RIDLEY & ASSOCIATES, INC.

Mr. Paul Niedzwiecki
Executive Director
Cape Cod Commission
PO Box
Barnstable MA 02630

November 20, 2014

Re: Comments on draft 208 Plan Update

Dear Mr. Niedzwiecki:

I am writing to provide comment on the East Harwich case study contained in the draft 208 Plan. The case study is largely drawn from a report I prepared in 2009 for the Cape Cod Water Protection Collaborative called *Sewers and Smart Growth*. It is significant that reference to additional work on the wastewater impacts of alternative East Harwich growth scenarios conducted after that report was issued is not included. As a result, the case study does not provide a complete and accurate picture of the growth management and wastewater treatment opportunities for this area. Inclusion of this information should be considered.

A proposal prepared by the Cape Cod Commission on behalf of the East Harwich Collaborative (East Harwich Handbook, 2011) demonstrated how increased village center growth could be paired with Natural Resource Protection Zoning (NRPZ) to provide a balance of increased growth and increased resource protection consistent with the community's vision. A thorough evaluation of the wastewater impacts of this approach to growth (Wright-Pierce, 2010) demonstrated that it could also reduce the town's cost for wastewater treatment by millions of dollars.

The Wright-Pierce study evaluated wastewater flows and infrastructure costs associated with this balanced growth approach of village center zoning and offsetting resource protection through the NRPZ. The study demonstrated that the balanced plan would allow more commercial growth and about the same number of dwelling units as current zoning while protecting more open space and natural habitat. The plan also would reduce the Town's wastewater infrastructure costs by $5-10 million.

The report goes on to demonstrate how a growth approach that increases development density in the East Harwich commercial district and surrounding area without the NRPZ offset could result in significantly higher wastewater costs to the town. Unfortunately, this is the approach that has been incorporated into the Town's draft wastewater management plan and current zoning proposals being developed by the Harwich Planning Board.

An updated East Harwich case study published in the Journal of the New England Water

Environment Association (Winter 2003) summarizes the key findings related to growth and wastewater costs in East Harwich that should be included in the case study. This article is attached.

The net net-flow-neutral approach to land use and wastewater represented by combined village center and NRPZ provides a powerful example of how communities can pursue the dual goals of vibrant town centers and enhanced resource protection while reducing sewering costs. A discussion about planning in East Harwich is incomplete without this information. Providing this information is doubly important in light of the plans being developed that rely a growth only approach, which has been demonstrated to result in higher wastewater costs along with increases in traffic and congestion.

Sincerely,

Carole Ridley

Cc: Michael Giggey, Wright-Pierce
Don Keeran, APCC
Ted Nelson, East Harwich Community Association

JOURNAL

OF THE NEW ENGLAND WATER ENVIRONMENT ASSOCIATION

VOLUME 47 NUMBER 4 | ISSN 1077-3002 **WINTER 2013**

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Managing growth in nitrogen-sensitive watersheds can help reduce Cape Cod wastewater infrastructure costs

NEWEA
WORKING FOR WATER QUALITY

Managing growth in nitrogen-sensitive watersheds can help reduce Cape Cod wastewater infrastructure costs

CAROLE RIDLEY, Ridley & Associates, Harwich, MA
MICHAEL D. GIGGEY, P.E., Wright-Pierce, Andover, MA

ABSTRACT | Many coastal areas in the U.S. have addressed wastewater-related water-quality problems by constructing extensive sewer systems and centralized treatment facilities. Complete sewering of near-shore areas has been the norm. A clear exception is Cape Cod, the spit of glacial outwash extending into the Atlantic Ocean from southeastern Massachusetts. There, very permeable soils have allowed intensive development that relies mostly on on-site septic systems. Septic-tank-and-leaching-field systems have addressed the sanitary needs of wastewater disposal, but their inability to remove significant amounts of nitrogen has led to extensive nutrient enrichment of coastal waters. Non-traditional means of nitrogen control (such as fertilizer reduction and use of natural attenuation) are being employed to combat this problem, but it is widely thought that extensive sewering will be needed to remove septic nitrogen from the watersheds of sensitive embayments.

Most of the controllable nutrient load reaching Cape Cod's coastal waters comes from residential or commercial development. Local communities planning sewers are sizing wastewater infrastructure to address nutrient load from existing development as well as a projected amount of future growth. Added nutrient load from projected future growth is a major contributor to overall system cost. This paper explores why growth is so important to the long-term costs for infrastructure and how strategies to manage future growth can help to mitigate these costs.

