tampa Bay Water: City of Tampa. Print.
[54] Bracciano, Dave. "East Coast Case Study: Tampa Bay." Telephone interview. 20 Nov. 2012.
[55]HAZEN AND SAWYER, P.C. *Evaluating Implementation of Multiple Irrigation and Landscape Ordinances in the Tampa Bay Region*. Rep. Tampa Bay: Hazen and Sawyer: Environmental Engineers and Scientists, 2005. Print

development and the other organizations, such as the Florida Irrigation Society (FIS), aided in establishing the more technical aspects of the model ordinance.[56]

There were issues that the subcommittee struggled to solve during development. The first was plant species requirements, which presented problems due to the complexities associated with enforcement (i.e. categorizing plants for homeowners/contractors and training inspectors to enforce the restrictions). In the end, the member governments were left to decide on this issue. The second major issue revolved around the percentage of turf grass to green-scape that would be mandated. The original recommendation was a ratio of 30:70 of irrigated turf/irrigated green space. However, following some debate and analysis by the Florida Irrigation Society, a new 50:50 ratio was agreed upon.

Specifically omitted from the *model* ordinance was the need for certification and specification of drawings. This was decided to allow for "flexibility in enforcement, increase ease of use application, and to help incent applicants (particularly existing renovations) to apply and work through the process" in the different communities which have adopted their own regulations.[57]

Results

Four of the six member governments adopted the majority of the model ordinance (Tampa, St. Petersburg, Pasco County, and Hillsborough County). One other city (New Port Richey) decided against adoption after residential development slowed because of the recession and the other county (Pinellas) adopted a specific landscape/irrigation ordinance that only applies to commercial properties. Enforcement for these communities generally comes through building code enforcement for each government, with assistance being provided from on the local level, from TBW and from SWFWMD.

Prior to adoption, many counties held workshops with their planning commissions, boards of commissioners as well as with affected parties from the irrigation/building industries. Some governments also solicited feedback and put an official revision process in place. Additionally, there was coordination between regulators across counties to ensure ease of implementation and consistency. Some of the key differences include the specific percentage of turf to green space ratio (Hillsborough and St. Petersburg), a less strict enforcement policy (Hillsborough), an explicit and more open revision process (City of Tampa), and in Pasco the requirement that 50% of the landscape be native to Florida plant materials.

In our interview with Mr. Bracciano, we were directed to a retrospective analysis of the landscape ordinances. In April of 2005, Tampa Bay Water contracted an environmental engineering company to produce a report looking at the effectiveness of the ordinances across the Tampa Bay region. Unsurprisingly, the report found that "lack of compliance

[56] Ibid
[57] United States. Tampa Bay Water. *Model Landscape Ordinance Development: From Start to Implementation*. By Kit Alexander, Dave Bracciano, and Mary Margaret Hull Tampa Bay Water: City of Tampa. Print.

was widespread and apparent for such measures as the percentage of turf grass, establishment of separate irrigation zones, use of micro-irrigation, and the uniformity of water application requirements."[58] One of the key reasons for this was that most items regarding the irrigation component are self-regulating. Contractors act on the "honor-code" to fulfill the site plans they initially submit. Mr. Bracciano commented, "the homeowners wanted to do the right thing, but the developers would put in bad irrigation systems" and that "the problem with adoption was that the building code officials weren't equipped, or simply didn't want to enforce the things that were mandated by the code."[59] The report found that on-site inspections were often severely limited to backflow prevention and rain shutoff devices, with more complex evaluations rarely being performed. Mr. Bracciano affirmed this citing the most prevalent form of evaluation being a visual inspection on a pass-fail type basis, with full inspections rarely being performed due to cost.[60]

In Pasco County, Mr. Dewey commented, "nobody really checks" for compliance anymore. He cited that after an initial period in which the builders were not complying, he "started enforcing it on an adhoc basis" and "would take a certain number of certificates of occupancy, go to check and see if they complied and hold the CO" until the issues were resolved. One of the more interesting insights Mr. Dewey provided was the notion that while the intent was to limit the size of the areas of turf grass, what ended up happening was a divided greenspace. In the front yard homeowners would plant traditional St. Augustine grass (requires heavy watering) and utilize a full irrigation system. However in the backyards they began to put in Bahia grass, which survives on rainfall just alone.

Mr. Dewey remarked, "the secondary effect of this has been a market signal in which you're seeing homeowners only wanting to use Bahia grass for both the front and the back yard to save money."[61] While both Mr. Bracciano and Mr. Dewey agreed that the most contentious part of the ordinance was the turf grass requirement, Mr. Bracciano observed developers cheating the system and installing faulty irrigation systems. Based on the report it appeared that Mr. Bracciano's observations were more accurate, however, Mr. Dewey may be signaling a more recent trend. Mr. Dewey also commented that one improvement that could have been made was having a minimum number of square feet of turf grass rather than the 50/50 ratio. He noted, "as you see new developments with smaller lots/denser buildings this would actually work in your favor."[62]

Despite this the report provided some suggestions key suggestions. One key recommendation lied in the notion that measures must be taken to ensure effective enforcement is practiced following construction. The report also recommended that the

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[58]HAZEN AND SAWYER, P.C. *Evaluating Implementation of Multiple Irrigation and Landscape Ordinances in the Tampa Bay Region*. Rep. Tampa Bay: Hazen and Sawyer: Environmental Engineers and Scientists, 2005. Print

[59]Bracciano, Dave. "East Coast Case Study: Tampa Bay." Telephone interview. 20 Nov. 2012.

[60] Ibid

[61]Dewey, Chris. "East Coast Case Study: Tampa Bay." Telephone interview. 19 Oct. 2012.

[62]Ibid

certification process be strengthened, including a more comprehensive inspection that relied on a non-compliance fee in which applicants are charged if they violate requirements. They suggested a more accessible permitting process, and an archive, both to be put on the Internet. Lastly, the report emphasized the need for education for both consumers and contractors: something both Mr. Dewey and Mr. Bracciano affirmed was necessary. The report recommended that Pasco change its requirements for native plants by adding a clause that specified the plants be drought tolerant. Enforcement was also seen as a problem, especially given the fact that Pasco allows drought tolerant turf grass to exceed the 50% limitation only if it is not irrigated by a permanent in-ground system.[63]

Lessons for Rockland County:

Mandating certain landscape requirements: Consistency as well as strength of landscape requirements proved to be a problem in Tampa Bay. However, as Mr. Dewey commented educating landscapers and contractors was the largest hurdle to cross. Mandating consistent landscape requirements across Rockland County will be critical in ensuring widespread compliance.

Enforcement must be outlined prior to implementation: A fundamental problem that Tampa encountered was a lack of compliance. While this in part stemmed from residents attitudes towards water conservation, a larger contributing factor was a lack of enforcement from the governments. Self-regulating ordinances do not work, at least in the initial period following the passage of an ordinance. Related to this issue is the notion of funding. One of the key drivers of the lack of apparent enforcement came from funding concerns. Training inspectors as well as hiring additional personnel can prove costly and needs to be appropriately assessed in Rockland.

Lawn watering can be mitigated by effective incentives: While lawn watering proved to be the most controversial issue in many communities, we saw that homeowners actually reduced their use of grass that utilized heavy watering after they saw the cost savings that were possible in the drought tolerant varieties. By stipulating a specific requirement of how much irrigated turf grass can be used, Rockland may be able to effectively incent residents to reduce their use of water because of specific cost savings.

Works Cited

Bracciano, Dave. "East Coast Case Study: Tampa Bay." Telephone interview. 20 Nov. 2012.

City of St. Petersburg, Florida. "City of St. Petersburg County Watering Restrictions." N.p., n.d. Web. 26 Nov. 2012. <http://www.stpete.org/water/watering_restrictions.asp>.

