Public and Private Solutions to Alleviating Combined Sewer Overflows (CSOs) in New England Coastal Towns

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The towns in the coastal region of New England are saddled with combined sanitary sewer and storm sewer systems that were designed and built before the Federal Environmental Protection Laws and Agency were enacted. Compliance with the modern requirements and practices enforced by the Environmental Protection laws at the federal, state and local levels of government is proving to be a very expensive and disruptive proposition. The city of Newport, Rhode Island, founded in 1639, is an example of the problem that is being addressed throughout coastal New England. With a population of 26,500 residents, Newport is looking at a solution that may cost $100 million and require ten years to complete their infrastructure re-work. This paper focuses on reducing the requirement placed on the municipal sewer system by sequestering rain water in private residences and small businesses. If a private solution can be combined with a public works solution the requirement to completely revamp the town's sewer infrastructure and the accompanying disruption of the tourist industry, which is the major source of income for the town, may be avoided.

Keywords: CSO, sanitary sewer, storm sewer, combined sewer system

Introduction

The city of Newport, RI, has violated the federal Environmental Protection Laws (Clean Water Act – 1977) and the state version of those statutes. The reason for the violation is the combination of the sanitary sewer systems and storm sewer systems that conveys the sanitary waste to the sewage treatment plants operated by the city. During dry weather the system functions as designed and the sewage treatment plants have about 25% excess capacity to process the flow. (Earth Tech Report – Nov 2006). When it rains any appreciable amount in the city, the combined sanitary waste and storm water volumes overwhelm the sewage plants' capacity to process the flow. During these events the sewage plant operators pour chlorine into the mixed flow before it flows into the harbor and into the water close to the public beaches (Earth Tech Report – Nov 2006). This event is a Combined Sewer Overflow (CSO). After each of these CSO events, the shell fishing beds and beaches are closed. For a town that depends on tourism for its main source of revenue, this outcome is a major disaster (City of Newport – Comprehensive Land Use Plan). Newport is not alone in its status as a violator of the Clean Water Act statutes in Rhode Island. The standard set by the Rhode Island Department of Environmental Management (RI DEM) and the federal Environmental Protection Agency (EPA) is a maximum of three events of combined sewer overflows (CSOs) in a year for all of Narragansett Bay, a 30 mile long estuary that splits the eastern portion of Rhode Island from the rest of the state. In 2005 there were more that two hundred and fifty CSO events. The city of Providence, Rhode Island, is spending approximately $1.1 billion to install a thirty foot diameter sequestering tunnel under the city this year and several projects, similar in scope and cost, are planned for the northern part of Rhode Island in the Blackstone River watershed in this decade. (NBC – 2006) The City of Newport, Rhode Island, is operating under a consent agreement with RI DEM, and must embark on a project to remedy its CSO events. This paper is a preliminary

investigation of the feasibility of applying a combined public works and a private solution to the problem to reduce the cost to the taxpayers of Newport.

Newport, RI

The combined sewer system was introduced in 1855 and was designed to dry out the streets by collecting rain-water runoff, domestic sewage from flush toilets, and industrial wastewater in the same piping system. It is typical for many older cities to have a Combined Sewer System because, at the time of building the first sewer systems, the city governments thought it would be cheaper to build one system rather than two, separate systems. The problem with this combined sewer system is when there is a heavy rainfall the sewage treatment plants do not have enough capacity to handle the increased volume of storm water combined with the regular sanitary sewage flow. When there is too much storm water, the system overflows. These systems are designed with escape overflow pipes so the combined sewage and rainwater flow does not back up into the buildings connected to the system. However, the Combined Sewage Overflow is then dumped into lakes, rivers, and coastal waters. In 1994, the Combined Sewage Overflow Control policy was instituted by the United States Environmental Protection Agency (EPA). The EPA works with local municipalities to improve antiquated sewage systems. There are two main options to deal with CSOs; (1) to build separate underground pipes for sewage and storm water or, (2) to build more capacity with the original combined systems. The problem with building a separate underground system for sewage and for storm water is the high cost and complicated, long-term construction process in a fully developed, densely populated area such as Newport, Rhode Island.

Newport, Rhode Island, can be used as a case study for making conclusions on solutions for a combined sewer system in a fully developed area. Newport has a combined sanitary and storm sewer system and when any appreciable rain enters the system the treatment facilities are over-taxed which leads to unauthorized flows of raw sewage into the Narragansett Bay. This is not only a violation of the law, but the CSO directly affects some of the city's best qualities. When the system flows into the Narragansett Bay public and private beaches must be closed as well as discontinuing shell fishing in the area.