KEYWORDS | Water, infrastructure, financing, gap planning

LAND USE AND EXISTING INFRASTRUCTURE

The need to protect coastal waters from excessive nutrient loads affects nearly all of Cape Cod. Figure 1 depicts all the principal coastal watersheds on Cape Cod; the shaded areas are tributary to coastal waters that are nitrogen sensitive. Nearly 70 percent of Cape Cod land—and most development—falls within this category. Residential homes account for 96 percent of the 134,000 developed parcels on Cape Cod, and nearly three-quarters of these homes are within a nitrogen-sensitive watershed. Existing development supports a year-round population of 215,000 that swells to nearly one million during the summer.

Scarcely any nitrogen load coming from developed parcels in nitrogen-sensitive watersheds is serviced by sewers. Figure 1 also shows the locations of the five existing publicly owned wastewater treatment facilities and the very limited area they serve. Private developers have installed about 50 satellite treatment facilities to serve condominium developments, shopping centers, and nursing homes. Between the public and private facilities, only about 14 percent of the Cape's wastewater is treated to remove nitrogen, and one-quarter of that capacity is in the private facilities. This lack of infrastructure has left Cape Cod scrambling to manage excessive nutrient loading of coastal embayments caused by decades of untreated wastewater discharges to the groundwater.

PROJECTED COSTS FOR NEW INFRASTRUCTURE

Restoring the health of Cape Cod's nitrogen-sensitive coastal embayments will require extensive sewering. Studies by the Cape Cod Commission have shown that as much as 55 percent of the current development must be served by advanced wastewater treatment facilities to deal with nitrogen overloading, even in the absence of added growth. If future development increases wastewater flows by 30 percent, treatment facilities must be large enough to serve 65 percent of the Cape, and 90,000 to 100,000 properties could require sewer service.

The Cape Cod Commission has estimated infrastructure costs associated with nitrogen control (see Figure 2). In the absence of growth, an investment of approximately $3.4 billion may be needed to treat wastewater from existing development. As large as that figure is, another $1 billion to $2 billion could be needed to address future nitrogen loads associated with new construction on vacant lots and redevelopment of under-used land.

The Commission has identified several factors that most strongly "drive" these costs. Those factors include the density of development in areas to be sewered, the growth rate in nitrogen-sensitive watersheds, and the ability to locate effluent disposal sites in non-sensitive areas. Among these factors, growth is the one that communities can most readily control to mitigate long-term infrastructure costs.

HOW DOES GROWTH AFFECT COSTS?

Before exploring the options communities have for managing growth, it is first important to understand why growth so strongly influences infrastructure costs. Growth represents the intensification of land uses that generate nutrient load. In the typical Cape Cod watershed,

