To: The Rockland Water Coalition

From: Albert F. Appleton

Re: A Report on the Proposal to Meet the Future Water Needs of Rockland County by Building 7.5 million gallons a day (mgd) of capacity on Haverstraw Bay to desalinate Hudson River water for drinking water purposes and whether a viable demand side alternative to it exists.

Date: September 23, 2013

Disclaimer

The information and conclusions in this report have been compiled, in part, by reference to and review of much of the work that has been generated in the six plus years since the desal plant was first proposed. Please note that none of the references herein to such information is meant to imply that either the Rockland Water Coalition or any the sources referred to agree with the recommendations and conclusions herein. They are solely the work of the author and are provided to the Coalition, at the Coalition's request, for the Coalition's consideration and use.

Introduction

As a former Commissioner of the New York City Department of Environmental Protection, in which capacity I served as the Director of the New York City Water and Sewer System, with experience in solving a water supply crisis for New York City through a comprehensive program of water conservation, and as currently an environmental consultant on issues of sustainable water resource management, and as a recognized expert in using market measures to address environmental problems sustainably, I have been asked by the Rockland Water Coalition (the Coalition) to do an overview analysis of the proposal above, which is commonly referred to as the "desal plant". This document contains the conclusions of that review. It is important to note that this document is submitted to the Coalition at a time of considerable turmoil and new developments in the desal debate, which have resulted in the focus of the debate shifting and expanding. This author was asked to do a review of alternatives to the desal plant and this report focuses on those. However, that alternative discussion must be seen in the overall context of how the desal debate has shaped up and evolved and the conduct of the public agencies (most importantly, the New York State Public Service Commission (PSC) and the New York State Department of Environmental Conservation (DEC)). Thus, this report opens with an overview of the desal issue.

The Desal Debate: A Current Overview

If the right decision about meeting Rockland County's future water needs is to be made, then it will be important to recognize the structure of the debate over that question. As that debate has evolved, it has four component questions.

The first question is what is the future demand for water in Rockland? The second question, on which this report focuses, is assuming the 7.5 million gallons a day of water (mgd) which the desal plant would provide is the correct measure of future water need, is the desal plant the only way to meet it, or are there better alternatives, faster, cheaper and with fewer adverse consequences? The third question, which so far very few have recognized, is whether or not the desal plant will, in the end, be an economic white elephant. And the final question is whether or not the planning process that has been undertaken to date, in private sector terms the due diligence, has been of the detail and depth required for a project of this size and impact.

A brief discussion of each question is in order.

i. Future Demand for Water

The desal plant is designed to meet a future demand of an additional 7.5 million gallons a day (mgd) of water. Critics of the desal plant have raised issues about that figure and the 2006 analysis that supported it, but most of the public debate in recent years has been about whether there are better alternatives than the desal plant to meet it. Recently, however, the New York Public Service Commission (PSC), bowing to public concerns as to how they were addressing the issue, has opened a new process to review the issue of future demand or water for Rockland County. This has put the issue of Rockland's future need for water back on the table.

The principal challenge to the PSC's 2006 conclusion that there is a need for the new water supply that the desal plant would provide is that the actual water demand over the last five years has fallen significantly below projected demands, suggesting that the need for new water has been considerably overstated. In its submission of August 19th, United Water of New York (UW) argued, in essence, that these variations between demand projections and actual demand were statistical blimps, caused by economic conditions and other exogenous factors over the last five years and did not discredit the demand projections that support the desal proposal. Critics argue that actual observed demand represents a significant change in the pattern of Rockland County water use and, at the very least, give the PSC and Rockland time to sit back, evaluate the extent of future increases in demand, and carefully consider what is the best way to meet future water needs. This paper does not take a position on whether or not the current demand projects represent a significant long term change in forecasted demand, but it does strongly concur that, given the size of the shortfall in projected demand, the conclusion that there is time for a far better and more rigorous planning process is indisputable.

Here, four important notes need to be made. First, as stated above, there is an initial question of assessing future water demand, followed by the obvious question of what are the best alternatives to meet it. However, many of the alternatives discussed in the context of meeting demand are, in effect, also measures that could be used to calculate demand. For example if, as suggested in this report and by many others, Rockland has the ability to utilize significantly more water from DeForest Reservoir, is that an alternative to meeting demand or does that surplus water go to reduce the demand for new future water. If, additionally, water conservation and better system management could significantly reduce water waste, is

that saved water an alternative for meeting demand or, by lowering water use, does it also reduce the need for a new water source. If changes in water pricing could significantly alter the demand for water, does that reduce future need for water or is it an alternative to meeting it? If other regional water providers have surplus water that Rockland could utilize, does that reduce future need for new water or is it an alternative to meeting it? Much of the debate over whether there is a need for new water gets lost in the weeds of these semantic questions. It will be critically important that the PSC process, which is stated to be a review of the need for a new water source, does not do so, but focuses on holistic assessment of the future management of Rockland County's water needs, and creates a unified planning vocabulary with commonly understood terms to do so.

Part of the problem with this debate, is that the current need analysis has been based on trending forward projections derived from past patterns of water use, ignoring the dynamic nature of the interactions of the many factors that can shape water demand. Many of the analyses that conclude there is a need for a new source of water rely on projecting forward past water use trends, without considering two critical variables. First, at a time of unprecedented climate change, due to global warming, the assumption that the past will predict the future of water use has never been shakier. Colorado's currently unprecedented, and unprecedently devastating floods, coming on top of a period of unprecedented drought are only the latest illustration of this fact. It highlights two concerns, first, a greater margin of water safety may be needed, making reliance on highly expensive additional supply projects a dangerous course to be committed to and, second, solutions which conserve water and lower water demand will provide additional resilience for the future. Second, Rockland County is also going through a period of significant economic change, including unprecedentedly high water rates, all of which will factor into determining the future demand for water.

Third, and directly relevant to that point, is that the impacts of water prices upon water demand have not been considered. In economic terms, it is an oxymoron to talk about demand for a product without also talking about its price. As discussed below, there will be major price spikes for Rockland County water users. For any decision maker to assume that Rockland County homeowners and water users are going to passively ignore prices that will significantly impact their total household expense and their level of discretionary income and continue to use water at the same volume irregardless of price is to defy economic theory, common sense and observed experience. In fact, it is a fair question as to whether or not the experience of the last five years when water use has fallen significantly below projected demand is directly related to water price increases, combined with other pressures on the cost of running a household being experienced in Rockland County, including rises in local taxes, that have put a premium on reducing household expenses. It can never be forgotten that these responses to price increases cannot be parsed, for they all come out of the same pocket and, to the homeowner, it is the cumulative total that matters.

Moreover, to drive the point home further, targeted water price increases are often a tool of water demand management. It cannot be stressed enough that any analysis of the future need for water in Rockland that does not factor in the already high level of Rockland water rates and how they will increase, is not going to give an accurate assessment of future demand. A

simple trending forward projection that assumes that the average Rockland water user is going to passively ignore the impacts of rising water costs on his household budget will not reflect reality.

Thus we come to the fourth point on looking at future water demand. Given the level of expenditure that is being considered for the desal plant, it must be observed that, in discussing water demand and future water needs, the PSC must ensure that the proper homework is done. While it would be legitimate to use traditional trending forward of past water use patterns to assess Rockland County's future water needs and to use such a one dimensional analysis as a check on other planning work, clearly what is needed is a far more sophisticated and dynamic planning process that incorporates price, better utilization of existing water supplies both locally and regionally, the incorporation of the work of USGS and others suggesting more availability of groundwater, an assessment of water waste and how much reasonable conservation measures similar to those implemented in other jurisdictions could save, and the risk levels associated with actual and potential drought management policies, instead of just rotely applying existing safe yield numbers to assess drought vulnerability. Without such a study, there is no reliable way for the PSC, UW and other Rockland decision makers to identify in any kind of dynamic framework Rockland's future water demands and what measures will be the most cost effective way to meet it. Fortunately for Rockland, the failure of water use in recent years to meet the 2006 former demand projections and the PSC's recognition that the past planning process has been flawed and needs to be revisited, gives Rockland both the time and the opportunity to get the issue of determining Rockland's future water needs right.

Fifth and finally, though there are parties, most notably the Rockland County Executive leadership, that while recognizing the complexity of the issues surrounding the question of future water demand, still feel that the prudent conclusion is that Rockland in the future will need additional water, it is important to note that such parties have also clearly stated that to state a need for additional water is not to state a need for the desal plant, only the need to assess what are the best alternatives available to Rockland County. This is a critical point that has to be stressed, for there has been a tendency in the public debate, one this author feels is clearly manifested in the August 19th submission of UW to the PSC, for supporters of the desal plant to assume that once a demand for future water is shown, that means that the desal plant is needed to meet it.

That is by no means the case. As the County Executive has often observed: to recognize a need for new water does not mean that the desal plant is the right way to meet it. Moreover, this author would point out that if, among those concerned with long term Rockland County water needs, there are differences in assessing long term demand, than the easiest way to resolve them is with a program that covers all foreseeable contingencies. That is the approach taken by this paper. Without concurring in the conclusion that there is a future need for 7.5mgd of new water in the time frame used by the desal proposal, this report takes the 7.5 mgd it would provide as a planning target, and asks whether there are alternatives that can provide it. Not surprisingly, compared to sinking over $150 million into the desal plant, there are.

ii. Alternatives to Meeting Future Water Needs

Much of the debate over the desal plant in recent years has focused on the question of alternatives to it, as proponents such as the Coalition have phrased it. However, as noted above, many of those alternatives could, with equal justice, be seen as reducing future demand or need, so to discuss future water need or water demand, outside the context of alternatives, or to draw an artificial distinction between demand and alternatives to meeting would be an exercise in formalism, one that it is hoped the PSC will make every effort to avoid getting sucked into. Moreover, that is not how the world works. One is hard pressed to think of an example, in either public or private life, where the identification of a problem, in this case future water need or demand, is not immediately followed by and linked to a discussion of what is the best and most cost effective way to meet it. Thus the language of the PSC order establishing the hearing on demand is worrisome for it seems to suggest that one can intelligently discuss the question of demand outside of the context of the many dynamic factors that affect it or the alternatives available to meet it. The sole concern of the PSC should be to determine if UW is, and has followed, the most prudent and necessary course, in discharging its obligation to provide Rockland Country water users with adequate, reasonably priced water.