[63]HAZEN AND SAWYER, P.C. *Evaluating Implementation of Multiple Irrigation and Landscape Ordinances in the Tampa Bay Region*. Rep. Tampa Bay: Hazen and Sawyer: Environmental Engineers and Scientists, 2005. Print

City of Tampa, Florida. "City of Tampa Watering Restrictions." N.p., n.d. Web. 26 Nov. 2012.<http://www.tampagov.net/dept_Water/information_resources/WATER_USE_RESTRICTIONS.ASP>.

City of Tampa, Florida. "City of Tampa Water Related Codes and Ordinances." N.p., n.d. Web. 26 Nov. 2012.<http://www.tampagov.net/dept_Water/information_resources/Water_Related_Codes_and_Ordinances.asp>.

Dewey, Chris. "East Coast Case Study: Tampa Bay." Telephone interview. 19 Oct. 2012.

HAZEN AND SAWYER, P.C. *Evaluating Implementation of Multiple Irrigation and Landscape Ordinances in the Tampa Bay Region*. Rep. Tampa Bay: Hazen and Sawyer: Environmental Engineers and Scientists, 2005. Print

Hillsborough County, Florida. "Hillsborough County Watering Restrictions." N.p., n.d. Web. 26 Nov. 2012. <http://www.hillsboroughcounty.org/index.aspx?nid=1341>.

New Port Richey, Florida. "New Port Richey County Watering Restrictions." N.p., n.d. Web. 26 Nov. 2012. <http://cityofnewportrichey.org/index.aspx?NID=173>.

Pasco County, Florida. "Pasco County Watering Restrictions." N.p., n.d. Web. 26 Nov. 2012. <http://pascocountyfl.net/index.aspx?NID=1369>.

Pinellas County, Florida. "Pinellas County Watering Restrictions." N.p., n.d. Web. 26 Nov. 2012. <http://www.pinellascounty.org/utilities/water-restrict.htm#citywater>.

United States. Tampa Bay Water. *Model Landscape Ordinance Development: From Start to Implementation*. By Kit Alexander, Dave Bracciano, and Mary Margaret Hull Tampa Bay Water: City of Tampa. Print.

United States. Pasco County. Pasco County City Council. *Ordinance 02-04*. Pasco County, 2006. Print.

United States. Tampa Bay, Florida. Tampa Bay Water County. *Model Water Efficient Irrigation and Landscape Ordinance*. N.p.: Tampa Bay, Florida, 2001. Print.

Santa Fe, New Mexico

Type of Ordinance Reviewed

The City Council updated water ordinances in Chapter 25 of the City Code in 2007, which reworked older ordinances from 2003 and 2005. Parts of past ordinances that were successful in saving water were incorporated into the City Code. Santa Fe is in a drought-prone area, and many of the emergency water restrictions from drought periods were incorporated into the City Code as well.

The City Council and State levels of government have also written documents to plan for the reduction of water use, although they are not officially ordinances. These include the long-range water supply plan (2008) and the 40-year plan. The legislature passed ordinances and also long-term plans as means to limit water use through different means. The ordinances are day-to-day restrictions while the plans set goals of water sustainability for future development to make sure that the community stays focused on water conservation for years into the future.

Outdoor, non-emergency requirements
The landscape requirements include a ban of outdoor irrigation between 10a.m. to 6p.m. from May to October. No residents may water the sidewalk with a hose, and residents must point the hose at vegetation when watering. According to Laurie Trevizo, Santa Fe Water Conservation Specialist, residents can use no more than 25% Kentucky bluegrass in the turf and are encouraged to use warm grass turf, which requires less water. Permits are required for all new irrigation systems as well. In addition, overhead spray irrigation is not allowed for water shrubs and trees, and shut-off nozzles are required.[64] Santa Fe officials have created new strategies for enforcing these requirements while also encouraging water conservation through educational programs, including many dedicated to educating landscape professionals about water efficient landscapes.

Local Situation & Background

Santa Fe is the capital of New Mexico with a population of 68,642 that lives in the northern deserts of the state. The economy runs on tourism, arts and the government. The hotel industry is particularly prominent, leading to a need for greater water conservation programs in hotels.

In the Southwest region of the United States, Santa Fe faces a dearth of water supplies, particularly each summer, and often copes with drought. At present, it uses two Santa Fe River mountain reservoirs, a surface water treatment plant and two well fields to supply about 10,000 acre-feet of water each year, according to the City of Santa Fe Water

[64] "Comprehensive Water Conservation Requirements." *Santa Fe, NM*. Web. 28 Nov. 2012. <http://www.santafenm.gov/index.aspx?NID=2562>.

Conservation and Drought Management Plan. The reservoirs only provide up to 50% of water needs each year when there is normal rainfall.

The city has a plan in place, however, to reduce water use annually by two gallons/person/day in a period of average rainfall. The city at first relied on surface water from the Sangre de Cristo mountain range until the mid 1900s. In the 1950s, the city started to drill wells in the area of the Santa Fe River and started to bring water from the Rio Grande in the 1970s. [65]

The water supply became publically owned in 1995 when the City of Santa Fe City Council bought it from a public service company. After this point, they became responsible for water conservation and public awareness programs as well as supplying water. The council enacted the Comprehensive Water Conservation Requirements Ordinance soon after Ord. #1997-17. Just a few years later in 2002, the area went into a period of severe drought.

This was a drought particular to the Northern New Mexico region, and the community was not prepared for an extreme drought with high amounts of evaporation and low amounts of rainfall, according to Ms. Trevizo. The average person was still consuming 165 gallons/day of water, and infrastructure in Santa Fe, the oldest capital in the United States, was aging and inefficient. This drought drew attention to the need for better programs to reduce water use in Santa Fe.

The City Council now reviews applications for development to ensure that the city does not use more water than is available. In response, the governing body called for restrictions, such as odd/even watering and a more restrictive time of day water (no watering for 12 hours a day) while also completing a toilet retrofit program. The citizen group, the "Water Conservation Committee," also meets to assess water conservation programs. The most stringent City Council plan during the period of drought (an emergency situation) included a no-watering restriction and, at another time, a once a week watering restriction.

In 2007, all drought restrictions were lifted, but the city incorporated some of the earlier restrictions that worked well into a year-round code. For example, the city kept the restriction of requiring all restaurants to serve water only upon request and asking hotels to wash sheets less frequently. The city of Santa Fe is working on water conservation measures for the metropolitan area, but the county of Santa Fe follows state laws, and does not need to comply with city conservation measures. However, the city of Santa Fe sends water to the county level at present. This means that the City of Santa Fe is supplying water to other parts of Santa Fe County, but the ordinances do not apply to them.

[65] City of Santa Fe. "City of Santa Fe Water Conservation and Drought Management Plan." Nov. 2010. Print.

Implementation

Enforcement phase
In the early 2000s, water conservation officials only worked on enforcement measures to limit resident water use rather than using educational programs, while also conducting a leakage survey and analyzing the city's aging infrastructure. In terms of punitive action, the office used a citation system to punish residents who did not follow water ordinances, and a payment amount that increases from $20 for the first citation, then $50, $100 and $200. After this, the office levies the water bill for additional funds.[66]

The office used citation crews to patrol on a regular basis around the neighborhoods, particularly early in the morning and late in the evening. There were at least five people who surveyed the neighborhoods for the unlawful use of water, which the office deemed was sufficient for the relatively small population of Santa Fe. These people were part of the general staff in the conservation office, and so worked on other projects other than enforcement as well.