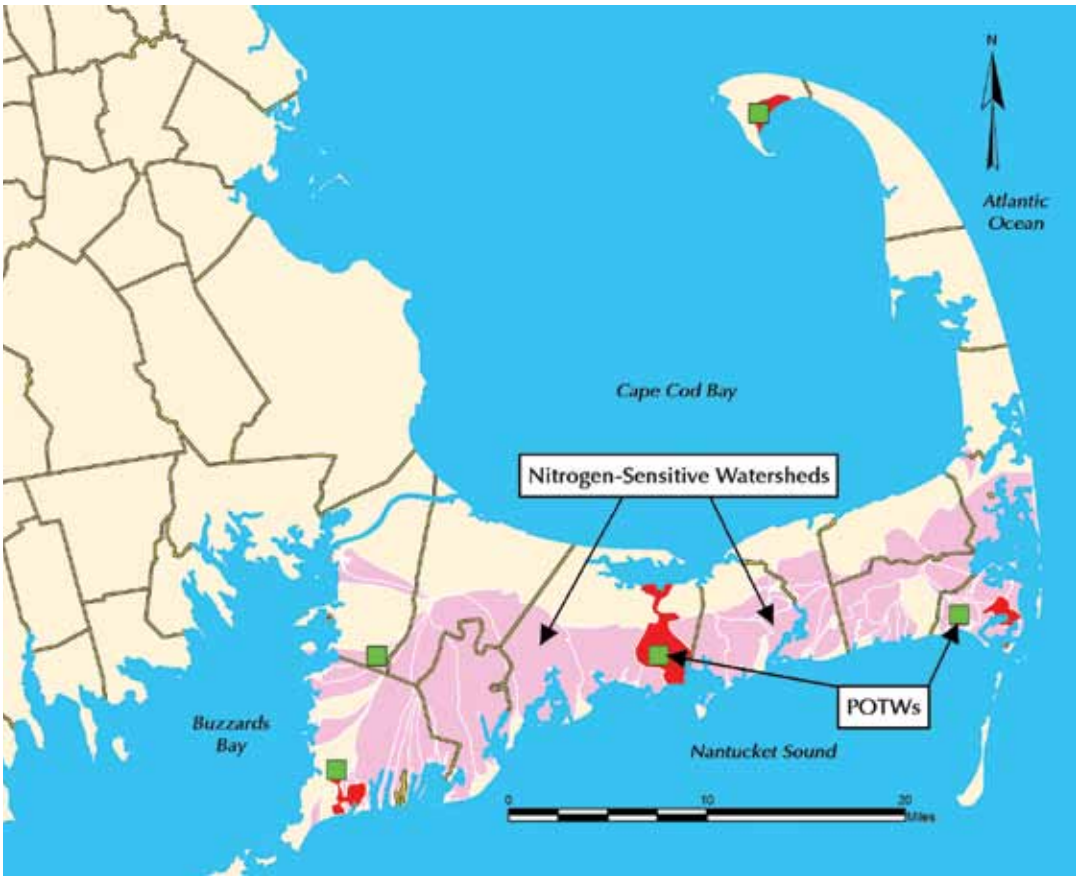

Figure 1. Nitrogen-sensitive watersheds and Cape Cod wastewater infrastructure

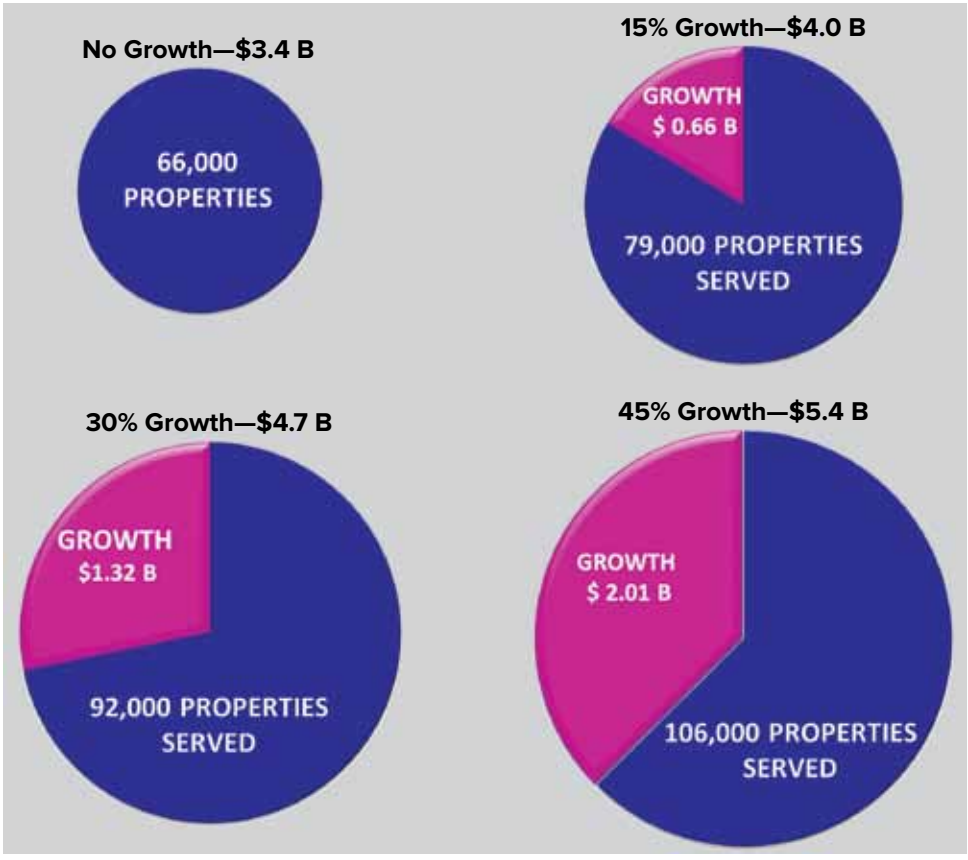

Figure 2. Cape Cod commission estimates of costs for new wastewater infrastructure