One must note that the PSC's institutional role is to ensure that utility customers have reliable service and pay only such costs for such service are prudent and necessary. What the PSC should do is to order the kinds of planning studies needed to systematically and comprehensively assess what is the best alternative to meet any future water needs Rockland County may have. It is particularly important that the PSC, in its oversight role over water charges to UW customers, fully review the claim of UW that the desal plant is the most cost effective option for meeting Rockland's future water needs. This seems an extraordinary claim, given the projected cost of the desal plant, its already unprecedented pre-construction costs, and the fact that it is the major contributor to the doubling of water rates that Rockland County would experience. The PSC has wisely created an opportunity that it must use now to make sure such claims are fully vetted and reviewed.

If they do so, they will discover that, as this paper will demonstrate, far more cost effective alternatives exist, at a far lower cost, with far fewer environmental impacts and far more benefits and that concern for the reliability of Rockland County water supply and the pocketbook of the Rockland County ratepayer, dictates their adoption.

iii. Will the Desal Plant Be an Economic White Elephant

The third element of the Desal plant issue is the question of whether the Desal plant will become an economic white elephant. When this author first reviewed this issue, nothing struck him more strongly than the fact that the public discussion of the desal plant did not include any assessment of what the costs of the desal plant would do to water demand in Rockland County and the implications of those demand effects on the economics and prudence of the desal plant solution. Since then, members of the Coalition, have been looking at the issue and discovered a wide range of instances, many from Australia (which in the last decade in response to the brutal droughts that culminated in 2007, rushed out and

built a generation of desal plants, only to find when the rains returned that the plants, costing in the hundreds of millions of dollars, had little if any economic value), but also a very telling instance from Brockton, Massachusetts, which built and then suffered a huge loss on a desal plant that turned out to be unnecessary. The reasons so many desal plants have turned out to be bad investments can be easily explained. Desal plants generally represent a major eight or nine figure capital investment that once it is made you are stuck with. Now, to recover that investment, it is generally necessary to run the plant 24/7 and sell the entire output of the plant. But if that output is not needed, or can be obtained more cheaply through other measures, than the water will not be bought, the value of the investment is lost and the plant becomes an economic white elephant.

Many have referred to this problem as stranded investment, but that is only partially correct. The term comes from the generation of garbage to power municipal waste burning incinerators of the 1980s and early 1990s, which were financed with loans (known as project finance) that were tied to that plant and to be repaid by the plant's income. Unfortunately, that income was often overestimated by assumptions on the amount of garbage to be burned that the growth of recycling undercut, leading to the investors in those plants having their loans stranded without hope of repayment, producing widespread political controversy and attempts to pass laws requiring delivery of enough garbage to the plants even if it could be recycled more cheaply so the cost of the plants could be recovered. It is worth remembering that Rockland County considered building such a facility, only to back away from it after carefully assessing the potential for recycling. But the Rockland desal plant will not specifically depend on funding derived from the revenue from the water it processes. Instead, it seems safe to predict, that the PSC will add the costs of the desal plant to the bill of the Rockland ratepayer, whether or not the plant is needed.

The irony is, in all likelihood, the rate increases needed to cover the plant's cost will, almost certainly, eliminate the need for the plant.

As noted above, to discuss demand without discussing price is an impossibly unrealistic exercise. So the question must be asked, what impact will the plant have on water prices in Rockland and what impact will that have on water demand? UW is currently asking for a rate increase of 28.9% over current rates, reaching a level that, even averaged over three years, will give Rockland some of the highest water rates in the United States. In addition, they are seeking to incorporate some $56 million in what they call preliminary costs for the plant (This report is not the place to discuss it, but speaking from the author's experience in supervising $3 billion in water infrastructure construction for New York City and earning his agency the Infrastructure Institute's designation as New York's most effective infrastructure construction manager, that an amount represents a percentage of total project construction costs that is practically unheard of for a project that has not yet acquired its site or put a shovel in the ground.). This rate increase would be in addition to a previous rate increase for preconstruction costs and is estimated to add another 26 to 45% to the water rates. Taking both rate increases together, the result will be an immediate water rate increase of 55 to 73%. Then there is the amount for the $100 to $150 million that would be incurred in actual desal plant construction. Though estimates vary of the ultimate impact of those costs, and though, however implausible it seems, there is apparently no systematic study on the long term rate

impacts of building the desal plant, it seems safe to say that at the end of this process the Rockland Country water ratepayer will see his water rates go up at least 100% or at least double what they are now.

How will that impact water demand? As stated above, apparently, no systematic and impartial cost, demand modeling has taken place. But economic theory gives at least some clues, through a look at potential water price elasticity. Elasticity is an economic concept that attempts to measure how demand for a product responds to changes in price. It is normally expressed as a percentage function. A product where demand fluctuates in phase with changes in price or available income, such as dining out, is considered highly elastic. A product where demand responds much more slowly to price changes, because it is something people cannot do without, such as diabetic medication, is considered to be inelastic. Elasticity is normally expressed as a ratio, for example if product has a .5 elasticity it means that for every 10% increase in price, demand will drop 5%.

A rigorous analysis of price elasticity of water is a complicated process and beyond this paper or its resources. Water as a product has both an inelastic component, and a highly elastic component, to its demand. The demand for water for basic household functions, drinking, cooking, cleaning, toilet functions, is relatively inelastic, unless addressed by incentives to adopt more water efficient fixtures. Still, a certain amount of water use is necessary and basic to every household (This fact, incidentally, why sophisticated ratemakers do not use across the board rate increases to promote water conservation, because such increases unfairly target non-discretionary water use.). On the other hand, there are other water uses, in industrial and commercial applications, in residential outdoor water use such as lawn watering that are highly elastic, for they can be safely cut back or have alternative practices substituted.

There is substantial research on the impacts of costs such as those of the desal plant on water demand (See, for example, the work of Upmanu Lall, Director of the Columbia University Water Center, or information prepared by economist Sue Holt, Research on Price Elasticity, particularly the tables on pp. 13 -14.). These document price elasticities of .4 to .6 in the water area. As noted above, with the desal plant, future water rate increases are likely to be in the 100% or more range. But, in keeping with the conservative philosophy of this paper, instead of applying a price elasticity of .4 to .6 to Rockland water demand, this paper will analyze what would happen with an elasticity of .3. At that level of price elasticity, water demand in Rockland would go down by 30%, or, on a base of 30 million gallons a day, roughly 9 mgd or considerably more than the same 7.5 mgd the desal plant would provide. Use an even more conservative elasticity rate, .2, and water use still declines 20%, or 6 million gallons a day, making the desal plant, for all intents and purposes, economically useless (whatever one thinks of water conservation and other demand side alternatives, no one can doubt that they could generate the last 1.5 mgd needed to match the desal plants 7.5 mgd) to Rockland County.

In short, building the desal plant will have the incongruous result of eliminating the need for building it, making it a classic white elephant with its close to $200 million price tag. There is only one way out of this dilemma, a dilemma that the PSC, with its obligation to protect

the interests of Rockland's ratepayers, now has to recognize and resolve. That course is to find an alternative package that meets Rockland's water needs.

Put a different way, the desal plant, if built, would likely become a classic example of the law of unintended consequences, as have so many other desal plants worldwide. It puts one in mind of the classic comment from the iconic movie "War Games", "The only winning move is not to play."

iv. UW and the Obligation of Due Diligence

Lastly, before turning to the question of the specifics of alternative demand side measures to provide the 7.5 mgd the desal plant would provide, the author would like to make some observations on the planning process to date. In his work in China and Latin America, the author has often been involved in the debate on public versus private water supply that is raging across the infrastructure world. In that debate, there are generally two reasons put forward to argue superiority of private sector solutions. The first is superior access to capital; the second is private sector management expertise. It is this latter argument that has particular relevance to the desal debate and the question of its alternatives.

A key private sector concept is due diligence, the process of review that a company is supposed to engage in before embarking on a major investment decision. Due diligence implies that the rationales and factual basis of a project will be checked, its legal underpinnings reviewed, its practicality and timelines checked for feasibility, and a rigorous financial analysis of the project and its impact on both shareholder and stakeholder values analytically determined. One of the major obligations of a company's Board of Directors is to ensure that due diligence is properly carried out.

One would have expected that UW would have taken this obligation particularly seriously before making a $200 million investment in a project that would so drastically raise the price of its product to its consumers. One would feel entitled to assume that UW would have wanted to find any path that would have reduced the cost of meeting whatever need it saw for new water and that it would have been keen to reduce the cost impact of those solutions on its customers. But there is no evidence that such was the case. Instead of an extensive process of due diligence that would have systematically looked at both demand projections and alternatives to meeting them, UW apparently came forward with a proposal for the desal plant with roughly one month after the PSC directive on new supply and since steadfastly and doggedly refused to do any systematic consideration of the many questions about alternatives and cost impacts raised by the Coalition and other Rockland County legislative leaders and stakeholders. Even its submission of August 19th of this year to the PSC is essentially dismissive of any suggestion that its consideration of the desal plant has in any way been unwarranted or incomplete.