The office also relied on meter readers and police department to keep track of excessive water use and to write citations. The city paid $3.6 million dollars to install 1000-meter devices in 2004, which send information about leaks and water usage, informing the public about their water use on a daily basis. Police officers incorporated this responsibility of monitoring water use into their regular duties. This enforcement was a mandate from the City Council. The budget for the enforcement project included all of the money that would normally be used for educational resources. There was negative community feedback regarding too much enforcement, which they wrote about particularly in local newspapers.

Shift to education phase
The office writes few citations now, however, as the office's emphasis has shifted from writing citations and fining non-compliant homeowners to education. The department would like to be more hands-on and thus shift the local attitude about water use. There are primarily youth programs, such as a water conservation poster contest. The office works with the public school systems to enhance their curriculum particularly while working with art and science coordinators. Developing a theme, teachers work with elementary school students to teach them about water conservation. The office provides teachers with information and materials. Posters are turned into a calendar to give to the community and the grand prizewinner posted on the back of a city bus as a reminder about water conservation.

Also developing special events, the office staff prepares a water fiesta event for 4th grade students so that they may learn about how water is a part of their lives. They also have implemented a 5th grade, yearlong river exchange program in the past to teach about water as it relates to geography, ecosystems and other subjects. These children's programs raise awareness about water use amongst elementary school students, so that

[66] Trevizio, Laurie. "West Coast Case Study: Santa Fe Ordinance." Telephone Interview. 1 Nov. 2012.

they will hopefully implement these lessons learned into their lives moving forward as residents of Santa Fe.[67]

The office has also arranged adult education classes in the past, such as an EPA program, homeowner water conservation, landscaping and drip irrigation classes. They have also offered significant rain sensor rebates after analyzing outdoor water use through devoting 300 hours to the project, although there was low participation. When surveyed, many people responded that they did not understand technology. Especially in response to this problem, the office is now developing a qualified water efficient landscapers (QWEL) certification program for irrigation professionals, so that they can spread the word in the community about more efficient water use practices. The city and state engineer also collaborated to produce an irrigation training DVD.

The City invests in a high level of public outreach. The public must receive water conservation information in public bathrooms, during real estate exchanges, in plant nurseries and during education training sessions about water efficient landscaping. Water conservation information is also distributed through newspaper ads, water bill inserts, during community events and prior to moving screenings at local cinemas. There is a radio program devoted to water use, called "Water Talk with the City of Santa Fe." The office uses a general operating fund and then every year in April, it places a $5 levy on water bills for programming costs and to fund rebates. These rebates include rain barrels to harvest rainwater and water sensors, among others. They structure the rebates so that residents receive more money off of their water bills based on how large the barrel is.

There has not been sufficient staffing in recent years to carry out many of these programs, however. During the recent economic downturn, there was a hiring freeze, so the department had to lay off staff members, resulting in a decrease in educational programs. However, water use continues to decrease, especially due to earlier educational and punitive measures.

Results

Santa Fe's water use has dropped to less than 100 gpcd from 168 gpcd in the 1990s (dropped 42%).[68] The amount of water produced also fell by 24% from 13,180 acre-feet in 1995 to 9,978 acre-feet in 2009 even though the population increased by 15% between 1995 and 2009 The city's plan set in 2008 to lower the amount of gallons/person/day to 110, has already been achieved and now the city plans to reduce the gpcd to 88 by 2014. Another contributing factor is that Santa Fe is using more treated wastewater for irrigation than before. This increased from 1,670 acre-feet in 2004 to 1,443 acre-feet in 2009. This saves potable water for drinking needs.

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[68] City of Santa Fe. "City of Santa Fe Water Conservation and Drought Management Plan." Nov. 2010. Print.

These statistics are especially important, as they are some of the lowest in New Mexico and among other parts of the American Southwest. Santa Fe's programs are constantly evolving to better meet the needs of the population to consistently reduce water use through a strategy of involving the community and raising awareness through a variety of educational programs for adults and children. Today many citizens are even registering comments with the office of water conservation to ask that the governing body enforce the water ordinances to a greater extent. This is a sign of strong citizen involvement and concern, which is a goal of any legislative body. In response, the office hired a marketing and public relations firm to communicate with the community in a more cohesive way and to send a clear message when there are constantly changing water conservation programs. If funds are available, the office plans to implement new programs, such as a rainwater-harvesting program, landscape efficiency classes and free courses in water conservation for the top water consumers in Santa Fe.

Lessons for Rockland County:

Based on Santa Fe's community's experience, relevant lessons for Rockland County include:

Enforcement must be tailored to local context:

- It's possible to improve enforcement efficiency by engaging meter readers and the local police force and incorporating water conservation strategies into their daily work.
- Mandating meter devices that transmit readings can be important enforcement tools, as they alert the office of water conservation about who the biggest users of water are and make enforcement by meter readers easy.

Education is an extremely effective enforcement tool:

- Educational programs have the potential to raise awareness to the point that citizens are asking for greater enforcement measures. A balance between punitive enforcement actions and education is important in terms of reducing water use and causing a behavioral change.
- It is important to remain in communication with the public and to share a concise, clear message about water use. At the same time, a water conservation strategy that constantly evolves keeps the public engaged and is an energetic way to reduce water use quickly by analyzing problems.

Forming partnerships with local leaders:

- One great strategy is to start by empowering key members of community, such as through educational programs for landscape professionals. Residents may be more willing to listen to their advice, after which point it would be useful to start offering rebates and incentives.

Application of drought conditions to regular ordinances:

- Incorporating parts of the emergency water ordinance that work well in dire conditions into the normal water code can reduce water use drastically during a non-drought period.

Writing flexible water ordinances that can evolve:

- The legislature can play a role not only of writing water ordinances, but also of constructing long-term water plans, which set the tone for decisions made about future development while constantly rethinking how well the ordinances and enforcement methods are functioning.

Works Cited

City of Santa Fe. "City of Santa Fe Water Conservation and Drought Management Plan." Nov. 2010. Print.

"Chapter XXV Water." *City Code*. Web. 5 Nov. 2012. <http://clerkshq.com/default.ashx?clientsite=Santafe-nm>.

"Comprehensive Water Conservation Requirements." *Santa Fe, NM*. Web. 28 Nov. 2012. <http://www.santafenm.gov/index.aspx?NID=2562>.

Trevizo, Laurie. Water Conservation Specialist. "West Coast Case Study: Santa Fe Ordinance." Telephone Interview. 1 Nov. 2012.

"Repermitting the Northwest Well." *Santa Fe, NM*. Web. 5 Nov. 2012. <http://www.santafenm.gov/index.aspx?nid=2575>.

"Water Conservation." *Santa Fe, NM*. City of Santa Fe. Web. 5 Nov. 2012. <http://www.santafenm.gov/index.aspx?NID=168>.

Seattle, Washington

The 1% Plan & Ordinance No. 120532

In this case study we review both the Seattle (city) specific ordinance as well as the broader water conservation program adopted by the surrounding communities. We interviewed Mr. Al Dietemann, the Saving Water Partnership Team Leader and Conservation Manager for the Seattle Public Utility (SPU). While there is no specific non-emergency outdoor ordinance we found Seattle to be a particularly fascinating case study that offers several important lessons.