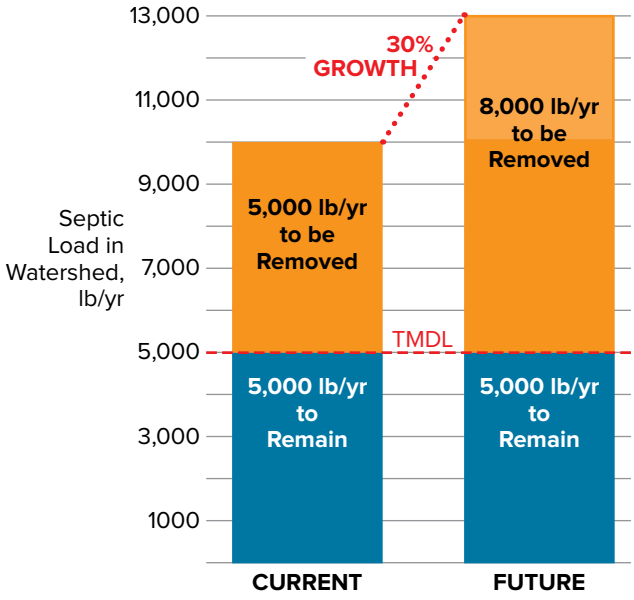

Figure 3. Growth significantly increases nitrogen control needs

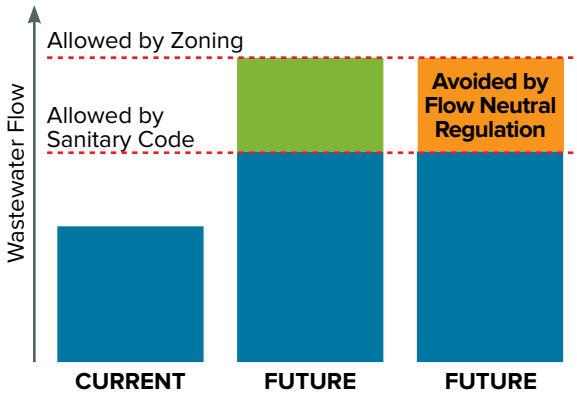

Figure 4. A flow-neutral approach avoids sewer-induced flow

three-quarters or more of the controllable nutrient load comes directly from septic systems, and the remaining quarter comes primarily from fertilizers and road or rooftop run-off. The Massachusetts Estuaries Project has been studying nitrogen-impaired embayments to determine how much nitrogen load from watershed land uses would need to be removed to restore eco-system health. The MEP has found that in most cases one half or more of existing septic systems would need to be eliminated (and typically replaced by sewers) to reduce the nitrogen levels in the embayment to a threshold level that does not cause algal blooms.

However, the average 50-percent reduction needed to bring down water column nitrogen to a threshold level addresses only the *current* load (see Figure 3). If there is additional growth in the watershed, in the form of homes or businesses that would be served by on-site systems, then *all* of that "new" nitrogen would need to be removed from the watershed to keep the total load at the threshold level. Thus, there are two factors in the equation for this hypothetical watershed:

- Reduce by 50 percent the current septic nitrogen load
- voiding 100 percent of the new septic nitrogen load resulting from growth

In watersheds where significant growth is expected, the costs to control "new nitrogen" actually exceed the cost for reducing "current nitrogen." The "new nitrogen" half of this equation can be mitigated with savvy growth-management techniques.

The location of expected growth is also critical. If a town is zoned to allow significant growth in a nitrogen-sensitive watershed, high costs will result for nitrogen control. If that town can shift its growth focus to non-sensitive watersheds, some of the growth-related costs can be avoided. Furthermore, growth that is spread out over a larger area of the watershed will increase collection costs, while growth that is clustered or concentrated in a town center can be collected more cost-effectively.

CONCEPT OF FLOW-NEUTRAL PLANNING

The amount and location of future growth has a significant impact on sewer cost. Further, the availability of sewers enables more growth. Towns can influence wastewater infrastructure costs by controlling the amount and location of future growth. This control over growth is accomplished through land-use zoning.