It is difficult to understand why UW did not undertake a number of obvious planning studies and work with various stakeholders to systematically assess the alternatives they were proposing. Not only did due diligence dictate they should undertake such analytic work, but given the kinds of consumer resistance that UW, with its experience in the water business,

could reasonably have foreseen to the level of rate increases the desal plant would generate, one would imagine that a responsible water utility would have wanted public participation in its planning process so that the need for the kinds of rate increases the Rockland County ratepayer is facing would be understood and more likely to be accepted.

The cost of the necessary studies that a prudent water utility would have undertaken to address this problem, even assuming they would be funded at a level beyond the dreams of consultant avarice, would be maybe $3 million tops. The time period to properly complete them would have been no more than twelve to eighteen months. Compared to the over $150 million cost of the desal plant, or the $56 million the UW in its PSC submission claims it has already spent and the six years the issue has been pending, the failure of UW to do proper due diligence is palpable. In fact, it is practically a textbook case for why companies should do due diligence in the first place.

UW's failure to aggressively carry out the due diligence this project should have received requires one more comment. One of the arguments for public management of water service is greater transparency and accountability. It must be said that it is difficult to imagine that, if Rockland County had a public water authority, such an authority would have ignored six years of growing public outcry, refused to spend what, in terms of the cost of the desal plant, would have been a nominal sum on the sophisticated analytics needed to address it, or been so willing to opt for a course that meant imposing a 100% water rate cost increase on Rockland County water users.

Hopefully, in its new proceedings, the PSC will take whatever steps are necessary to ensure that both the issue of future demand and the issue of alternative ways to meet it are rigorously and comprehensively addressed.

With these preliminary discussions completed, this paper now turns to its central question: whether there is a readily available set of alternatives that would provide the 7.5 mgd of water the desal plant would provide.

Supply Side v. Demand Side Solutions: A National Water Resource Debate

To set the stage for that discussion, it is important to recognize that the debate over the desal plant in Rockland County needs to be seen in the broader context of a full-fledged and ongoing national debate over water resource strategy. It is a debate that, in various iterations, has become commonplace in the last quarter of a century in water resource management all over the United States, and indeed worldwide. What has become the central issue of all modern water resource management is whether to use a supply side strategy or a demand side strategy to solve water resource problems.

A supply side strategy, which the desal plant embodies, generally seeks to solve water management problems, such as how to meet future water demand, through solutions that add capacity, or supply. These solutions tend to be new facility oriented, emphasize capital construction (and capital expenditure), utilize the institutional skills of water engineers and tend to dismiss the environmental consequences of such new facilities as a necessary tradeoff for the

water resource benefits they will provide. Supply side solutions dominated most of the 20th century in water management, as America rushed to meet the need for more infrastructure to support a rapidly growing and urbanizing society. The traditional organization of water utilities, which evolved in that era, was designed to promote the effective implementation of supply side solutions through creating institutions that embodied the specialized and narrowly focused expertise needed for a successful program of physical infrastructure planning and construction.

But in the last quarter of a century, since roughly 1990, there has been a growing interest in what are called demand side solutions, which emphasize solving water resource issues through programs of wise resource management. A program of water conservation, such as that which New York City used in the early 1990s to meet a water supply crisis, is a demand side solution. However, it is important to note that the term demand side should not mislead readers into thinking that the only demand side solutions are conservation solutions. A demand side solution is a solution that focuses on better use of existing resources, instead of the creation of new ones. This can include better management of system water, better use of natural infrastructure, and a whole host of management measures such as utilizing waste water or stormwater, or tapping into surplus water from other sources. In the case of Rockland County, a demand side solution would not only include water conservation, but also, as shall be discussed below, better management of its principal water assets, the Lake Deforest Reservoir and its groundwater fields.

A variety of reasons underlie the emergence of demand side strategies and the generational change in water management thinking they represent. The first has been cost. Supply side solutions are capital intensive and expensive. Demand side solutions, with their emphasis on preventing problems, or eliminating them by better resource management, have often proven to be cheaper. Nationally, the deficit in water infrastructure capital investment has been estimated by EPA to be at least several hundred billion dollars. Solutions that save precious capital and avoid or minimize increases in water and sewer rates have become highly prized.

A second factor driving the emergence of demand side solutions has been their flexibility. Demand side solutions can often be implemented more rapidly, do not require the all or nothing commitment, both institutional and financial, of major facility construction, and often enable water utilities to avoid politically contentious issues of facility siting.

The third factor driving the new focus on demand side solutions is sustainability. Demand side solutions revolve around four themes: resource conservation instead of increased resource use; pollution prevention instead of pollution cleanup; wise use of and investing in natural infrastructure instead of concrete and steel facilities; and the optimization of water utility operations and assets. In each case, utilization of such strategies can provide new water in ways that do not require expensive construction of new facilities, many of which, like the proposed desal plant, will have significant impacts on other environmental resources, meaning that demand side strategies, whether conservation or management oriented, tend to be more environmentally and sustainability friendly than facility construction.

Finally, there has been the rise of what could be called, Socially Responsible Investing (SRI) or triple bottom line thinking (economic, environmental and social benefits) as a way to judge public and private investment. Demand side solutions tend to be friendlier to a broader range of

social interests. For example, the Staten Island Bluebelt, a pioneering venture in the early 1990s in the use of natural infrastructure, not only saved New York City many tens of millions of dollars in avoided storm sewer construction. It also increased the property values of homes located next to these natural amenities. A particularly important concern here is that demand side solutions, generally being labor intensive, often have far more beneficial employment consequences. The New York City water conservation program not only provided many permanent jobs at DEP in water conservation, it also generated an estimated 1200 man years of plumbing work.

Thus the question in modern, 21st century water resource management has become whether there is a demand side solution that addresses a water resource problem faster, cheaper, better and with more ancillary benefits for the public that a solution that relies on facility construction. It is now generally recognized in forward thinking water planning that the intrinsic advantages of demand side solutions are such that they should always be considered first. The State of Massachusetts, EPA guidance materials, the American Planning Association and other expert water sources often require or recommend such a hierarchy of water management approaches. The experience with the deal plant, and the failure of UW to consider a demand side solution, argues that such a priority should also be mandated in New York water and environmental law, particularly since, to do so, would be consistent with New York State sustainability and global warming policies.

Of course, as this author has stressed in a number of presentations over the last two decades, supply side versus demand side should not be seen as an either-or, or an ideological, choice. From a holistic management perspective, the challenge for a water utility manager is to find the right balance between supply side investments in hard infrastructure and demand side management solutions. Finding that balance is a factual question, how to meet water service needs in the fastest, cheapest, and most beneficial and sustainable way possible. But, in specific instances, as with the desal plant, the question will often revolve around the choice between a specifically proposed facility and the demand side alternatives to it.

The Question for Rockland

The desal plant is a classic supply side strategy. It proposes to build a new facility that will desalinate the brackish tidal waters of the Hudson River to provide Rockland County with an average of 7.5 mgd in new water supply. Like such supply side strategies, it is expensive (claimed cost to date $56 million, estimated future total cost apparently in the ultimate range of $200 million, or potentially over $400 a year per individual ratepayer), with significant environmental issues, some important quality concerns (can the quality of the Hudson River water match current drinking water supplies for Rockland, especially given radioactive contaminants from Indian Point), and low social benefits, an estimated ten permanent employment jobs. Thus, the question has to be whether it has been demonstrated by desal plant advocates that there is no demand side solution that will not solve Rockland's water demand problem, in a way that is faster, cheaper and more sustainably or whether available information suggests that a demand side solution exists and should be systematically explored before proceeding with desal plant construction.

The Demand Side Approach to the Rockland County Water Problem: An Overview

The water resource problem for Rockland County, as set forth by the New York State Public Service Commission in 2006 and reaffirmed in later rulings, is to develop an additional water supply to insure that Rockland County will have enough water to meet projected peak demands. In its rulings, the PSC has essentially set the planning target as adding an average additional water supply of 7.1 mgd, which the desal proposal has raised to 7.5 mgd. There is very little evidence, in either the public statements of desal plant advocates, or in their responses to the many criticisms of the desal plant, or in the Environmental Impact statement, that a serious and systematic effort has been made to develop and assess a demand side alternative, despite the fact that the Coalition and many other civic groups and elected officials, responding to the desal plant proposal with its high financial costs and environmental impacts, most notably on the aquatic environment of Haverstraw Bay and high levels of energy use and its implications for global warming, have, for years, called for a look at various elements of a demand side strategy.

But what should be the elements of such a strategy and the starting point for such an inquiry? A number of proposals, such as stormwater capture or sewage effluent recovery, which have been successfully used elsewhere, undoubtedly deserve to be looked at as part of a long term water management strategy for Rockland (see discussion below). But it is questionable whether, without detailed planning and analysis, they can be the centerpiece of an immediately demonstrably faster, cheaper and more sustainable demand side water supply strategy. To use unconventional sources such as those just referred to is always more expensive than utilizing surface water resources. So, the starting point for this inquiry will be whether the surface water resources of Rockland County and of the larger region can be better managed to meet the 7.5 mgd water supply target of the desal plant.