In 2000, the SPU set out to keep water demand from rising over a ten-year period, in spite of regional population and economic growth. The cornerstone of the plan was reducing per-capita consumption an average of 1% per year, or 10% over the life of the program. Accordingly, the title of the program was "The Regional 1% Water Conservation Program" and it had 5 key target areas:[69]

1. Residential indoor water use: Clothes washer rebates and high efficiency toilets
2. Commercial domestic and process water use: Partnerships with energy utilities and trade groups, equipment vendors, and targeted recruitment of businesses to improve efficiency
3. Residential landscape water use: Promotional campaigns and collaboration with plant nurseries, garden centers and garden
4. Commercial landscape water use: Water Efficient Irrigation Program to expand the array of choices customers and contractors have for improving efficiency in irrigation systems
5. Youth Education: Teacher workshops, classroom presentations and materials, curriculum development and watershed tours

As part of the broader plan, Seattle (city) passed Ordinance 120532 in September of 2001. Ordinance sought: 1) to accelerate voluntary, cost-effective water conservation in Seattle 2) create the "Everyone Can Conserve" program to fund water conservation in low-income housing and 3) establish that a primary source of funding for conservation program shall be rates charged on residents and business that use extraordinary amount of water.[70]

Local Situation & Background

Seattle obtains ~70% of its raw drinking water supply from the Cedar River and most of the remaining 30% from the South Fork Tolt River. Seattle's two well fields are available to provide drought and emergency supply. SPU's retail customers use approximately half of SPU's water and SPU sells the other half through wholesale contracts to 19

[69] United States. Seattle. Seattle Public Utilities. *Saving Water Partnership 2010 Report*. Seattle, Washington: City of Seattle, 2011. Print.
[70] United States. Seattle. Seattle Public Utilities. *2010 Annual Report on City of Seattle Ordinance No. 120532*. Seattle, Washington: City of Seattle, 2010. Print.

municipalities and special purpose districts that provide the water to their own retail customers.

Both population and water consumption have steadily risen since 1975. Water demand leveled off in the 1980s before dropping off sharply in 1992 due to a severe drought and mandatory curtailment measures. Seattle Public Utility (SPU) adopts a policy of strict conservation, or "using less water for the same task without causing undue hardship or sacrifice" in contrast to "curtailment, which seeks to legally ban citizens from using water for certain purposes."[71] In 2000 the SPU sought to comprehensively address its water shortage by forming a **Saving Water Partnership** (SWP) with its member communities.

The goal was to reduce per capita consumption by an average of 1% per year for 10 years and thus rein in water demand despite regional population and economic growth. Water conservation manager Al Dietemann commented that the plan came out of a desire to address water supply needs in the most cost-effective manner. He noted, "When we started to look at the cost of providing additional water supply, whether from new wells, a desalination plant or increased purchases of water, the cost of voluntary demand reduction proved to be the cheapest new source of supply. We found that we could conserve water this way for about ½ the cost per unit of any other alternatives." He further adds that a central part of the philosophy behind the new plan was to decouple the sale of water from the sale of water service. Seattle sought to do this in order to establish prices that accurately reflected the true cost of the commodity, letting customers decide on their own optimal consumption.[72]

Implementation

Starting out with the five target areas noted at the beginning, Seattle established a set of measures as well as strategies to achieve these measures.[73]

Saving Water Partnership Measures and Strategies

Target Area	Measures	Strategies
Residential Indoor	a. Replace washing machines b. Replace toilets, showerheads & faucets c. Fix leaks (toilets) d. Change behaviors (faucet use, shower time, full loads)	a. Washwise rebates b. Multifamily and single family toilet rebates c. Showerhead distribution to multifamily properties d. Behavior messaging e. Collaboration with energy utilities f. Program recruiting through retailers, ads in property manager trade publications, website

[71] Dietemann, Al. "West Coast Case Study: Seattle Ordinance." Telephone interview. 17 Oct. 2012.
[72] Ibid
[73] United States. Seattle. Seattle Public Utilities. *Water Conservation Plan 2007-2012*. Seattle, Washington: City of Seattle, 2007. Print.

Residential Landscape	a. Improve irrigation system performance b. Change landscape watering behaviors c. Encourage practices that affect watering (mulch, soil prep and plant selection)	a. Irrigation system efficiency rebates b. Right Plant, right Place promotion via retailer partnerships (nurseries, home and garden centers) c. Savvy gardener e-newsletter and classes d. The garden Hotline e. Natural Lawn & garden guides (how-to materials) f. Training for irrigation professionals g. Developed irrigation technology performance testing through Irrigation Association Smart water application Technologies initiative h. Online weather data, watering index, water budgeting and irrigation scheduling tools
Commercial Domestic and Process	a. Upgrade toilets and other domestic water use fixtures b. Upgrade industrial and commercial water-using equipment c. Improve building cooling performance d. Upgrade efficiency of specific water consuming medical and lab equipment e. Outreach to ethnic businesses	a. Financial incentives (custom projects & standard rebates) b. Targeted promotion through vendors, trade groups, agencies with focus on Korean businesses c. Restaurant targeting – Commercial Kitchen equipment Partnership with multiple energy and water utilities d. Outreach to business groups through resource venture e. Technical assistance, assessments, workshops f. End-use metering wherever possible to build cost-effective conservation recommendations
Commercial Landscape	a. Upgrade irrigation equipment (controllers, rain sensors, drip) b. Improve scheduling and maintenance c. Train irrigation contractors and installers	a. Targeted outreach to large commercial customers b. Site-specific recommendations and technical assistance c. Financial incentives (custom projects and set rebates) d. Targeted recruiting and promotion to large commercial customers e. Market transformation by establishing and building vendor and contractor relationships f. Online weather data, watering index, water budgeting and irrigation scheduling tools g. Training for irrigation professionals

Youth Education	a. Build conservation awareness and residential measures	a. Support of water festivals and events b. Educator resources online c. Classroom and take-home materials d. Web-based interactive activities

Seattle-City Conservation
As stated earlier, a water conservation program designed exclusively for low-income customers in Seattle was passed in the form Ordinance 120532. This ordinance required the City to address conservation beyond the Regional Program to target on low-income housing and provide conservation assistance. The City established the *Everyone Can Conserve Program* with the mandate of providing 3 mgd of water savings in the Seattle Service area by 2010.

Results

Since the 1990 peak of 170 mgd of demand, water consumption has declined by 52 mgd (30%); population increased 15% during the same period. The central goal of reducing per capita consumption an average of 1% per year for 10 years was not only achieved, but also surpassed. Average annual demand was lower in 2010 than in 2000 and regional water consumption was at the lowest level in 50 years. In terms of water savings Seattle saved 11 mgd by the end of 2010 at a cost of $35 million dollars (initially budgeted at $55 million).[74] In the most recent assessment, the water supply was extended to last from the 2020's to now beyond 2060.[75]

The SWP identified four main factors contributing to the regional decline: 1) Conservation programs that saved 9.6 mgd from 2000 to 2010; 2) System operation improvements; 3) Water rates that encourage conservation; 4) Building codes and appliance standards raising the efficiency of plumbing fixtures and appliances.[76] In 2010 the residential indoor programs were shown to have accounted around half of the total program savings in the ten-year period. The second largest savings sector was estimated to be commercial process and domestic, and the third largest was residential landscape.[77] Below we outline some select achievements in the targeted areas:

In the **residential indoor** sphere, during the years of the 1% program, almost 80,000 washer machine rebates were issued, saving a million gallons of water per day. Participation averaged 7,270 rebates per year with incentives ranging from $50-$100. SWP also offered three models for high efficiency toilets that work in all settings with rebates ranging from $60-$100. Since 2001 more than 32,800 toilets have been replaced

[74] United States. Seattle. Seattle Public Utilities. *Water Conservation Plan 2007-2012*. Seattle, Washington: City of Seattle, 2007. Print.
[75] United States. Seattle. Seattle Public Utilities. *2013 Water System Plan: Our Water. Our Future*. Seattle, Washington: City of Seattle, 2012. Print.
[76] United States. Seattle. Seattle Public Utilities. *Saving Water Partnership 2010 Report*. Seattle, Washington: City of Seattle, 2011. Print.
[77] Ibid

in 1,610 buildings. Partnerships with local businesses and other utilities were used to increase participation and divide the cost of the program to the program more cost effective.[78] The initial focus for **residential landscape** conservation was changing behavior with respect to lawn watering. Marketing campaigns were widely used and information was distributed across nurseries in the area. In addition Seattle established strong relationships with the landscaping industry, public agencies and garden writers to leverage outside expertise.