Planning approaches that coordinate the design of wastewater infrastructure with zoning help to ensure that sewering accomplishes the necessary nutrient removal for existing development as well as a desired level of future growth. Under this approach, the sewering capacity or flow allocated to different parcels is determined by a combination of zoning that governs the uses and intensity of development of parcels and sewer regulations that determine the allowed flow that can be contributed to the sewer system. The combination of land-use controls and flow limitations ensures that limited sewer capacity is allocated where growth is desired. Conversely, by working in tandem the regulations ensure that sewers do not enable unwanted growth.

Sewering is thought to enable growth when the full development potential of a parcel under zoning had been restricted by on-site septic treatment regulations. This has indeed been the case on Cape Cod where setback and flow- design limits of the state sanitary code have restricted full build-out of some parcels and, in some instances, rendered parcels unbuildable. In such cases, construction of public sewers removes the setbacks and flow limits in septic regulations, making full development under zoning possible. Figure 4 illustrates this.

Flow-neutral planning seeks to ensure that future sewering will not accommodate an increase in wastewater flow over what could have occurred under the zoning and on-site septic treatment regulations in effect prior to sewering. Flow neutrality is an important policy consideration that has grown out of local and regional concern that installation of sewers would lead to proliferation of unwanted residential and commercial development.

Recognizing this concern, the Massachusetts state revolving

fund has made flow neutrality a criterion for obtaining zero-interest loans for construction of wastewater infrastructure projects involving nutrient control. To demonstrate flow neutrality, a town must have adopted land-use controls to ensure that planned wastewater infrastructure will not increase wastewater flow beyond what was authorized under the zoning and wastewater regulations at the time the wastewater infrastructure plan was adopted. That is to say, if towns want sewers to allow more growth, zoning to allow that additional growth must be in effect at the time the sewer plan is adopted. Zero-interest loans for Cape Cod towns, compared with traditional municipal bonding, could be worth hundreds of millions of dollars.

The intent of the flow-neutral requirement is to ensure that installation of sewers does not result in an increase in growth unless the added growth is consistent with duly adopted land-use regulations in effect when the infrastructure plan is put in place.

To meet the flow-neutral requirement, communities need to decide how much growth they want sewers to accommodate. Estimates of future growth used to plan wastewater capacity should be fully vetted by the community to ensure that resulting growth patterns are desired. In practice, a town developing a wastewater plan may estimate future growth using assumptions that have not been fully vetted by the community, or are based on zoning that is decades old and may be inconsistent with contemporary community planning objectives. The result may be a sewer plan that reinforces undesirable or outmoded growth patterns, or that masks the cost of wastewater treatment necessitated by that growth. Once a desired level of growth is identified, the community should consider how much it would cost to build a sewer system to accommodate that level of future growth. This ensures that a community understands and accepts the cost of providing a level of wastewater treatment needed to support future growth. The selection of growth level and assessment of costs may be an iterative process to determine the balance of growth and costs acceptable to the community.

The Cape Cod Commission provides a framework for this iterative approach in its "Guidance for Local Wastewater Management Plans" (December 2012). The guidance instructs towns in the earliest stages of planning to estimate the cost of wastewater treatment for mitigating wastewater flows based on current zoning and to estimate the cost of wastewater treatment for alternative scenarios of future growth. Providing the public with this information early enables the community to understand and indicate a desired growth potential with an acceptable cost. The guidance further recommends that later stages of wastewater planning should not begin until the town has achieved consensus on future growth and associated costs for providing wastewater treatment for that growth. Given the cost implications of growth in nitrogen-sensitive watersheds, this early identification of costs is critical to development of a publicly acceptable plan.