While, as noted above, the need analysis that underlies a 7.5 mgd new supply target is flawed, this paper will demonstrate that even taking the 7.5 mgd the desal plant would provide as a planning target, there is a plausible combination of demand side measures that could provide a better alternative way to meet that target. Despite the efforts of desal plant advocates to dismiss questions of demand side alternatives out of hand, examination of Rockland County's situation suggests that there is a relatively straightforward demand side strategy that could provide Rockland with the equivalent of at least 7.5 mgd in new water, one that would be faster, cheaper and more sustainable than the desal plant.

What would be the elements of such a demand side strategy? It would have three elements, developing a new operating rule for the DeForest reservoir, conserving system water through reducing water main leaks, and reducing wasteful consumer water use with a primary focus on summer lawn watering that drives up peak demand. In addition, this immediate demand side option should be followed up by development of a long term water resource strategy for Rockland County, as called for in the County Comprehensive Plan, one that would look at a whole series of measures such as obtaining access to regional water providers with water surpluses, such as New York City's upstate water system, or from water suppliers in New Jersey, particularly the Newark Water system or the Oradell Reservoir; the potential for new well fields, for better ground water recharge and storage, stormwater capture, reuse of sewage effluence, targeted price increases, and programs of water neutral housing development. The failure to undertake this two step process, first finding a viable demand side alternative and then

developing a long term water resource management plan has distorted this debate and threatens Rockland County with punishing water rate increases and an unsustainable water resource strategy.

The Elements of a Potential Demand Side Strategy for Rockland County and Detailed Discussion of Them

i. A New Operating Rule for DeForest Reservoir Management

One critical element of a demand side strategy is optimizing management of existing resources. In the case of Rockland, the critical opportunity is in the operation and use of the water collected in the Lake DeForest Reservoir (DeForest).

The DeForest Reservoir is a key facility in the management of the Rockland County Water system and the management of the Hackensack River which flows downstream into New Jersey, where it is a critical water resource. A facility such as the DeForest, which is central to the management of interstate water basins such as the Hackensack with their competing political jurisdictions, presents complicated questions of water management and the fairness of water allocations. Over time, a series of complicated rules and norms have accumulated to guide the management of the DeForest Reservoir. Under those rules, there are two critical numbers. United Water can take an average of 10 mgd for its Rockland customers. Meanwhile, a minimum of 9.75 mgd must go downstream as passing flow, of which 2 mgd goes to Nyack and 7.75 mgd goes to New Jersey. In most years, the volume of water sent downstream is considerably larger, and can approach an average of 30 mgd, but these based numbers are based on what has been calculated as the safe yield of DeForest, 19.75 mgd.

One other element of this complex situation should be noted. United Water of New York is a wholly owned subsidiary of United Water New Jersey which sells the Hackensack water sent downstream from the DeForest Reservoir to their New Jersey customers, so that the consistency and fairness of the rules for allocating the costs of managing DeForest between the two companies is a key concern and is governed by a 20 year intercompany agreement that expires on September 24th and whose renewal is currently being renegotiated. That renegotiation should have public participation and should be delayed until the recommendations made herein for a reconsideration of the water flows from DeForest have been considered and acted upon by DEC.

The key question for Rockland about the management of the DeForest Reservoir is whether the 7.75 mgd being sent downstream to New Jersey is the appropriate water volume for passing flow or whether more of it could be made available to Rockland water users. The answer to that question is based on two necessities, first how much flow is necessary to meet New Jersey's riparian rights and equitable allocations within the Basin and second, how much is necessary for the ecological health of the Hackensack River environment, particularly the Hackensack Meadows in New Jersey. In a letter to the County Executive, which is attached to this report and was prepared with the assistance of the expertise of Robert Kecskes, a long time State of New Jersey water

manager responsible for regional water planning, the Coalition requests the County to exercise its right, as a party to the original proceedings, to have DEC reopen the permit proceedings governing the use of DeForest Water, pointing out that, measured New Jersey's own standards for passing flow, the passing flow from DeForest is far too high.

Moreover, as the Coalition letter sets out, there are other technical, hydrological reasons why the 7.75 mgd figure is wrongly calculated, and, even further, that such a large passing flow is not necessary to meet the requirements of New Jersey for water, given that New Jersey has other resources to meet its water needs and is not making the same level of effort in water management as Rockland County. The letter recommends that the passing flow be reduced to a level that would provide 4 mgd additional water to Rockland County. Such a figure would provide over half of the water of the desal plant and would be the building block of a demand side management strategy for meeting Rockland's future water needs.

The County Executive has indicated that he concurs with the analysis submitted by the Coalition and intends to petition DEC to reopen the permit hearing and reevaluate the issue of passing flow. In fact, the County has previously petitioned DEC to do so, in 2010 and again last year. As noted above, in response DEC promised to address the matter, but it appears that it failed to carry out that commitment, despite the fact the Rockland has an undisputed right, given its role as a party to the original permit and given that the language in the original permit that states the Deforest will be operated for the benefit of Rockland County, to seek reopening of the DeForest operating permit and reconsideration of the passing flow.

In addition to the 4 mgd in additional water the Coalition letter identified, a calculation with which this author agrees, one other aspect of changing the DeForest operating rule that could be an important additional water supply resource for Rockland should be noted. In his testimony before the PSC in 2009 on the 2010 UW rate case, Dan Miller, the Rockland County Department of Health official responsible for water supply matters focused on the many years in which passing flows in Rockland significantly exceed the 7.75 mgd passing flow required to be sent downstream. Miller suggested that there would be important benefits for Rockland County if some of that excess flow, instead of being sent to New Jersey, would be retained for the use of Rockland County. It would reduce by a commensurate amount withdrawals of groundwater, thereby improving groundwater management and conserving that resource.

Miller, appropriately, did not suggest that in every year this could lead to a net addition in available water for Rockland, but his comments point out another important benefit for Rockland of reopening the DeForest water use permit and seeking a new operating rule for DeForest. Clearly, it would be an important planning exercise to do a rigorous study of the interaction of potential uses of DeForest water with groundwater availability and the implications of better managing the same for meeting Rockland's long term water needs.

In summary, it is clear that a full scale review of all the operating parameters of DeForest, aimed at developing a new and modernized operating rule for the reservoir, starting with reducing passing flows and utilizing that water to meet Rockland's needs, is long overdue. This, it needs to be noted and emphasized, is not a new observation. The 1982 DEC survey of Rockland County water needs noted the problems with the management of the DeForest Reservoir and called for changes. Similar observations were made over the ensuing years, most notably in 2010 in the testimony of the Rockland County Department of Public Health before the PSC, referred to previously. And the Rockland County Executive, as also noted above, has twice raised the issue with DEC and requested them to undertake the review recommended here.

Now, facing a back-breaking rate increase from the desal plant, Rockland needs to obtain the reopening of the issue of DeForest's operating rules and passing flows. If, as the evidence indicates, a new operating rule for DeForest could provide a major increment of water for Rockland, the question becomes why, when there is such an obvious demand side solution available, are not all parties relentlessly pursuing it? And, to ensure proper consideration of this issue, it will be important that the PSC does not make any additional decisions on the Rockland County water situation until this option has been fully reviewed. And this includes reviewing and approving any changes to the inter-company agreement to ensure that the agreement addresses and reflects the reality of needed changes in the DeForest passing flows, and allocates costs in ways that are fair to the Rockland County ratepayer.

One final observation should be made about this issue. If the changes in passing flows and withdrawal rates discussed here were made, they would have the added advantage of increasing the ability of the reservoir to capture much of the inflow at high water that must now be spilled downstream, therefore increasing the ability of DeForest to provide flood control, also addressing what is apparently a growing problem with management of the Reservoir. Given that the changing patterns of weather from global warming that are increasing extreme precipitation events, enhancing the potential for better flood management is an important long term concern for all water systems that operate reservoirs.

Addressing the operating rules and passing flows at DeForest will also necessarily mean developing a new set of water relationships and financial arrangements with New Jersey and United Water of New Jersey. These will need to be based on consistent management norms for operating all the reservoirs and water management facilities that serve the Hackensack Basin, on equal maintenance of effort with respect to water conservation and water management norms for similar facilities, and for an equitable allocation of both water and cost that is fair to the water customers in both New York and New Jersey. It means modernizing the Hackensack Basin management plan, in the ways outlined in the attached coalition letter, including adopting New Jersey's own standard for passing flows, eliminating remnants and standards drawn from the Delaware River Basin, an issue the author is very familiar with as a former New York City water system director, and he concurs in the letter's description of the purposes of the passing flows established

there and their lack of relevance to the Hackensack situation, and integrating it with the management of other North Jersey water resources.

Doing so will set the stage for a demand side alternative that, using the 4 mgd a day that Rockland could obtain will set the stage for a demand side alternative that will enable the expense and undesirable environmental impacts of the desal plant to be avoided. Though there is no doubt that facing this issue will require DEC to engage in what can be expected to be difficult discussions with New Jersey, DEC cannot be allowed to evade this task. The stakes for Rockland County and New York State are simply too high.

ii. Saving System Water

Though the public often thinks of water conservation as just involving reducing consumer water use, and though water utility experts can often create the same impression by consumer oriented presentations of water conservation alternatives, a comprehensive and integrated water conservation program will have two main components: reducing system water loss and then reducing consumer water use. The New York City water conservation program, which has reduced New York City water use by over 35% per capita, or roughly 400 million gallons a day, achieved at least 25% of that gain by reducing system water loss.