Description of the Newport, RI, Community

Newport, Rhode Island, is a city in Newport County which is located in the southeast corner of Rhode Island. It is located on Aquidneck Island, approximately thirty miles south of Providence, the capitol of Rhode Island. Aquidneck Island is located at the mouth of the Narragansett Bay estuary. According to the United States Census Bureau the city is sited on 11.5 square miles. This is distributed between 7.9 square miles of land and 3.6 square miles of water. Of the 7.9 square miles of land, approximately half (3.875 square miles) is residential property. (City of Newport) The population as of 2000, was approximately 26,500. The growth in housing in Newport can be seen in the Table 1, below.

Table 1 Newport Housing Data

Census Year	**Housing Units**	**Change (%)**
1970	11,158	
1980	11,186	0.25%
1990	13,094	17.01%
2000	13,226	1.01%

Sources of Income for Newport

The two main industries for the city of Newport are the U.S. Navy and tourism. With the reduction of the U.S. Navy presence in Newport in the early 1970s, the development focus has been on tourism. A look at Table 1 will show the decreased activity in housing unit construction following the departure of the Navy (1970 to 1980) and the resurgence in that activity as the city shifted to tourism between 1980 and 1990. (City of Newport) The CSO's are having a negative impact on Newport tourism because tourists are beginning to think that the water is polluted in Newport. Since much of the income for the city revolves around water and aquatic activities, if people think that the water is polluted, they will tend to not spend time or money in Newport. When the beaches close, people usually head to other beaches in the area, including Cape Cod, Massachusetts. The danger is that they may not return to Newport when the problem is solved or there will not be enough revenue to solve the problem if the tourists depart. The city also relies on its shell fishing as a source of income (fresh shell fish provide an attraction for the local restaurants) and the CSO's have reduced the amount of shell fishing that can occur. This is particularly critical to the fishing industry because, in order offset the declining revenues from fishing (60,223 metric tons at a value of $73.3 million in 1990 to 54,111 metric tons with a value of $72.5 million in 2000) the city is turning to aquaculture and aquaculture is not viable in polluted water. (City of Newport)

Recent History of the Problem

Over the past four summers (2003 – 2006) in Narragansett Bay about 125 beach days were lost due to consistently high levels of bacteria in the ocean water, as measured at the beaches. In the most recent summer of 2006 the beaches were closed for a total of 59 times. (The Newport Daily News 10/17/06) One main source of the problem for overflows in Newport is the Middletown Wave Avenue sewage pump station which is located at the north end of Easton's Beach, the largest public beach in Newport. The combined sewage overflow at the Middletown Wave Avenue site is dumped into the same stream that leads out to Newport's Easton's Bay, which causes the beach to be closed. However, this is not the only bay area that is affected by the CSO's. Newport's two CSO facilities are located at Washington Street and Wellington Avenue. It was reported by the City Council of Newport that they discharge millions of gallons of partially treated storm and sewage water into the Newport Harbor during periods of heavy rain. (City of Newport) It is estimated that the water is usually back to RI DEM standards after 24 hours because of the diurnal tidal changes after an overflow occurs. (Earth Tech, LLC)

Compliance With RI DEM Consent Decree

Beaches are closed after a CSO event and they are tested for the presence of a bacteria called enterococci. Enterococci come from the intestines of warm blooded animals and their presence is an indicator that there is raw sewage in the water. The Rhode Island standard for enterococci is a maximum of 104 colony farm units (CFU) per 100 milliliters of salt water. On June 7, 2006, a day that Atlantic Beach in Middletown and Easton's Beach in Newport were closed after a rain storm, both beaches were found to have 24,192 CFU per 100 milliliters of salt water. Under a consent order instituted in 1999 between the city of Newport and the RI DEM, the city must eliminate all CSO discharges from the Wellington Avenue facility and also average no more than four discharges a year from the Washington Street facility (two of the five sewage treatment facilities in the area). The policy is stricter at the Wellington Avenue facility because of its proximity to swimming beaches.