For **commercial process,** SWP implemented three primary strategies: "1) Promotion through service and equipment vendors; 2) Partnerships with energy utilities, agencies and trade groups (restaurant and hotel associations for example); 3) Targeted recruitment of business categories (large customers, hospitality, medical and schools, and institutions)."[79] Restroom measures have proven to be the biggest saver, though special projects have also been very successful. The SWP engaged small, medium and large customers. Al Dietemann highlighted several important projects such as recirculating car wash facilities, helping a bottling plant work on efficiency, consulting with steel mills to reduce evaporation and reuse cooling water. He emphasized that hospitals were the most inefficient (cooling in heavy machinery and lack of reuse).[80]

In the **commercial landscape** focus on irrigation audits and custom rebates based on a site evaluations and total cost associated with a project. At the start of the program, customers could qualify for up to 50% of their landscape project cost. Despite this, there was low participation because of lengthy registration and approval process and in 2006 the SWP helped develop standard rebates based on the size of the irrigated landscape and the potential savings of the program. Additionally they offer free and reduced cost irrigation water efficiency trainings twice per year.

On the broadest level the SWP focused on emphasizing the reasoning behind water conservation and worked to spread awareness. Strong partnerships were formed with teachers and school district curriculum staff through classroom presentations as well as training for teachers (college level courses provided to elementary school teachers). In addition, the utility developed an online educational game, Water Busters, which received 12,000 hits in 2006 alone.[81]

In terms of the ordinance, Seattle's retail service area was 19.4 MGD lower in 2010 than in 2000. 20,842 low-income housing units were retrofitted and all low-income households were contacted or informed, using a variety of mechanisms[82]. Lastly, in 2005 and 2008 Water Rate Design Studies were conducted to: 1) provide for an equitable

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[78] United States. Seattle. Seattle Public Utilities. *Water Conservation Plan 2007-2012*. Seattle, Washington: City of Seattle, 2007. Print.
[79] United States. Seattle. Seattle Public Utilities. *Saving Water Partnership 2010 Report*. Seattle, Washington: City of Seattle, 2011. Print.
[80]Dietemann, Al. "West Coast Case Study: Seattle Ordinance." Telephone interview. 17 Oct. 2012.
[81] "Water Busters Online Game." *Bert & Phil's Water Busters*. Seattle Public Utility, n.d. Web. 12 Nov. 2012. <http://www2.seattle.gov/util/waterbusters/>.
[82] United States. Seattle. Seattle Public Utilities. *2010 Annual Report on City of Seattle Ordinance No. 120532*. Seattle, Washington: City of Seattle, 2010. Print.

allocation of conservation costs between residential and commercial customers 2) include a two-season rate structure (peak/off-peak) for commercial customers to encourage conservation 3) extend the third-tier summer rate for residential customers 4) allow for hardship exceptions for low-income residents.[83]

Future

From 2010 to 2040 population is forecast to increase by 21% in SPU's retail service area and by 25% in the service areas that SPU's contract holders serve. Despite this, total average annual demand is forecast to remain at or below current levels of approximately 133 mgd through 2060.[84] SWP plans on continuing many projects implemented from 2000-2010 and estimates the average savings from the 2013-2018 Water Use Efficiency Program will be .3 to .4 mgd of annual savings at an estimated annual utility cost of $2.15 million (2011 dollars).[85] The central goal for SWP lies in reducing total water use to less than 105 mgd (~85 gallons per person/day down from the 1990 high of 160+ gallons per person/day) from 2013 to 2018.

Lessons for Rockland County:

Forming partnerships with local leaders: Seattle's public utility partners with energy utilities, equipment vendors, local businesses, gardeners, and schoolteachers to establish a broad conservation program. Leveraging all stakeholders helps immensely when trying to raise awareness.

Incentivizing rather than punishing customers: In Seattle, the rate structure has been one of the central provisions to ensure water conservation. In addition, the philosophy that excessive water users should pay for improvements in lower-income households is interesting. Though this could prove divisive, thus far it has worked in Seattle and in the upcoming rate case may prove helpful.

Establishing a flexible conservation program: It is important to update conservation programs as well as ordinances on a regular basis in response to changing local context. Initially establishing awareness is a critical part, and Seattle utilized various marketing strategies to convince consumers about conservation. However the program evolved, especially in commercial process rebates, in response to customer feedback and needs. Embedded in this is the necessity of periodic assessments in order to gauge response and success of an ordinance.

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[83]United States. Seattle. Seattle Public Utilities. *Water Conservation Plan 2007-2012*. Seattle, Washington: City of Seattle, 2007. Print.
[84]United States. Seattle. Seattle Public Utilities. *2013 Water System Plan: Our Water. Our Future*. Seattle, Washington: City of Seattle, 2012. Print.
[85]Ibid

Works Cited

Dietemann, Al. "West Coast Case Study: Seattle Ordinance." Telephone interview. 17 Oct. 2012.

United States. Seattle. City Council. *Seattle City Council Ordinance 120532*. Seattle City, 18 Sept. 2001. Web. 8 Nov. 2012. <http://clerk.ci.seattle.wa.us/~scripts/nph-brs.exe?s1=&s2=&s3=&s4=120532&s5=&Sect4=AND&l=20&Sect1=IMAGE&Sect2=THESON&Sect3=PLURON&Sect5=CBOR1&Sect6=HITOFF&d=CBOR&p=1&u=/~public/cbor1.htm&r=1&f=G#hb>.

United States. Seattle. Seattle Public Utilities. *Saving Water Partnership 2010 Report*. Seattle, Washington: City of Seattle, 2011. Print.

United States. Seattle. Seattle Public Utilities. *2010 Annual Report on City of Seattle Ordinance No. 120532*. Seattle, Washington: City of Seattle, 2010. Print.

United States. Seattle. Seattle Public Utilities. *Water Conservation Potential Assessment*. Seattle, Washington: City of Seattle, 2004, Revised 2006. Print.

United States. Seattle. Seattle Public Utilities. *Water Conservation Plan 2007-2012*. Seattle, Washington: City of Seattle, 2007. Print.

United States. Seattle. Seattle Public Utilities. *2013 Water System Plan: Our Water. Our Future*. Seattle, Washington: City of Seattle, 2012. Print.

Orange County, California

Assembly Bill 1881, "The Water Conservation in Landscaping Act of 2006"

In this case study we review Assembly Bill 1881, a state bill passed in 2006, regarding efficient landscaping. We also look at Orange County and Mission Viejo, a city within the County. We interviewed Joe Berg, the Water Use Efficiency Programs Manager for the Municipal Water District of Orange County, as well as Joe Ames, the Assistant City Engineer for Mission Viejo.

The State of California passed Assembly Bill 1881 (The Water Conservation in Landscaping Act of 2006) as part of a statewide effort to enact a Model Water Efficient Landscape Ordinance. The bill required local agencies to adopt the model ordinance or another water efficient landscape ordinance *at least as effective* in conserving water by January 1st, 2010. The central provision of AB 1881 was the idea of a Maximum Applied Water Allowance (MAWA) and an Estimated Total Water Use (ETWU)—two measures calculated using formulae provided for in the ordinance. The basic provisions are listed below.