This water loss tends to have two sources, first leaky pipes and second mismanagement of system metering and valving. (New York City had a third, the classic summer practice in neighborhoods without air conditioning of opening fire hydrants to cool off from the heat. This was solved through creation of a customized system of unbreakable hydrant locks based on a technologically innovative use of magnetism). As to the latter, the water loss from inadequate metering of water flows, failure to properly set blow off valves and similar mismanagement of other system hydraulics is impossible to measure upfront and an estimate of potential savings from better valving management is not included here. However, any proposed water conservation program should include both a review of the adequacy and accuracy of United Water's system metering and water use tracking, and its maintenance practices with respect to system valving. But in terms of addressing system water, and estimating a concrete savings figure, leaky water mains are a different story. Most water utilities at least have estimates of leak loss and the management measures for attacking them are straightforward and easy to implement.

It is important to note why well managed water utilities will first concentrate on minimizing system water loss as part of a conservation program. The reason is simple. All the water saved from reducing system water loss is, in essence, free water to the utility. Though reducing such leaks requires certain investments, in leak tracking and pipe replacement, the water saved does not come from reduction in consumer water use, so that it does not impact utility revenues or cash flow, does not generate potential consumer resistance to changing former patterns of water use, and gives the water utility additional flexibility to deal with consumer needs. It is the logical starting point for any conservation program.

The DEC draft EIS on the Haverstraw projected a 17% water loss from leaky water mains, and then goes on to say that United Water intends to reduce that loss to 13% by 2035. That reduction would produce a savings of roughly 1.2 million gallons of water per day, suggesting the United Water clearly recognizes the potential for water saving from leak reduction. It does not explain why United Water proposes to take two decades to address this problem when it has a water supply problem now. [1]

This analysis proposes that, on the basis of United's own DEIS, a slightly more ambitious target of a 10% leakage rate be set, which would produce an addition of 2.1 mgd in water availability. For the sake of being conservative, this figure will be reduced by 30%, to 1.5 mgd. Moreover, it is safe to assume that the rather lackadaisical twenty year time frame set forth in the EIS for obtaining 1.2 mgs could be reduced to five years that would produce a 1.5 mgd savings, by making reducing water main water loss a management priority and accelerating management programs to reduce leak loss, which, as discussed above, would be in the clear institutional interest of UW. New York City, with a vastly larger water system was able to achieve all of its system management goals, including reducing water main water loss to below 10% and reorganizing system valving maintenance in three to five years.

There is clearly no institutional reason why UW could not do the same and UW has failed to furnish any plausible explanation as to why it cannot do the same, merely taking refuge in generic arguments that Rockland already has a low rate of per capita water consumption. However, since UW already acknowledges in the DEIS a 1.2 mgd potential water loss reduction is achievable, the question is why wait and why not aim at the 10% that is the benchmark of a tightly run water system. Leak detection and repair is not rocket science, but is done with on the shelf technology that needs only to be deployed with a proper level of effort. If one assumes UW would add an additional thirty person leak detection and leak repair personnel (lacking access to internal UW staffing no more than an estimate can be made here), who could also be deployed to ensure proper valving and metering management of the water main system, there is no reason to suppose that the UW leak level could not be reduced to the neighborhood of the 10% level that characterizes an aggressive and well run water system.

But there are two ways to reduce water loss from leaky water mains, not just leak detection and repair, but also water main replacement of particularly compromised or stressed sections of the distribution system. As to the latter, it appears that UW is currently replacing 1% a year of Rockland's water mains. Doubling that ratio to 2% would be a low cost way to reinforce a program to reduce water main leak loss by five percentage points as well as bringing important ancillary benefits, such as improved water infrastructure, improved street conditions and local construction employment.

[1] It should be noted that the DEIS process has also produced a leak loss estimate of 13%. However, using this figure produces the anomalous result that two decades of leak management will have no impact on the rate of water loss, so this rather circular conclusion has been ignored. It should also be noted that, generally, in a water system, water main leakage increases with high demand, because it increases the water pressure going through the mains. Since UW has a peak demand problem, the leak detection measures proposed here would probably have an extra benefit during periods of peak demand. However, lacking the availability of a proper modeling analysis, so estimate had been made of such additional leak savings.

One aspect of the desal program that has not received enough attention is that, given its high cost, it is likely to preempt the resources that UW should be spending in maintaining and upgrading existing infrastructure. By contrast, a focus on reducing leaks from water means will mean that there will be an ongoing program of capital investment in the weakest parts of the distribution system, instead of spending ratepayer funds on a desal plant that will do nothing to upgrade Rockland's current aging water infrastructure by strategic replacement of critical sections of the distribution system. And, as noted, doing so would provide ongoing, systematic construction employment, most likely to local contractors who would, over time, develop an important local expertise in the Rockland water system, instead of squandering massive capital resources on a stand alone desal plant with no long term benefits to the local construction industry.

Ideally, when the issue of adequate future supply first arose, UW would have done a systematic water system management conservation program out of a desire to maximize saleable water and minimize impacts on local water consumers but, lacking that, one has been forced to make plausible estimates based on available information and experience.

Thus, taking the very undramatic projections of leak reduction expressed in the DEIS as a starting point, this study has concluded that a reasonable target for an aggressive program to reduce water main leaks and repair water mains would be to reduce the current rate of water loss from 17% to 10%, with a conservatively estimated savings of 1.5 mgd with a potentially larger figure of at least 2 mgd. Of course, 1.5 mgd is a minimum figure. If United Water were to bring its loss rate to 10% target or below, it would gain significant additional water. But for the purpose of this analysis, and given the very conservative estimate of savings UW uses in its DEIS, this report adopts a figure of 1.5 mgd a day in reduced water main leakage is set forth as the system water loss component of a potential demand side strategy.

iii. Reducing Consumer Water Use

There is now in the United States an extensive literature on water conservation and reducing consumer water use. There are extensive methodologies and case studies available for planning such conservation programs, such as the well known "Least Cost Planning Demand Management Decision Support System," which is based on extensive breakdowns and analysis of the details of local water use. For example, the average residential household has six targets for reduced water use: toilets, baths and showers, laundry, faucets, cleaning, and outdoor use. Successful examples of doing so abound, in the Northeast most notably the experiences of New York City and Boston. New York City has reduced its water use by 40%, Boston by 25%. Across the country, cost effective water use reductions of 15 to 20% are common.

Experience has shown that the important rule is to proceed situationally, to understand the dynamics of the local realities of water use, to set realistic targets and design proposed measures accordingly. There can be an unfortunate tendency by water conservation advocates to conclude that because some water conservation is good, even

more is better, and to propose a long litany of measures, often without systematic assessment of what problem one is trying to solve.

Unfortunately, UW seems to have gone to the other extreme. In its public statements it is dismissive of water conservation and appears to have done no systematic attempt to assess through scientifically based study the conservation potential in Rockland County. This has been a critical lapse as Rockland County is well situated to achieve a level of conservation savings that would support a demand side alternative to the desal plant.

For the purposes of developing a viable demand side alternative to the desal plant, a modest goal of a 10% reduction in consumer water consumption would be the appropriate policy target, or roughly 3 mgd a day. In the context of what has been accomplished elsewhere, this is an unambitious target and one that, for reasons explained below, Rockland should have no trouble meeting.

Desal advocates have tended to be very dismissive of such arguments. Their primary argument seems to be that water use by Rockland residents is already lower than the national average, (62.2 gallons per person per day vs. 69 according to one set of figures) but these are essentially meaningless numbers for purpose of analysis. Rockland also pays one of the highest per capita rates in the United States for water service, but one can be permitted to doubt whether Rockland's water providers would take seriously an argument that, given its already high water rates in comparison to national averages, there should be no further increase in water charges in Rockland County.

The critical fact about water use in Rockland County is that much of it is driven by summer peak demand, which is largely demand generated by lawn watering, as the USGS survey of Rockland water usage noted.

There is extensive and successful experience with in the United States with reducing excess use of water in lawn watering. Moreover, in an area that averages 49 inches of rain a year, lawn survival is not, except in rare hyper-drought circumstances, dependent on lawn watering. Current lawn watering practices appear to reflect old habits of saturation lawn watering, which we now know do not reflect any horticultural reality.

Finally, if it is summer peak demand that is largely driving the PSC's concern over reliably meeting peak demand, both simple common sense and basic fairness would suggest that, instead of placing the cost burden of an expensive desal plant on the back of all Rockland water users and their families and local businesses, a conservation program targeted on excessive and unnecessary lawn watering would be far more efficient economically and far more fair socially.

There are many ways to control excessive lawn watering demand. There are a series of command and control measures that are typical in more water stressed regions. These include banning lawn watering under certain conditions, limiting it by an odd even day system, restricting it to nighttime hours to improve soil absorption and limit

evapotranspiration, or in the Southwest, banning the typical American green lawn and insisting on landscaping with indigenous vegetation.

Due to the importance of addressing lawn water in any water management strategy, all of these measures deserve consideration. However, in a community such as Rockland, most water managers and water economists would advocate using price signals first and more mandatory measures as a fallback. Water tariff systems can be designed to provide economic incentives to better manage lawn watering. United Water does charge Rockland water users a summer water charge that is 1.5 times above regular water rates, but that charge is applied to all water use, whether or not it is essential or easily controllable, which makes it an inefficient and arguably inequitable tool for getting at the lawn watering usage that is driving the peak demand problem, while the 15% volume surcharge, while better than nothing, is not simply larger enough to make a significant impact on demand.

A better sense of the scope of incentive needed is the experience of Santa Barbara in California. In the early part of the 2000s, they effectively doubled the charge for lawn water. The result was a 32% decline in overall water use. Rockland requires nothing so dramatic, but there is a strong case for a meaningful program of what in technical terms would be called an ascending block grant rate system that would knock out the worst lawn watering excesses by pricing lawn water usage in terms of its real cost. Such a rate could be designed to provide a low affordable rate for the level of water needed to meet basic indoor domestic needs, cooking, cleaning, bathing and toilet functions. It would then add a significant, consumption discouraging cost increase for usage levels associated with extensive outdoor water use.