Testing Procedure When it Rains

If there is rain measuring less than one-half inch of accumulation in a day in Newport, a 200 ft. area around Easton's Beach and Atlantic Beach must be closed for swimming. If there is between one-half inch and one inch of rain accumulating during 24 hours, the entire eastern portion of the beaches must be closed and officials must take water samples from the western edge, the eastern edge, and the center of the beaches. If there is greater than one inch accumulation in a 24 hour time period in Newport, the beaches must be closed for at least 24 hours and samples must be taken at various positions on the beach. The beaches can only be reopened after the samples indicate that a count of 104 CFU per 100 milliliters of water has been achieved. If there is a discharge from the Wave Avenue sewage treatment facility (located adjacent to Easton's Beach, the largest public beach in Newport), officials must close the beaches for swimming until compliance with the limit of 104 CFU of enterococci.

Steps Taken by the Newport City Council to Comply With RI DEM Mandate

Earth Tech, LLC Role

In January of 2006, Earth Tech, LLC, received $540,000 from the Newport City Council to develop a plan that would fit Newport's need to remedy the CSO. Earth Tech, LLC, set forth a series of goals that include eliminating inflow from public and private sources.

Newport City Council Role

Concerned Citizens of Newport, Rhode Island, gathered signatures for a petition to have an initiative placed on the November 2006 election ballot. The Concerned Citizens succeeded in that endeavor and the ballot initiative that bans new sewer connections in the city until the city is in compliance with the RI DEM regulations on CSO discharges for three consecutive months was placed on the November 2006 ballot. The Newport City Council of Newport was against the moratorium on sewer connections because the city is already well developed and there are not enough new sewer connections per year to have a drastic impact on the existing CSO status. The Newport City Council also argued that the moratorium would deter new growth in the city, and the increased tax revenues that accompany new growth. The initiative passed in November 2006, by a comfortable margin. (Newport Daily News)

The Newport City Council is seeking ways to pay for the cost of each overflow event. One option that the Newport City Council contemplated during November 2006 was to add $45 onto a Combined Sewer Overflow fixed fee for the current fiscal year. Even if every housing unit owner paid the $45 surcharge it would generate a maximum of about $1,200,000, and still not address a permanent solution. A more realistic estimate of the revenue generated from the surcharge is $595,170, which is based upon an estimate of 13,226 sewer connections in the city (City of Newport).

A second option that the Newport City Council has been exploring in order to help curtail large debts due to the CSO is renegotiation of the sewer contract with the neighboring town of Middletown. Middletown uses part of Newport's sewer system and pays an amount that was fixed in a ten year contract that ended in November 2005. Unlike Newport, Middletown has experienced rapid growth in the last decade. A problem with the contract is that Middletown pays a rate set in 1995, and the rate does not cover the costs associated with the amount of sewage and storm water Middletown is sending to the Newport combined sewer system for processing.

The Newport City Council is also looking at a third solution which involves installing a large pipe into Easton's Bay that would carry storm water away from Easton's Beach and Atlantic Beach (minutes of Newport City Council meeting November 21st, 2006). The City of Newport has currently contracted with a local company to study the tides and currents in order to decide the feasibility of the idea. Newport needs extensive information on how dumping mass amounts of storm water into the ocean will affect the shore, sea-life, and other beach-goers. Initial reactions from the RI DEM have been unfavorable. RI DEM feels the city of Newport is just moving the source of pollution, instead of solving the problem. (Newport Daily News)

Citizens' Role

In the early part of 2006, a group of Newport residents thought that the RI DEM should take additional action in order to end CSO discharges in Newport. The group lobbied for months to gain enough signatures to put a referendum on the November, 2006, ballot. The referendum states that no new sewer connections will be allowed in Newport beginning on January 1, 2007, until the city of Newport complied with the RI DEM wastewater discharge permit. The moratorium would be lifted after the city is in compliance with the RI DEM wastewater discharge permit for a period of three, consecutive months. The moratorium was passed by voters on November 7, 2006. A problem with the moratorium is, since no new sewer connections will be allowed until the city is in compliance with the RI DEM, certain building lots have been re-categorized as "un-buildable". If lots are considered "un-buildable", the lots must be revalued at a lower tax basis, causing as much as $700,000 in lost property tax revenue because the classification of the lots has changed. This loss of revenue more than offsets the $45 per annum surcharge considered by the Newport City Council to be levied to pay for the CSO events which puts the Newport City Council behind in gathering revenue to fix the problem. (Newport Daily News)