The key aspects of managing growth and wastewater costs are best understood in terms of a broad range of fundamental options open to a town. Table 1 contrasts these options for determining limits of growth and associated wastewater flows that will have implications for wastewater treatment costs. The options are:

- No-growth
- Flow-neutral
- Status quo
- Growth-promoting
- Net-flow-neutral

The options in Table 1 allow a town to assess the relationship between growth and wastewater costs. The options demonstrate that the best ways for towns to limit wastewater costs are to reduce future wastewater flows by limiting growth to what could occur without sewers

Table 1. Options for managing growth and wastewater flows

Option	Growth and flow effects	Cost implications
No-Growth	Zoning is amended to prohibit new development or expansion of homes and businesses to avoid any increase in nitrogen load.	Costs are reduced because future nitrogen loads are avoided.
Flow-Neutral	Sewer regulations are put in place to limit flow to only what would have been allowed under the state sanitary code. Full development of parcels under zoning yet limited by the state sanitary code still is not allowed to occur.	Costs are controlled by limiting nitrogen loads to those that would be allowed by zoning but not by the state sanitary code.
Status Quo	Zoning is unchanged but the absence of state sanitary code limits means that sewering allows incremental growth in instances where the state sanitary code had prevented the full potential of growth allowed by zoning.	Growth enabled by sewering results in higher costs than under the flow-neutral scenario.
Growth-Promoting	Zoning is amended to allow increased growth, which in turn increases nitrogen load.	Costs increase due to wastewater flows associated with added costs.
Net-Flow-Neutral	Zoning allows more growth in some areas and less in others to result in a flow-neutral level of growth and nitrogen load; often referred to as smart growth.	Costs are the same as flow- neutral or are reduced due to improved efficiency of treatment.