This paper will not suggest a level, for to design such a rate system should be done using an economic demand model, with which planners could iterate conservation targets and adjust the proposed charges to put the two in balance. It is a standard water rate planning exercise and one that is clearly called for in this situation. Introducing such a rate change in Rockland would produce some very dramatic water savings.

It should be noted that the effect of such rate incentives can be amplified by clear messages on water bills that bring them to the attention of ratepayers. It should also be noted that commercial and industrial water users currently have a descending block rate structure, one that charges less per unit of water, the more water is used. Such systems are a clear disincentive to careful water use, are increasingly disfavored in water management, and should be changed as part of the process of adopting conservation rate incentives.

Of course, price increases, particularly in a high water tariff area such as Rockland Country, are always unwelcome and may raise objections, particularly from those who do not want to or understand the need to better manage their lawn watering practices. But considering an ascending block grant rate and its rate impacts for the individual homeowner needs to be done in context. The desal plant is going to generate major rate increases, depending on who is calculating, by as much as $450 a year per customer. An

ascending block rate that would target only lawn watering as a major part of a campaign to eliminate the need for the desal plant is not only going to be far better economically for the bulk of Rockland rate payers, but even those who will face the surcharge on lawn watering are likely to find it is significantly lower than what they will pay if the desal plant proceeds.

This does not exhaust the list of strategies available to deal with reducing water use in lawn watering. There is an extensive horticultural literature on grass varieties which require less watering and keeping lawns free of water gobbling weeds and exotics. There is the use of soil moisture measurement technology to better time lawn watering and limit it to when truly necessary. There are buried systems of drip irrigation that can significantly reduce the amount of water required to maintain plant health. There are automatic shutoff systems for lawn watering equipment to avoid day long watering by busy suburbanites who must be away from home during the day. A major advantage of an ascending block rate system is that it provides an economic incentive to invest in and utilize such water use reducing technological tools and so economically maintain lawn quality. All of these systems, including selected command and control measures in a drought emergency can be combined to meet a water reduction target.

Could the 3 mgd water conservation target be met with reductions in lawn watering alone? It is an attractive prospect, given the large volume of Rockland water use that is due to peak usage in the summer. But, absent a full blown modeling of water demand and water tariffs, it is impossible to say so, and it would be unwise to assume so. However, it is clear that reducing water use for lawn watering is the first critical step towards managing water demand in Rockland and would clearly contribute a major portion of the targeted 3 mgd in conservation savings. Moreover, it needs to be remembered that, if it is lawn watering that is creating the peak demand problem that is driving so much concern about future water supply, than both common sense and standard economic principles of price allocation and fairness dictate that lawn watering should be the first target of any conservation program.

To supplement elimination of excessive lawn watering, a series of other conservation measures should be developed. Here, the strategy would be to look at water use segments in the county and to develop specific strategies for them, based on water audits and utilization of advanced water saving fixtures and practices. For example, the industrial and commercial sectors of Rockland County could be targeted with technical assistance and water audits, leading to both the introduction of water saving technology such as closed loop water systems, and the substitution of stormwater and gray water at reduced prices for meeting water needs. Current building code requirements should be reviewed to see what gains are possible from going beyond existing requirements for modern water saving fixtures. Even without code changes, the introduction of water saving fixtures can be spurred by rebates and incentives, programs that many water utilities have found cost effective, and which were also recommended as cost effective by the recent Columbia University study of water conservation in Rockland County.

The stock of county and local government buildings such as schools, are obvious targets retrofit with cost saving water conservation measures, as are hospitals and other large institutional users of water. Incorporated into a general green buildings sustainability strategy, such savings could leverage significant improvements in the public building stock and lower the operating costs paid by owners and users.

Some measure of the potential of these building use water saving measures is that, compared to current Rockland usage of 62 gallons per day per household, the Environmental Protection Agency estimates that per capita use in a newly built house with water saving fixtures is 50 gallons per person per day. The American Waterworks Association has a 45 gallon a day benchmark for a similar home. Such savings can be locked in by drawing on the extensive literature on green buildings to develop the most advanced water saving standards for new building and by requiring fixture replacement in existing facilities to utilize modern, water saving technology. Such requirements can be tied into the rebate programs discussed above, that UW could fund.

Another potentially high value conservation strategy would be to address the concern that is often raised about the impact of continuing suburban development in Rockland. Requirements for lawn space and irrigation could be adopted to minimize water use. A particularly promising strategy, one that has the benefit of using market tools, would be to adopt requirements that new development should be water neutral. This is done by establishing impact fees sufficient to pay for fixture retrofits in existing development or public buildings such as schools and hospitals that would offset the development's new water demand. Doing so also insures, consistent with market principals, that existing water users do not subsidize new development.

Finally, effective water conservation programs have an aggressive public education program that highlights both the economic and sustainability benefits of water conservation for the water consuming public. A theme of save water, save money, save the environment has been the organizing principal for such campaigns, especially when linked to the widely documented public support for clean and abundant water.

To review, this discussion of consumer water use opened by setting a modest goal of a 10% reduction in Rockland water use. A conservation program that started with addressing excessive lawn watering would achieve at the least a major portion of that goal. With those savings in hand, the level of water savings needed from the other sectors and measures described above are minor and, experience in other cities shows, should be easy to obtain. In short, there is no reason to conclude, based on experience elsewhere, that the goal of a 10% water use reduction, or a 3mgd savings in consumer water use in Rockland, is not achievable.

And, once again, this represents a minimum target. New York City, with far more water use demands, achieved close to a 40% reduction in water use and its per capita water use is still declining. Boston achieved close to 25%. Santa Barbara, a more comparable upscale community in an arid climate, achieved 32%. If Rockland were to lay out a comprehensive and integrated water conservation program supported by the proper rate

incentives, a water use reduction of 20% would seem well within reach. But for the purpose of this analysis, to demonstrate the viability of a demand side solution, the conservative figure of 10% water savings from consumer conservation has been used.

Ideally UW should have, as part of its due diligence, done sector by sector studies of water conservation potential, so that much more precise estimates of these savings would be available. Absent such studies, this report has been forced to use a very conservative estimating process. However, these estimates are consistent with the one effort that has been done in Rockland County, one undertaken by Columbia University students working with the Rockland County Department of Health. Though the report only focused on residential water use, and stressed that it was not proposing that all of Rockland County's future water need could be met through consumer water conservation, it did note that, as this report concludes, such conservation did have real potential for water savings and should be part of Rockland's long term program for meeting water demand.

One point that is often made in an attempt to derogate water conservation as a water resource management strategy for Rockland County (for example in the UW claim in the DEIS that water conservation could only produce a 1% incremental water gain) is the argument that UW does not have the power to order mandatory conservation or that the division of planning authority between the towns and the County mitigates against implementing an effective conservation program. Such a conclusion is unwarranted by experience.

First, any water utility has the authority to offer its customers incentives to promote desired behavior and such incentives, combined with the kinds of price increases that the desal plant would impose on customers, would provide a powerful conservation tool. Successful conservation programs use price to incentivize behavior to adopt conservation technologies. Moreover, without the kinds of aggressive conservation planning that more ambitious due diligence would have provided, UW has not been in a position to indicate to the County and towns the benefits of adopting conservation programs.

It is very difficult to believe that, when faced with the kinds of cost increases the desal plant will produce as the alternative to inaction, Rockland's political entities would be so inert as to not make cost effective water policy decisions. Of course, at one level such a conclusion is speculative, but at the same time it is an equally speculative conclusion that, without trying to obtain local support for conservation, the lack of an ability to force it would be a fatal flaw in pursuing water conservation. Reliance on such a self fulfilling prophecy has no justification. Given the commitment of Rockland County's leadership to finding a cost effective alternative to meeting future water needs, to the support given by various towns to Coalition efforts to obtain an issues conference with DEC, any *a priori* assumption that an intelligent conservation program is not possible because UW or no one else has the political authority to order it is completely unwarranted and should be have long ago been tested by putting forward a systematic conservation strategy. In any event, it is clear from the context of Rockland County that such mandatory measures are

not strictly necessary to meet the unambitious conservation target set forth here for inclusion in a demand side alternative to the desal plant.

The cost implications of a water conservation program are difficult to assess without detailed conservation planning, but there is no question that these options would be far more cost effective. There would be some increase in water usage charges for those currently using excess amounts of water for lawn watering, potentially offset by some rate reductions for those paying the across the board summer water surcharge. But, these costs are likely to be significantly below the costs all water users would pay for the construction and operation of the desal plant. Additional utility staff would be needed to run public education programs, engage in conservation planning and provide technical assistance to specific use sectors in conservation efforts. Specific staff needs would depend on detailed sector planning that is beyond the scope of this analysis, but a generous estimate of staff cost for every ten people dedicated to conservation work would be $1 million dollars, a trifle in comparison to the cost of the desal plant.

Demand Alternative Summary

The purpose of this analysis was to explore whether there was a reasonable basis to conclude that there is a demand side alternative to the desal plant. Clearly there is a strong potential that one exists. Using modest assumptions as to the potential for find new water from changing the operating rules at DeForest, controlling water main leakage, and reducing wasteful consumer uses of water, produces a demand side alternative whose overall total of 8.5 mgd a day more than exceeds the 7.5 mgd a day of the desal plant would provide. To summarize the water the measures in the demand side alternative discussed here would provide:

New Operating Rule for DeForest	4.0 mgd
Water Main leak Reduction	1.5 mgd
Consumer Water Conservation:	3.0 mgd

And this alternative does not include any additional benefits from also changing the operating rule at DeForest to take advantage of the excess passing flows as the Rockland County Department of Health recommended in 2009.