Some Newport citizens are taking matters into their own hands in a different way than the political system. A group of surfers and other beach enthusiasts are conducting water sample tests of their own in order to determine what is in the water. Major concerns of these groups of people are for their personal health while they are in the water, and the health of their families. The group is called Clean Ocean Access and this group is in favor of testing year round to find out specific sources of pollution so they can report it to state officials and have these sources investigated and solved. The money that the Department of Health gives the city of Newport to run testing is only enough to do testing during peak summer months. However a liaison between the Clean Ocean Access and the RI DEM has convinced the RI DEM that year-round testing is necessary. The members of the group wade in the ocean water and collect samples from approximately 10 different locations. While the state is currently paying for the actual testing, it was up to the Clean Ocean Access to purchase all the other necessary materials.

Preliminary Earth Tech, LLC Study Results

Earth Tech, LLC, a Tyco International Ltd. Company, is studying the CSO in Newport and developing a plan of action for the Newport City Council. Earth Tech, LLC, has held two town meetings to educate the local public on the progress of the study. The second interim progress report shows a schematic of the work that has taken place from February of 2006 to a projected schedule through January of 2007 (minutes of Newport City Council meeting, November 2nd, 2006). Some of the work being performed includes a closed circuit television monitor in the sewer system and, in particular, the Thames Street Interceptor. The Thames Street Interceptor is a 3 foot x 4 foot x 6,200 foot long major brick sewer artery that runs most of the length of

Thames Street in Newport, and was built before 1904. Thames Street is important because it is a major tourist destination during each summer season (Memorial Day through mid-October). Earth Tech, LLC, has also conducted flow metering in certain catchment areas, manhole inspections, smoke testing, flow isolation testing, house to house surveying, dye testing, and "windshield" surveys. Earth Tech, LLC, is also constructing a hydraulic model in order to evaluate the system of drainage. These efforts are reported in the CSO Control Plan Report. Some of the discoveries on the Thames Street Interceptor include that the interceptor is in relatively good condition, that there is a small amount of clear running water from the side street sewers that cross into the interceptor through leaking or missing bricks and that the sewer is pierced by pipes of unknown origin throughout its length. Earth Tech, LLC, also recommended a plastic slip liner for a long term solution to prolong the life of the pipe. In some of the catchment areas they found that an appreciable amount of wet weather inflow is entering the sanitary sewer. However, this is different from infiltration (leaks from outside ground water), of which no significant instances were noted. Earth Tech, LLC, recommends house to house surveys, smoke testing, and dye testing in a particular catchment area (Catchment Area 6) to further classify inflow causes to the sanitary system. While studying the over 400 manhole covers in the district Earth Tech, LLC found that the manhole covers cause very little leakage into the combined sewer system and nothing out of the ordinary was found during their survey. Earth Tech, LLC, recommended replacing perforated manhole covers and further examination of some of the pipe crossings.

While performing smoke testing, Earth Tech, LLC, found specific private and public sources of storm water inflow into the sewer system that contribute to CSO. The private sources include yard drains, floor drains, foundation drains, sump pumps, and, most typically, roof leaders. Some of the public sources are defective manhole covers, sewer manholes, catch basins, and storm drains. Earth Tech, LLC, located a total of ninety-one illegal connections into the sanitary sewer system which includes sixty-five private sources and twenty-six public sources previously mentioned. Earth Tech, LLC, recommends notifying private property owners of their illegal connections of rain leaders as well as reconnecting catch basins to the storm drains. All of these findings are to be submitted in a report to the RI DEM by January of 2007. The report also recommends that construction begin by the middle of the 2007 calendar year. During the presentation of their initial results, a representative of Earth Tech, LLC, gave an "upper bound" estimate to rectify the problems presented by the combined sewer system of $100,000,000. (Earth Tech, LLC)

Potential Private Solutions to Alleviate the CSO Volume

Newport can be divided into two sections for the purpose of analyzing rainwater contribution to the combined sewer system. The area surrounding the harbor on the west side of the island (vertical section, about 4 square miles) is the densely populated area where sequestration of water is necessary for a positive impact on the storm water surge problem. The less populated (horizontal section, about 3.9 square miles) of Newport, generally in the area of Ocean Drive, is not a problem because this area has larger residential lots, grassy areas for the rain to be absorbed back to the water table, and no connection to the combined sewer system.