Basic Provisions of AB1881		
• Minimize overspray/runoff • Landscape water budgets • Appropriate use and groupings of plants	• Automatic irrigation systems and schedules • Soil assessment and soil management plans • Landscape maintenance practices	• Encourage capture and retention of storm water onsite • Encourage use of economic incentives • Educate water users

Local Situation & Background

Prior to the passage of AB1881, there were two relevant pieces of legislation passed by the State of California. The predecessor to AB 1881, The Water Conservation in Landscaping Act of 1990 (Assembly Bill 325), was passed in September of 1990. This bill came out of severe droughts across the state as well as conflicts between counties that were taking water from each other. The bill mandated that the Department of Water Resources (DWR) put into place an advisory task force to create a Model Ordinance by January 1st, 1992. The central theme governing this ordinance was that landscape design, installation and maintenance "can and should be water efficient."[86] One of the key elements of the Model Ordinance was the concept of a landscape water budget and the use of a Maximum Applied Water Allowance (MAWA) based on the site-specific landscape area and the local climate. Despite the initial success it was found that many communities lacked awareness. Joe Berg commented that one of the key problems was that "there was no threshold for effectiveness, the only requirement was that the

[86] United States. State of California. Department of Water Resources. *State of Adoption of Water Efficient Landscape Ordinances, Pursuant to AB 1881 Section 65597*. By Edmund G. Brown, John Laird, Mark W. Cowin, and Susan Sims. N.p.: State of California, 2010. Print.

community passed an ordinance. In reality, most cities adopted weak ordinances that proved ineffectual."[87]
Following AB325, the state took an interest in urban landscapes. And in 2004 Assembly Bill 2717 was passed requesting a "stakeholders taskforce" comprised of private and public agencies as well as landscape industry leaders to evaluate and create proposals for improving California's water use efficiency in new and existing *urban* irrigated landscapes. The task force provided a set of 43 recommendations, many of which suggested updating the Model Ordinance from AB325.
The central update that AB 1881 provided was the requirement of thresholds. Joe Berg underlined this point and contrasted it with the lackluster response received for AB325. The state considered stakeholder input during 14 public discussions, with public comment periods with two official public hearings.[88]

Orange County
As in many parts of Southern California, Orange County suffers from water scarcity. Following the state mandate, the municipal water district and league of cities in Orange County decided to work together to take the state ordinance and tailor it to the local area. The county wanted to create an ordinance for the 35 cities in OC to ease compliance and ensure consistency. The county took in stakeholder input on ordinance development from 3 large groups of stakeholders, 5 technical drafting committees and a participation process that was open to the public.[89]
The ordinance is effectively very similar, though one key difference is that Orange County separated the technical aspects, which were put in a guidebook, from the legal document. In addition, the technical aspects were made a bit more flexible to ensure that as technology advanced, the ordinance would remain effective in the future.

Implementation

As defined by the State, the key purposes of the ordinance were to:[90]

1. Promote the values and benefits of landscapes while recognizing the need to invest water and other resources as efficiently as possible
2. Establish a structure for planning, designing, installing, maintaining, and managing water efficient landscapes in new construction and rehabilitated projects
3. Establish provisions for water management practices and water waste prevention for existing landscapes

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[87] Berg, Joe. "West Coast Case Study: Orange County Ordinance." Telephone interview. 2 Oct. 2012.
[88] Ibid
[89] United States. Orange County, California. Municipal Water District of Orange County. *Implementing the New Water-Efficient Landscape Ordinance in Orange County*. N.p.: Orange County, California, 2010. PowerPoint.
[90] United States. State of California. Department of Water Resources. *Updated Model Water Efficient Landscape Ordinance AB1811 Presentation*. N.p.: State of California, 2010. Print.

4. Use water efficiently without waste by setting a Maximum Applied Water Allowance as an upper limit for water use and reduce water use to the lowest practical amount
5. Promote the benefits of consistent landscape ordinances with neighboring local and regional agencies
6. Encourage local agencies and water purveyors to use economic incentives that promote the efficient use of water, such as implementing a tiered-rate structure
7. Encourage local agencies to designate the necessary authority that implements and enforces the provisions of the Model Water Efficient Landscape Ordinance or its local landscape ordinance

Orange County

In Orange County, while many of the purposes were similar, there were other policy issues that drove the ordinance. The first was to protect local control and avoid increased layers of government. This was done to minimize cost of compliance. The second was to ensure as much simplicity, efficiency and flexibility as possible. The third was to provide for as much consistency among OC cities as possible. Beyond the creation of the model ordinance, budgeting and staffing was left to the local communities for enforcement.[91] In addition to the County level, we also interviewed an engineer from the city of Mission Viejo (within OC). Mission Viejo passed their ordinance on November 16th, 2009. City engineer Joe Ames commented that "landscape plans have always been done in Mission Viejo. Following the model ordinance they became a bit more stringent, but we check all developments very thoroughly from an irrigation perspective." The process starts when a developer submits a landscape plan after which an inspector goes out to check the site following construction but prior to occupancy. A landscape maintenance agreement is then signed detailing a list of maintenance requirements annually. The penalty for non-compliance is a lien on the property, though Mr. Ames could not recall any instance of this occurring. In contrast to other cities, the developers are required to pay for an initial plan check. Mr. Ames commented that this aspect has been helpful in managing costs as well as ensuring compliance.[92]

Results

On September 10th, 2010 DWR adopted the updated ordinance and mailed a copy to 586 addresses including all city and county land use planning agencies in California and those water purveyors that had requested a copy. Of the 586 local agencies, the California Department of Water Resources received a total of 338 responses from local agencies and

[91]United States. Orange County, California. Municipal Water District of Orange County. *Implementing the New Water-Efficient Landscape Ordinance in Orange County*. N.p.: Orange County, California, 2010. PowerPoint.
[92] Ames, Joe. "West Coast Case Study: Orange County." Telephone interview. 12 Oct. 2012.

water purveyors (a 57% response rate).[93] There were 3 possible responses, 1) to adopt the state ordinance; 2) to adopt an alternative ordinance; 3) to temporarily adopt the state ordinance with the aim of creating their own ordinance. The majority of cities adopted their own ordinance (60%), with the remaining cities split evenly between adopting the State ordinance temporarily and permanently. Among counties the split was even across all three options. The reasons provided for this were that some needed more time to create the ordinance, and many locations simply needed more money. The State has not performed any quantitative analyses of the effectiveness of the ordinance, though they have indexed all of the cities ordinances in a centralized database.

Within Orange County there has been unanimous adoption of the ordinance, though Joe Berg commented that following the recession, development has been severely limited and thus so have any tests of the ordinance. Mr. Berg expects that "going forward there will be more and more questions from the various agencies in terms of how to administer the ordinance. Practical implementation will be a problem that we certainly face."[94]

Mission Viejo was unable to provide information on residential developments though they did send a report on a public restoration project. The Oso Creek restoration project allowed for irrigation based on time, evapotranspiration rate and soil-moisture sensing as well as replacement of high water use landscaping, installation of high-efficiency irrigation heads and water catchment areas. The site took on not only the requirements but also the recommendations of the ordinance and in total showed significant water use reduction during the traditionally heavy usage months (July/August). For further information see the report.[95]

While there have not been explicit analyses of water savings, both people interviewed signaled widespread compliance and a generally positive attitude toward the model ordinance. As noted above, implementation may prove more difficult as development picks up, but the framework has been established for the future.

Lessons for Rockland County:

Based on Orange County's experience relevant lessons for Rockland County include

Collaboration between different levels of government can be immensely effective: In Orange County, California, we have seen a great degree of collaboration from the State to the County to local governments in creating an ordinance to effectively address conservation issues. Creating an ordinance that is easy to apply across a broad swath of communities will be very important for Rockland County.

Ongoing evaluation is important: Despite the state level evaluations, Orange County notably lacks any quantitative assessments regarding the effects of the ordinance.