Thus, there is a demand side alternative that can provide more water faster and at significantly smaller cost and rate impact and with many more additional benefits than the desal plant. Needless to say, this alternative should be subjected to the kind of detailed analysis that should have been undertaken years ago as part of normal corporate due diligence. But, until such an analysis is done, the desal plant should be put on hold, potentially to be replaced by the demand side strategy outline above.

It should also be noted that this is not necessarily the only viable or attractive demand solution available to Rockland County. A proper planning process is likely to produce a number of significant iterations of this proposal. Part of the purpose of conducting a comprehensive and holistic planning process is to ascertain what opportunities have been overlooked. It will be important that the PSC process now underway shall ensure that shall happen.

Benefits Discussion of the Demand Side Alternative

As noted above, the benefits of a demand side alternative are often significantly greater than those from facility construction. In comparing the relative benefits of a demand side strategy to the desal plant, the list is long. To note the most important ones:

1. Cost Benefits and Benefits to the Rate Payer

   As discussed above, without more detailed planning, one cannot provide more than generic scope numbers. But assuming a generously staffed leak detection program and conservation program plus a capital investment in pipeline replacement, estimated at $6 million a year for ten years, the total annual cost so such a program would appear to be $7.5 million operating plus $6 million year capital, for a decade long total of $60 million. By contrast, the claimed cost of the desal plant is already $56 million before putting a shovel in the ground, and among the many estimates of plant cost that are circulating plus $150 million would seem to be a reasonable center point. However, given a pattern of spiraling costs, an ultimate cost figure of $200 million is not out of the question. While the annual operating costs of the desal project cannot be intelligently compared to the costs of a demand side program, given the lack of serious planning for one, such costs would clearly be small in comparison to the overall cost of the desal plant, even after the impact of rate incentives to discourage excessive lawn watering are factored in.

2. Better use of capital resources.

   An issue that seems to have received very little attention is that for a water system the size of Rockland to spend in the neighborhood of $200 million on one capital facility, particularly given the already high water rates in Rockland, will mean gobbling up nearly all of the capital resources available to Rockland for water investment, meaning that the water system will lack the resources to make the basic investments in replacing outdated infrastructure and modernizing its system. By contrast, the demand side alternative not only leaves such capital resources available, by investing in water main replacement it begins the process of updating and maintaining Rockland's water infrastructure.

3. Empowerment of Rate Payers

   A supply side alternative with its major capital investment locks ratepayers into a future of permanent and rising water rates to pay for it, not to mention the costs of all of the external impacts of the desal plant, such as its energy use and carbon footprint. By contrast, a demand side alternative, with its use of price signals, empowers individual water users to manage their water bills and take advantage of costs saving opportunities.

4. Better quality water

   The desal proposal envisions replacing much of the current surface water and groundwater used by Rockland with desalinated Hudson River water. Though the radiation levels in that water from Indian Point discharges are apparently below New York State Department of Health (NYSDOH) drinking water thresholds, nevertheless, slipping under the regulatory threshold does not make the water quality issue of radioactivity in desal water go away. It would seem likely that, if Rockland County water users were asked if they would like their current water augmented with Indian Point discharge contaminated water, they would loudly answer no. Preservation of

existing water quality must therefore be considered another benefit of the demand side alternative.

5. Preservation of Haverstraw Bay and Hudson River Coastal Zone resources
   Extensive comments filed in response to the DEC DEIS have documented the value of Haverstraw Bay as a sensitive marine habitat and an aquatic nursery, and a critical coastal zone resource. These resources have been officially designated as irreplaceable. Concerns have been raised about the siting, which would replace an area meant for coastal zone access and recreational use with a wall of industrial development and the impact on fisheries of the water intake and the brine discharge into the Bay. All of these, a demand side alternative avoids.

6. Better Resilience in the Face of Storm Events and Avoidance of Potential Water Supply Crisis with New Jersey if there is a reoccurrence of Sandy.
   If the desal plant is built, as pointed out the economics of recovering the massive investment made in it means it cannot be used just for meeting peak demand. The economics of such a major capital investment will require the plant be run all of the time, 24/7, to amortize its cost. This will ultimately make the plants 7.5mgd a major element of Rockland's basic water supply.

   The location of the desal plant will be vulnerable to the kinds of Sandy level or worse events that many now fear will mark a new era of global warming. If the plant were to be knocked out by such a storm event, Rockland would lose roughly a quarter of its basic water supply. Should there then be a delay in getting the plant back on line Rockland, to protect its water users, might well have to limit downstream water deliveries to New Jersey, a step that New Jersey would undoubtedly resist, both legally and politically, creating an interstate crisis. Though many may regard such a scenario as farfetched, concerns over the damage of a Sandy level storm were also regarded as farfetched before it happened. Thus, by placing the desal plant in a storm vulnerable location, Rockland would be ignoring the lessons of Sandy and creating the potential for a water supply crisis for both Rockland and New Jersey.

7. Better Resilience in the Face of Potential Precipitation Changes from Global Warming
   For water providers globally, there is growing concern over disruption of precipitation patterns from global warming and what they will do to the reliability of water supplies. The more water demand increases, the more the vulnerability of an area to a change in accustomed precipitation will grow. State policy stresses developing resiliency in the face of global warming. Demand side measures, by lowering the amount of water an areas uses, as proposed herein, are far more compatible with a future of global warming than allowing water use to continue to spiral upwards. In fact, DEC's new water policy specifically stresses conservation.

8. Significant Energy Saving and Consistency with New York State Policy on Global Warming
   It has been well documented that the desal plant will have a high level of energy use and be a major contributor to New York's production of greenhouse gas emissions. The desal

process is highly energy intensive. Energy costs are often the single biggest cost element in the operating cost of a desal plant. Moreover, as the desal plant is essentially at sea level, there is also the energy cost of pumping 7.5 mgd uphill to the Rockland distribution system. By contrast, a demand side strategy will avoid this energy burden and be far more consistent with New York State's objective of reducing the state's contribution to global warming. Moreover, if, as some have advocated, large energy users such as the desal plant, are brought under the umbrella of the Northeast Regional Greenhouse Gas Initiative (RGGI), the cost of buying carbon offsets for the desal plant, will add to its burden on Rockland County ratepayers.

9. More Employment Benefits

   Though precise staffing estimates are unavailable as the kind of comprehensive conservation assessment planning that should have been done is lacking, one of the generic attractions of demand side strategies is that tend to be labor intensive and thereby provide more jobs, than operating a treatment facility such as a desal plant. It will also be true that an ongoing program of water main replacement, driven by a strategy of conserving system water, will probably be a more reliable economic stimulus for the local Rockland economy than a one-time major facility construction project. There is an unfortunate habit, in thinking about the benefits of infrastructure construction, to focus only on the short terms impacts of the construction employment, instead of looking at the long term employment and investment benefits that would come from the kinds of optimal resource uses that demand side alternatives stress.

10. Better Positioning of the County for Sustainable Future Growth,

    One of the often commented upon and unresolved problems in terms of Rockland's long term water management strategy is the relation of water use of future suburban growth and development. Whatever other planning issues that concern raises, it can be safely assumed that all sides in that debate wish to keep the water footprint of development affordable and manageable. The desal plant, by ignoring demand side alternatives, will commit Rockland County to a long term, high cost strategy of chasing growth with new supply. By contrast, creating a demand side strategy, will not only avoid burdening the future with high cost water, by creating an ethic of responsible resource conservation, it will enable development planning to proceed along lines of smart growth and sustainability.

    While desal advocates argue that the plant is necessary to ensure that adequate water is available to accommodate business and therefore economic growth, it is a fair question to ask what will be the impact on business location decisions of paying some of the highest water rates in the country, with dealing with the rate spike the desal plant will produce, and with the knowledge that the plant will lock Rockland County into a long term pattern of increasingly costly water and water costs.

11. Time and Ease of Implementation

    The construction schedule for the desal plant extends out over a decade, to 2030. By contrast, even factoring in the time to do the necessary conservation and operating rule planning studies, the economic modeling of rate impacts, the development of the sector

by sector conservation strategies discussed herein, a successful demand side program should take only three to four years to implement. New York City's conservation program took basically three years, 1992 to 1994, to obtain enormous water savings in the range of 40% across a universe of 6,000 miles of streets and 807,000 water customers. The goal for Rockland set forth here, a 10% water use reduction and a 5 point drop in leakage rate should be easily obtainable in the same time frame. None of the measures proposed are rocket science, all are based on extensive experience in the American water industry and with programs in the Northeast. Quite apart from eliminating a nasty and divisive political controversy, a demand side alternative will be faster and easier to implement.

This concludes the basic discussion of a demand side alternative. However, in terms of the overall decision making context for Rockland policy and in answer to questions raised by the Rockland Water Coalition, this report will touch upon three other topics: 1. Use of surplus water available from other regional providers; 2. Long Range Water Policy Planning for Rockland; and, 3. What the PSC and Rockland water stakeholders should do next.

Additional Discussion Topics

i. Use of surplus water potentially available from other regional water suppliers.