The residents of Newport are in a dilemma. Their options are limited and the city is facing a major sewer replacement project that may cost each resident of Newport $3,700. A family of four, with an average income of $54,116, would be facing a bill of $14,800, if paid over a single year or $1,250 per year for twenty years, if paid as a twenty year bond amortized at 5%. An alternate calculation would be to divide the cost of the project by the total number of residential

units. The best estimate is taken from the 2000 census data and shows 13,226 housing units (Table 1 Newport Housing Data). Using this figure, the cost would be $7,560 as a one time charge per housing unit or $626 per year per housing unit if paid as a twenty year bond amortized at 5%.

Also, there is the consideration of lost tourism revenue during the construction process. As each sewer is reconfigured, the roads will be closed to traffic and to parking. Every summer the population of the town more than doubles as the tourists arrive and parking is at a premium (a monthly average of 41,666 inquiries per month at the Gateway Tourist Center in Newport), not to mention added difficulty in navigating the narrow streets that were developed for pedestrians and horse travel. The density of vehicles is approximately 1.05 vehicles per resident in Newport. During the peak tourist season (April through October) it is estimated that one additional vehicle per every 2.5 visitors is added to the traffic flow. The housing stock in Newport was developed long before the automobile was even a concept and "on street parking" is the norm. (City of Newport) The addition of the visitors' vehicles makes negotiating the streets difficult and restricts the ability of the Newport Fire Department to reach the scene of a fire. Parking is at a premium and the city collects about $800,000 ($25 per parking ticket) during the April through October tourist season as a result of illegal parking. (City of Newport) Any major rework of the sewer system will have a major negative impact on the flow of tourists to the city by exacerbating the congestion. Under the consent agreement with RI DEM, the CSO problem must be corrected in a timely manner. The only option considered, to date, is the standard public works option, i.e., fix the sewer system to accommodate all the storm water and all the sewage flow.

There is another option that opens up alternatives for the residents of Newport. Personal sequestering systems are used in common practice all over the world in dry regions, specifically Australia, where the water is in limited supply, and in places that are not so dry, such as Belgium, where the cost of potable water is dear.

The sequestration systems can be as basic as a storage tank that feeds off the down spout of the roof gutters, to as complex as becoming part of the housing unit water distribution system (gray water systems).

Impact of Individual Sequestration

During a rain storm, the majority of the storm water that falls on the residential and commercial areas of Newport passes through the Newport sewer system. (Earth Tech, LLC) The rainfall mixes with the sewage that already present in the system. In a worst case situation, about 3.25 inches can fall in a severe rain storm during a single day and roughly 1,620 gallons of rainwater are transferred to the ground per 1,000 square feet of roof area during that period. (City of Newport)

In a worst case scenario it will rain about four inches in five days. The roof will deliver up to 80% of that to the storm sewers, and 20 % is lost to absorption. The months of March and November have the highest average rainfall of about four and one-half inches. In a worst case scenario there will be 868 gallons of rain water in one day. For the first ten minutes of rain the water would not be directed to the sequestration tank. Instead, approximately 7 gallons would be used to clean the roof before the water is collected and recycled in a sequestering device.

This sequestration will be a tremendous relief on the CSO because it will reduce the rainwater entering the storm drain system by up to 50%. This calculation is supported by an analysis of

School Street, located in Catchment Area 6, a typical street in the 3.8 square mile residential area of Newport. The following data were collected from survey measurements of School Street and the property tax records of the city of Newport.

Table 2 Housing and Lot Data From Newport, RI, Property Tax Rolls

Address	Roof Area	Lot Area	Net (uncovered) Area
1 SCHOOL ST EXEMPT PORTION	1,418 s.f.	15,246 s.f.	13,828 s.f.
10 SCHOOL ST	1,098 s.f.	3,920 s.f.	2,822 s.f.
15 SCHOOL ST	965 s.f.	3,049 s.f.	2,084 s.f.
2 SCHOOL ST	1,664 s.f.	2,178 s.f.	515 s.f.
20 SCHOOL ST	1,483 s.f.	5,227 s.f.	3,744 s.f.
21 SCHOOL ST	1,361 s.f.	4,792 s.f.	3,430 s.f.
22 SCHOOL ST	4,910 s.f.	10,454 s.f.	5,544 s.f.
25-29 SCHOOL ST	1,305 s.f.	2,614 s.f.	1,309 s.f.
31 SCHOOL ST	1,553 s.f.	3,485 s.f.	1,932 s.f.
32 SCHOOL ST CONDO	3,277 s.f.	3,485 s.f.	208 s.f.
39 SCHOOL ST	1,171 s.f.	3,485 s.f.	2,314 s.f.
40 SCHOOL ST	1,571 s.f.	7,405 s.f.	5,834 s.f.
41 SCHOOL ST	1,136 s.f.	4,792 s.f.	3,655 s.f.
49 SCHOOL ST	1,002 s.f.	2,178 s.f.	1,176 s.f.
50 SCHOOL ST	6,067 s.f.	6,534 s.f.	467 s.f.