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[93] United States. State of California. Department of Water Resources. *State of Adoption of Water Efficient Landscape Ordinances, Pursuant to AB 1881 Section 65597*. By Edmund G. Brown, John Laird, Mark W. Cowin, and Susan Sims. N.p.: State of California, 2010. Print.

[94] Berg, Joe. "West Coast Case Study: Orange County Ordinance." Telephone interview. 2 Oct. 2012.

[95] United States. Mission Viejo. City of Mission Viejo & Dudek. *Oso Creek Restoration and Protection Project*. Mission Viejo, California: City of Mission Viejo, 2012. Print.

Establishing an ongoing monitoring system and/or a period assessment is something that will be important in identifying what parts of the ordinance have proved successful and which parts need to be updated.

Works Cited

Berg, Joe, Water Conservation Manager MWDOC. "West Coast Case Study: Orange County Ordinance." Telephone interview. 2 Oct. 2012.

Ames, Joe, City Engineer, Mission Viejo, CA. "West Coast Case Study: Orange County." Telephone interview. 12 Oct. 2012.

United States. State of California. Department of Water Resources. *Assembly Bill No. 1881 Chapter 559*. N.p.: State of California, 2006. Print.

United States. Mission Viejo. City of Mission Viejo & Dudek. *Oso Creek Restoration and Protection Project*. Mission Viejo, California: City of Mission Viejo, 2012. Print.

United States. Mission Viejo. City of Mission Viejo. *Ordinance 09-277*. City of Mission Viejo, 2012. Print.

United States. Orange County, California. Municipal Water District of Orange County. *Technical Guidelines for the Implementation of the Water Efficient Landscape Ordinance*. N.p.: Orange County, California, 2010. Print.

United States. Orange County, California. Municipal Water District of Orange County. *Implementing the New Water-Efficient Landscape Ordinance in Orange County*. N.p.: Orange County, California, 2010. PowerPoint.

United States. Orange County, California. Municipal Water District of Orange County. *Model Water Efficient Landscape Ordinance*. N.p.: Orange County, California, 2010. Print.

United States. State of California. Department of Water Resources. *Model Water Efficient Landscape Ordinance*. N.p.: State of California, 2006. Print.

United States. State of California. Department of Water Resources. *State of Adoption of Water Efficient Landscape Ordinances, Pursuant to AB 1881 Section 65597*. By Edmund G. Brown, John Laird, Mark W. Cowin, and Susan Sims. N.p.: State of California, 2010. Print.

United States. State of California. Department of Water Resources. *Updated Model Water Efficient Landscape Ordinance AB1811 Presentation*. N.p.: State of California, 2010. Print.

Case Study Discussion

There are important lessons that Rockland County can learn from both the successes and the failures of various communities within these case studies. We break these lessons out into broad categories and subsets providing further information below.

On the broadest level, we have found that conservation ordinances have been effective (from both a cost perspective and a conservation perspective). Within ordinances, however, we have also seen that voluntary citizen engagement fosters widespread compliance and ensures long-term success. While these ordinances often exist alongside other measures that broadly aid in conservation, we have seen that they are very useful.

Relationships

Leveraging relationships, whether between the different levels of government or within the community has been seen as a fundamental part of many conservation initiatives, particularly with respect to ordinances.

Relationship between different levels of government: We have noted that communities have faced difficulties deciding which level of government will make decisions for the municipality. For example, Nassau County and its individual communities all operate within the framework of the NYS Home Rule allowing for relative autonomy in the decision making process. The county passed water conservation ordinances in 1987, but many municipalities and water districts within the county have created their own ordinances (leading to some ambiguity between the different levels of government). In Orange County, California, however, we saw a large degree of collaboration at the state, county, and local government levels in creating ordinances. Relevant lessons include the possibility that Rockland could play a leadership role in helping towns and villages adopt conservation ordinances.

Forming partnerships with local leaders: As we saw in Seattle, WA, Santa Fe, NM, and Tampa Bay, FL engaging with professionals in the community may lend legitimacy to the water ordinances and inspire more action among citizens. One example of this is Seattle's public utility partnership with energy utilities, equipment vendors, local businesses and gardeners. Santa Fe's water conservation office sets up courses for local irrigation and landscaping professionals to improve their skills and then engage with the community itself. And in Tampa Bay, enforcement and partnerships evolved from originally targeting developers and contractors during the housing boom to now focusing more on homeowners improving their irrigation systems. All of our case studies have signaled that community engagement and participation is critical in creating a successful ordinance. Moving beyond public hearings and discussions or modifying these discussions to create more interaction will be very important for Rockland.

Enforcement, Incentives and Education

Perhaps unsurprisingly, compliance proved to be the most complex issue many communities have faced in dealing with the implementation of water ordinances. The communities studied have approached the issue in diverse ways, ranging from explicitly punitive measures, to more educational approaches, and in many cases "incentive" based programs.

Enforcement must be tailored to local context: In Seattle, WA and Santa Fe, NM, we saw that measures such as education and incentivization can be highly successful. These "softer" methods rely on community engagement and voluntary water use reductions, despite population growth and development pressures. For example, when Santa Fe switched from punitive enforcement measures to a wholly education based system, involvement in water conservation activities increased significantly. Seattle's mix of incentives and education was also successful in terms of working with various stakeholder groups on both the private and public. On the other hand, we have seen that ordinances can divide communities and lack of compliance can be widespread in locations where attitudes regarding water are not uniform. Such was the case in several communities in Tampa Bay, Florida, where compliance was deemed to be low. In Rockland, gauging the various communities' attitudes towards conservation and ordinances will be important in assessing potential success. Additionally, ensuring designated enforcement officials as well as periodic reviews will both necessary in the long-term.

Education is an extremely effective enforcement tool: We have observed that a large challenge in many communities lies in ensuring that citizens are not only aware, but are also willing and motivated to take action to conserve water. In many cases, the most effective enforcement methods are those that provide warnings and reminders to citizens before taking punitive steps. Employees in Chapel Hill, North Carolina, for example, call customers to offer reminders as a first step before taking action. Additionally in Seattle we saw diverse engagement with education, ranging from homeowners to schoolchildren. For Rockland County, creating an effective education program will prove indispensable. Given that UWNY already conducts educational programs, perhaps the county can work in concert with UW to support the ordinance.

Learning from the past

Application of drought conditions to regular ordinances: We observed in many communities that ordinances in non-drought times are often successful because the legislature has incorporated parts of the drought, emergency ordinances into the regular legislation. Citizens become used to the drought conditions and then are more likely to follow the regular ordinances. The legislature would just adopt the practices that were most useful in reducing water use during droughts. We have found that real change often comes out of drought.

Writing flexible water ordinances that can evolve: As we see in Seattle, WA and Santa Fe, NM, it is important to update ordinances on a regular basis in response to the changing local context and following a thorough analysis of why or why not citizens are following the ordinance restrictions, especially through speaking with them directly. Public forums in Chapel Hill, NC, for example, were effective in gathering a public response. As observed in Santa Fe, however, constantly changing ordinances can be confusing to citizens who require a clear, easy-to-access message about what the ordinance stipulates at any given time.

Water Efficient Landscaping

In contrast to the other themes that focus on how to make the ordinances effective, this set of recommendations revolves around the actual nature of the ordinance, specifically targeting landscaping methods.

Incentives to improve water efficiency in lawns: In Santa Fe, NM and Chapel Hill, NC, policymakers employ incentives to reduce water use through changing the type of irrigation system technology that one uses or by making one's landscape more water efficient. In Chapel Hill, for example, customers using underground drip irrigation and hand watering mechanisms are exempt from the alternate day ordinance. In Santa Fe, there are often rain sensor rebates and classes available to learn about saving water in irrigation. These incentives can make it more appealing for residents to make changes to conserve water. In Tampa Bay, the ordinance called for changes to the irrigation systems and use of vegetation, but there were not enough incentives to bring about a change in behavior. However it was observed that after an initial period and due to the recession, customers began taking up conservation practices on their own. For Rockland, addressing lawn watering will perhaps be the most important aspect of an ordinance.