One of the demand side alternatives available to Rockland County to meet its long term water needs would be for Rockland to obtain water from other regional water providers that may have surplus water. Options that have been suggested include the use of New York City water, Newark water or water from the Oradell and Wanaque reservoirs. Obviously, any of these options present significant questions of logistics and cost and this report has not suggested that any of them be considered as an immediate option to the desal plant. But in terms of the long term water planning discussed below, and in view of the fact that, with the Hackensack River as one of its primary water sources Rockland is already deeply involved in questions of regional water management, it is important to highlight that turning to regional water suppliers is a resource that should be considered in any long term water planning.

As the New York City option has, from time to time, been discussed, and as the author is a former director of the New York City water system, the following is information is offered for the use of those who wish to consider this option, which could make available what, in Rockland terms, would be virtually unlimited amounts of water.

The New York City system collects close to 1.3 billion gallons of water a day down from its upstate watersheds, much of which is now surplus for New York's needs. Moreover, New York City arguably has a claim to be America's most sustainable water system, not only because of the brilliance of its water engineering, but because many of its policies are a model of sustainability, most notably its world renowned Catskill watershed protection partnership, its pioneering efforts such as the Staten Island Bluebelt in the use of natural infrastructure, and its famed water conservation program, the world's most successful urban water conservation program, which has reduced water use from the 1.5 billion gallons a day in 1990 to the roughly 1.1 billion gallons a day. These reductions in

water use continue to increase. The resulting water savings, which have brought New York water use from a level 200 mgd a day over safe yield to one now 200 mgd below safe yield, have left New York City with water to spare and share (Those policies also, in a testimony to the benefits of a demand side approach to water resource problems, saved New York City nearly $5 billion in capital and operating costs for an investment of $550 million.) and it has also brought water use so far below safe yield that it made drought alerts a thing of the past and left New York City in the enviable position of being America's best positioned water system to face the new era of global warming climate changes.

. Now Rockland is not in the position of several other counties in the region such as Westchester and Orange, which have a right under the State's Public Health Laws to draw on the New York City water system because New York City has water infrastructure located in them or passing through them. So Rockland would have to negotiate a wholesale water purchase deal with New York City. The starting point for such negotiations would be New York's wholesale water rates, new versions of which New York City has just published. New York City has informally indicated a willingness to discuss such a deal with Rockland, recognizing that in the future, with its abundant water, New York City may increasingly have a role as a regional water supplier.

Of course, drawing on surplus regional water is not a magic bullet. In any of the instances suggested above there are significant planning, logistical, financial and regulatory issues that will have to be addressed. But surplus regional water is the kind of existing resource whose better utilization is the essence of demand side thinking and it deserves to receive a rigorous cost benefit analysis in the proposed development of a long term water strategy for Rockland's future discussed below.

ii. <u>Long Term Sustainable Water Management Planning for Rockland County</u>

First, as many have noted, Rockland water use over the last five years has fallen considerably short of water use projections, a fact that, at the very least, gives the PSC and the County time to consider its water future more carefully and systematically, without the air of water crisis which often surrounds discussion of the desal plant.

Second, recent work by USGS raises interesting questions about the rate of aquifer recharge and the possibility that there are alternative bedrock wells that can provide more water in the future. (See *ny.water.usgs.gov/projects/rockland/images.pdf*) A recent Hydroquest study also raised the possibility that additional ground water might be available. That issue deserves a more thorough study to determine if the 7.5mgd a day desal plant target may overstate the amount of new water needed.

Third, as noted above, to discuss future water demand without discussing future water prices is in economic terms an oxymoron. There needs to be a new and comprehensive look at Rockland's future water supply needs, looking not only at past and historical trends, but at all the other factors that interact with determining water supply need.

Starting with a new demand analysis, water supply planning for Rockland should then proceed to look, in an integrative fashion, at the many suggestions for water management improvement that have been made during the desal plant debate. While many of them were not, in the opinion of this author, appropriate to consider in fashioning an immediate demand side alternative to the desal plant, that does not mean they do not deserve careful consideration in planning Rockland's water future. In addition to possible utilization of regional water surpluses, others that would have significant potential are beneficial reuse of sewage effluent and other gray water, beneficial capture of stormwater runoff, proposals for creating new groundwater well fields in Rockland and for enhanced groundwater recharge, different management paradigms for various well fields and for specific water users such as the town of Nyack, water neutral development policies, and a much more aggressive water conservation strategy than the one proposed above and construction of new reservoirs.

The long debate over the desal plant highlights the need for a development of a long term sustainable water resources management plan for Rockland, not only from an environmental and natural resource perspective, but also from an economic and growth management perspective. It is also clear development of such a plan should ideally take place in a context of interstate basin management for the Hackensack Valley. One politically loaded question will be which state is bearing the larger financial burden in terms of managing the Hackensack River resource, with many feeling that, in the past, the interests of Rockland County water users and the Rockland environment has been sacrificed to the interests of New Jersey water users. It will be important for sustainable long term management of the Hackensack and of Rockland's water resources that a water resource management plan be developed and accompanied by a new intercompany agreement that is transparent as to mutual burdens and responsibilities and fair in allocating them among the two states.

This also highlights the point that a long term water management plan must incorporate a sophisticated financial analysis of the impacts of such plans on the Rockland County ratepayer and the Rockland County economy. Otherwise, it will be an academic exercise of limited value for the real world.

Such a planning exercise must necessarily incorporate all of the studies discussed in this report, should also be coordinated with some of the other studies recommended in this report, such as the DEC's permit mandated review of the operating rule for DeForest, the modeling of water rates and their impact on water demand, and the investigations of USGS and others into aquifer recharge. There can be little question that the public processes for reviewing the question of Rockland's long term water demand, and the wisdom of using the desal proposal to meet it, have failed the public and failed to produce the kind of open public debate and careful assessment of alternatives the importance of the issue and the economic stakes that surround it require.

iii. Conclusion: What the PSC and Rockland County should do next

As noted above, both nationally and internationally, in the area of water management, demand side solutions are clearly the policies of the future, with many recognizing a hierarchy of water management choices, in which demand side alternative are considered first and only if no demand side alternative exists would a supply side alternative such as the desal plant be considered.

Lacking what would clearly be a highly desirable requirement in state law for the PSC to consider such a hierarchy, how can Rockland ensure that a demand side solution, being far cheaper, far more flexible, and having the many other benefits detailed above, will receive the consideration it deserves? The Rockland County Executive has already indicated it will take the first critical step in that process, by renewing its 2010 request to DEC reopen the issue of the DeForest operating permit and its passing flows.

The County Executive and County Legislative leaders have also noted the need for a more transparent and inclusive planning process address these issues. This report therefore recommends that the County Executive take the lead in creating a an informal public private task force among key stakeholders such as UW, the Rockland County Department of Health, the Coalition, Hudson River and ratepayer interests, to insure both the issues of long term demand, the alternatives to meeting it, the financial implications for Rockland County ratepayers, and a long term water management plan for the County is developed.

To support such a task force, arrangements should be made for impartial experts to carry out the studies UW should have carried out as part of its due diligence, including not only the new demand analysis, previously discussed, but also 1. A detailed assessment of the potential for reducing water main leaks and an accelerated operational plan for doing so; 2. the development of an ascending block system of water rates to incentivize the elimination of wasteful peak water use; 3. Sector by sector end user based water conservation strategies, 4. Assessment of refinements in building codes to require a new generation of water saving fixtures and water saving green buildings practices and their implementation; 5. The hydrological modeling necessary to create a new operating rule for DeForest reservoir; 6. An assessment of the potential for improved groundwater utilization and recharge; 7. A demand impact analysis of the water rate increases the desal plant will produce on long term water demand and the consumer response to them. These are the planning studies that have been missing from the desal debate. In addition, the task force should pursue carrying out the other analytic work needed to develop a comprehensive long term plan and address the issues that the discussion above suggests the plan incorporate.

Who should fund such studies? The entity that should have done so originally, UW. And how can this be ensured? The County and the Coalition should both petition the PSC to put the Desal plant on hold, to undertake such a planning process, to specify its analytic components starting with a comprehensive review of demand and then of the demand side alternatives to meet it and charge the County with developing a transparent planning process that could mobilize the support of the public behind any solution and its financial implications. And by establishing an informal task force approach now, with a two tier

mandate of looking at the immediate desal issue and then long term water management issues for Rockland, the County would be well positioned to evolve such a task force into a tool that could carry out such a PSC mandate and come, by the end of 2014, to some definitive answers on these questions.

Closing Observation

It has to be said that a seven year process that ends in a politically divisive debate over an unbending insistence that the only way to meet Rockland's future water needs is to build a facility with numerous unwelcome impacts at a cost that would double the water rates for Rockland taxpayers cannot be regarded as a model of water resource planning. Had this debate been properly understood from the beginning as a choice between a supply side strategy and a demand side strategy, and had UW been willing to invest the money, at most 2% of the ultimate desal plant cost, in the kinds of planning studies needed to resolve this question, Rockland would be in a far better place and facing a far better water future. Financially UW would also be in a better position had it invited the public into this debate, instead of so unyieldingly dismissing the many concerns raised about this proposal.

Fortunately, there is still time to reconsider the issue of need and give demand side alternatives to meeting it the attention that this paper has indicated they deserve and to create the kind of open, public planning process that has become the hallmark of enlightened water resource managers. The PSC, in its decision to reopen the desal issue, has a key role to play here in ensuring cost effective, sustainable water resource management for Rockland. If it fails to meet that challenge, it will represent a major failure of state water resource management. Meanwhile, the author recommends that the Coalition persist in its pursuit of such alternatives, within and without the PSC framework for, in seeking a demand side strategy for meeting Rockland's water needs, it is helping to build a future for Rockland that will make it a more affordable and a more water rich and environmentally sustainable place to live.