The area of the paved street and sidewalk is 35 feet x 420 feet = 14,700 square feet. The housing on School Street is situated at the street side of each lot (no setback), providing no front yard buffer. The gardens in the rear of each dwelling are very small, as shown by the column giving the net, uncovered area on each lot. Since each dwelling used to have an outhouse, the ground is sloped to drain to the back of the lot. Thus, the total area collecting rain and conveying it to the storm drains is composed of the street-sidewalk, totaling 14,700 square feet, and half of the roof area, totaling 29,981 square feet / 2 = 14,991 square feet. The combined total of these watershed areas is 29,690 square feet. School Street will contribute about 18,508 gallons of storm water per inch of rainfall. If the rain collected from the roof is sequestered, the contribution of School Street to the storm drain system will be reduced to 9,163 gallons per inch of rainfall, a reduction of 50.5%.

The introduction of private sequestration would reduce the problem of handling the rainwater run-off and diverting it from the sanitary sewer system. The question is, would the introduction of private sequestration of storm water reduce the public works re-work of the combined sewer system enough to warrant adding it to the total solution of the CSO problem?

Cost Calculation

If the households of Newport were to use the collapsible tanks to collect the rain water from their roof then the cost would be minimal compared to other solutions. A collapsible tank is essential because installing it in the basement requires passing through the narrow doors and stairs that are prevalent in the housing units of Newport but no where near stairways and doors required by modern building codes. A suitable size tank would cost each homeowner about $1,179 (1,140 gallon capacity). It will also cost the homeowner about $150 in PVC piping to route the water

from the gutters to the collapsible tank in the basement. So the homeowner would incur a total of the $1,350 in materials and probably an additional amount in labor, if contracted out, to complete this project, for a total of $2,700. (WaterTanks.com)

Economic Incentives

Economically this is a viable system for the housing unit owners of Newport. Although they need to spend up to $3,000 to install a system, money will be saved by recycling the water that is collected. Since the water that is collected can be reused throughout the house in appliances, such as dishwashers, washing machines, flushing toilets, and lawn watering, homeowners will save money on their water bill and their sewer bill since the sewer charge is tied to potable water consumption. Each homeowner will have to decide if they want to spend the extra money to route feed pipes to their lawn watering system (cheapest and easiest), washing machine (cheap connection because it is usually located in the basement), the dishwasher (usually accessible from the basement), and the toilet (often most difficult because of the confined space in the plumbing chase). If none of these options is desired, the water can be eliminated from the tank by pumping it back into the storm sewer system when the weather permits. During drought conditions in the Midwest, it is not unusual for the municipalities to control lawn watering through local ordinances and public education. Using the same techniques for notification, the city of Newport could regulate the flow of sequestered rainwater back into the city sewer systems during dry weather.

Conclusion

Using the calculations for revamping the sewer system of Newport, the capital investment could be recovered by each housing unit owner in as few as ten years (assuming the capital project would be reduced from $100 million to $50 million). At this stage of the study being conducted by Earth Tech, LLC, there is no firm estimate for the project. The $100 million price tag was offered by the representative of Earth Tech, LLC, when pressed for a "number". The "number" for the project is not as important as the method of solving the problem. If the city of Newport is required to close off significant portions of the city from the tourists for a year or two, and overload the traffic and parking in the parts of the city that are not undergoing repairs, the economic impact on the tourism industry and the city revenues may be catastrophic. The rough, "back of the envelope" calculations provided in this paper indicate that the option of private sequestration of storm water merits further investigation and inclusion in the planning process for complying with the RI DEM consent agreement. The city is fully "built out", as indicated by the City Council arguments presented against the run up to the November election. (Newport Daily News) The solution to upgrading an aging sewer infrastructure problem to comply with 21st Century environmental requirements and to not destroy the sources of revenue for the community in the process will have to be a creative one that elicits full support of the community. Anything less may lead to political gridlock.

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