Use of odd/even watering restrictions: In the majority of case studies, the legislature called for odd/even watering days, so that odd-numbered houses could only water every other day and vice versa. This restriction is so ubiquitous because it is both easy to follow and is easy to enforce should police officers or water conservation staffers decide to do so. Another example is lawn irrigation in the Port Washington Water District. Lawn irrigation is the largest user of water in this area, and odd/even restrictions have been in place since 1953, but this has not been successful in reducing water use by itself, so the district has started to restrict access to irrigation systems unless homeowners or contractors demonstrate the capability to reduce water use. For Rockland odd/even-watering restrictions may be the easiest to put into an ordinance, at least from the standpoint of effective precedents around the country.

Mandating certain landscape requirements: This strategy has proved successful in many communities, including Tampa Bay and Orange County. In Tampa Bay, educating landscapers and contractors was the largest hurdle to cross. In Orange County, it was seen that helping establish a model with easy to follow technical guidelines enhanced adoption in smaller communities throughout the county. The notion of a model landscape ordinance mandating certain requirements is one that may be applicable to Rockland.

Conclusion

At the high level, we have found that conservation ordinances have been effective, both in terms of cost and conservation. Within ordinances, however, we have also seen that voluntary citizen engagement is one of the most potent methods of creating compliance as well as ensuring long-term success. Leveraging relationships, whether between the different layers of government or within the community has been seen as a fundamental part of many conservation initiatives, particularly with respect to ordinances.

Perhaps unsurprisingly compliance proved to be the most complex issue many communities have faced in dealing with the implementation of water ordinances. The communities studied have approached the issue in diverse ways, ranging from explicit punitive measures, to a more educational approach, and in many cases "incentive" based measures. With respect to Rockland, the county can leverage its connections with different communities and stakeholders to effectively implement and potentially enforce a non-emergency outdoor ordinance.

This report has aimed to not only review specific experiences with water conservation across the United States but also provide relevant and timely information for Rockland County as it faces the potential for a rate change as well supply expansion. While there are many challenges associated with effective implementation, ordinances present a compelling option for communities facing water scarcity. *We firmly hold that non-emergency water ordinances have potentially potent and long-term effects for Rockland County.*

Appendix

Appendix 1: Team Contact Information

Team Member	E-mail	Case Studies
Aaron Simon	Ams2363@columbia.edu	Cary, NC; Chapel Hill, NC
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Caitlin Watterson	Cww2121@columbia.edu	Nassau County, NY; Suffolk County, NY; Westchester County, NY
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Melissa von Mayrhauser (Project Manager)	Mmv2121@columbia.edu	Nassau County, NY; Santa Fe, NM
Nicole Morgan	Ndm2113@columbia.edu	Sensitivity Analysis
Shelly Xu	Sx2125@columbia.edu	Mahwah, NJ; Sharon, MA

Appendix 2: Case Study Contacts

Name of Case Study	**Type of Ordinance**
Nassau County, NY	1. Dennis Realmuto; President, Irrigation Association of NY; proirrigation631@aol.com 2. Jack Scully; Water Purification, Chief Plant Operator; jscully@longbeachny.org 3. William Archambault: Public Works Director, Glen Cove; warchambault@cityofglencoveny.org 4. Loretta Dionisio; Hydrgeologist of Nassau County; ldionisio@nassaucountyny.org 5. Brian Zimmerman; District Manager, Nassau County Soil and Water Conservation District; nassauswcd@optonline.net 6. Brian Gunderson; Superintendent of Water and Public Works, Village of Sands Point 7. Italo Vacchio, Superintendent, Port Washington Water District, info@pwwd.org 8. Richard Tobin; Water Superintendent; plwd@optonline.net 9. Michael Levy; District Superintendent; mlevy@gcpwwater.org
Suffolk County, NY	1. Ms. L. Harnett; Employee at Dix Hills Water District 2. Paul Ponturo; Senior Water Resources Engineer at H2M Engineering Group; pponturo@h2m.com
Westchester County, NY	1. David Rambo; Water Superintendent 2. Jeannette Koster; Town Attorney
Sharon, MA	1. Eric Hooper; Superintendent of the Sharon Department of Public Works 2. Liz Curley; Business Manager 3. Paul Lauenstein; Sharon Water Committee Member
Mahwah, NJ	1. Paul Scherer; Superintendent, Mahwah Water 2. Katherine Coletta; Township Clerk 3. Mayann Malone; Water/Sewer Utility
Cary, NC	1. Marie Cefalo; Conservation Program Supervisor

Chapel Hill, NC	1. Patrick Davis; Sustainability Manager OWASA
Tampa Bay, FL	1. Dave Bracciano; Demand Management Coordinator, Tampa Bay Water; dbracciano@tampabaywater.org 2. Christopher Dewey; Landscape Program Coordinator for Pasco County (SWFWMD); cdewey@pascocountyfl.net
Orange County, CA	1. Joe Berg; Water Use Efficiency programs Manager, Municipal Water District of Orange County; jberg@mwdoc.com 2. Joe Ames; Assistant City Engineer, Mission Viejo, CA; james@cityofmissionviejo.org
Santa Fe, NM	1. Brian Snyder; Water Division Department Director; bksnyder@santafenm.gov 2. Laurie Trevizio; Water Division Conservation Manager; ltrevizio@santafenm.gov 3. Rick Carpenter; Water Resources and Conservation; rrcarpenter@santafenm.gov
Seattle, WA	1. Al Dietemann; Conservation Manager; al.dietemann@seattle.gov

Appendix 3: Case Study Questions

We conducted our interviews by using the following framework:
I'm part of a Sustainable Development workshop at Columbia University. We're focusing on developing a series of case studies of community experiences with non-emergency water conservation ordinances like the ones you have had in *X Community*. We're working with the Rockland County Legislature in NY which is considering adopting something similar.

1. **Background**
    a. Can you talk about the circumstances that drove this ordinance? Water shortages?
    b. Can you discuss any prior laws and emergency ordinances that were enacted? Or perhaps any anticipated changes or updates?
    c. Can you touch on the stakeholder groups, technical drafting committees as well as public participation?
    d. What was the legal foundation and have there been any legal challenges?
    e. Most contentious part of the ordinance? How did it evolve over time before final recommendation?
2. **Implementation**
    a. Can you talk a little bit about the philosophy behind the details?
    b. What alternatives were proposed?
    c. What types of legislative bodies did it need to get passed through?
    d. Who were the key decision makers?
    e. How big of a role did town/county/state law play?
    f. Can you talk about the staffing details? Your role, the role of individual communities?
    g. Did you help create budgets? How have these evolved over time?
    h. Can you talk about the dissemination/awareness campaigns? How did you spread the word?
    i. How have you enforced the legislation?
    j. Have there been any reviews or changes in your recommendations?
    k. Have there been any legal challenges?
3. **Results**
    a. Can you talk about the community responses?
    b. How have you measured the effects in both qualitative and quantitative ways?
    c. How has delinquency looked?
4. **Discussion/Recommendations**
    a. Any major lessons you learned?
    b. What advice would you give a county legislature trying to enact such measures?
    c. Have you thought about expanding the ordinance? Or new ordinances?
    d. Can you recommend others to speak with who can give me insights into the passage of the ordinance, implementation of the ordinance, its impact on the community and community acceptance?
    e. Can I call you back with further questions?