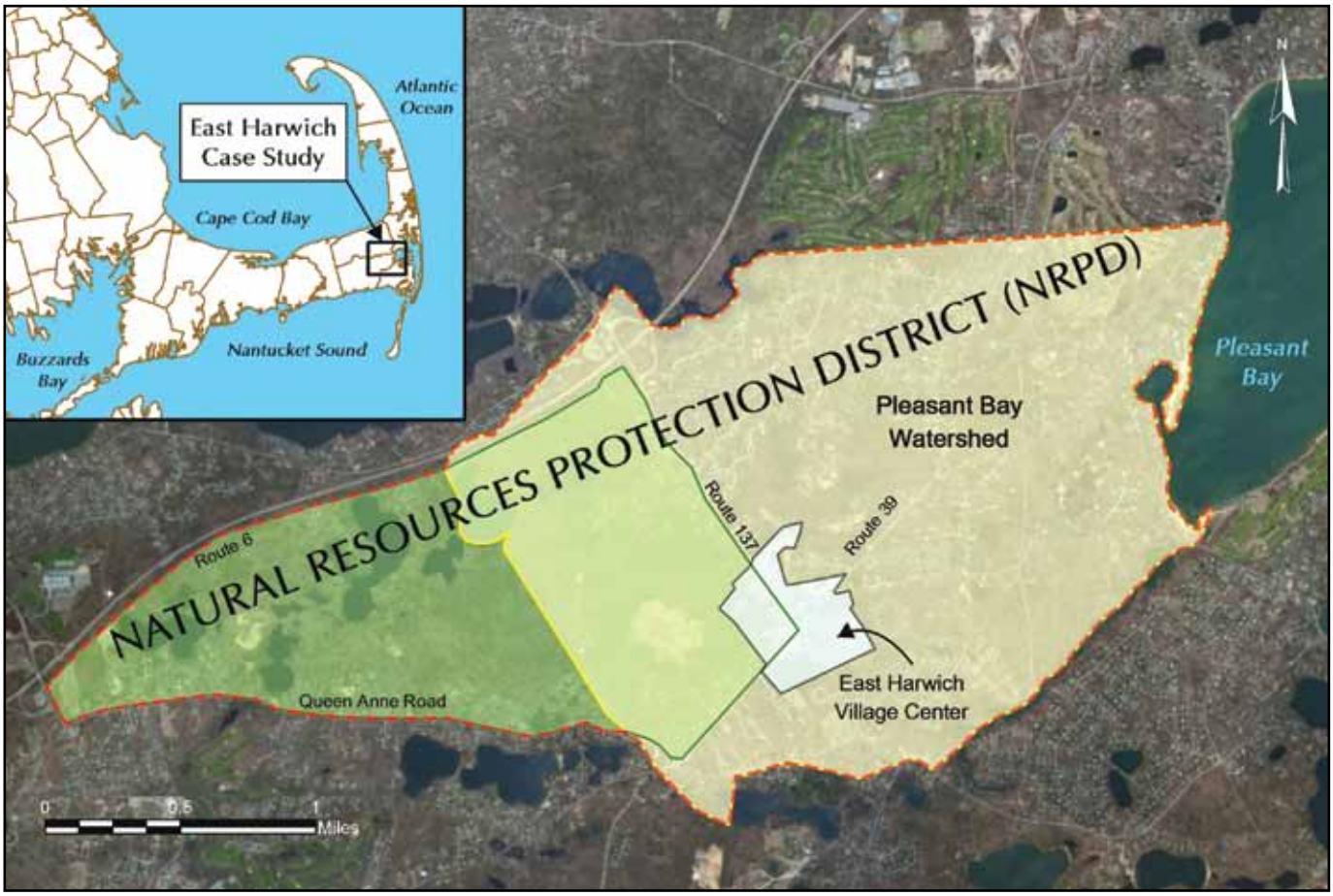

Figure 5. Location of East Harwich Village Center within Pleasant Bay Watershed

(flow-neutral) or by ensuring that more growth in one area is offset by less growth in another area (net-flow-neutral).

SEWERS & SMART GROWTH

Some Cape Cod communities view sewering as an opportunity to reintroduce village-style development that involves a high-density mix of housing and businesses not easily accommodated under the state sanitary code. New zoning to create village centers would be growth-promoting and therefore would increase wastewater flows and infrastructure costs. Using the net-flow-neutral approach the community could create the same village center with increased density and wastewater flows, and balance those increases with a reduction in density and wastewater flow in another area where growth is not desired. This net-flow-neutral approach, also known as smart growth, allows communities to rely on sewers to achieve economic development goals without increasing wastewater costs or impairing sensitive resources.

To help Cape Cod towns understand the effects of sewers on community growth patterns, the Barnstable County Water Resource Collaborative commissioned a report, "Sewers and Smart Growth." The report provides a reference guide for towns seeking to achieve flow-neutral or net-flow-neutral (smart growth) planning and explores the planning challenges and opportunities that emerge with the introduction of sewers.

The planning challenges and opportunities are explored in four scenarios to demonstrate how the introduction of sewers can alter growth patterns:

1. Existing dense residential neighborhoods where the introduction of sewers would eliminate state sanitary code setback and design flow criteria which previously limited full parcel development.
2. Town or village centers where the introduction of sewers could support a desired mix of commercial and residential uses or, alternatively, enable unwanted expansion of land uses.
3. Under-developed areas susceptible to growth that may have sensitive natural resources that could be threatened by additional growth enabled by sewers.
4. Nitrogen-sensitive watersheds in which only a portion of the watershed is sewered, with the remaining area using on-site septic treatment.

Each scenario poses different growth management challenges and opportunities. The report provides case studies to demonstrate the policy tools and

regulations available to ensure that wastewater infrastructure reinforces community character, economic development goals, and resource protection.

Presented below is a case study demonstrating how a net-flow-neutral approach combining smart-growth zoning with wastewater planning could accomplish community development goals and reduce overall sewer costs.

EAST HARWICH CASE STUDY

The East Harwich commercial district is within the nitrogen-sensitive Pleasant Bay watershed (see Figure 5). The district is typical of sprawling commercial districts across Cape Cod featuring single-story buildings surrounded by large parking lots. This development pattern is unfriendly to pedestrians, lacks housing, and undermines community character. Under current zoning, substantial new development and redevelopment is possible in the district following this same pattern.

Surrounding the commercial district, several hundred acres of undeveloped land could yield as many as 350 additional houses under current residential zoning. The commercial district and the surrounding undeveloped residential land contain sensitive natural resources, including the Pleasant Bay watershed, unprotected portions of the town's drinking water supply, and several vulnerable freshwater ponds.

The East Harwich planning challenge is two-fold. The first challenge is to guide future development and redevelopment within the commercial district in a mixed-use village development pattern. The second challenge is to preserve as much open space as possible in the surrounding sensitive resource areas and ensure that future nitrogen loads in the Pleasant Bay watershed do not slow progress toward achieving nitrogen thresholds.

Two very different approaches to meeting the planning challenges for East Harwich have emerged from community discussions. A third option, leaving zoning unchanged, also is under consideration. Table 2 lists the three alternatives, and Figure 6 illustrates their impacts on wastewater flows.

- Under Alternative 1, *status quo*, zoning is unchanged, and sewers would allow the same level of development and wastewater flows as current zoning.
- Under Alternative 2, a *growth-promoting* approach, zoning is amended to allow for substantial increases in commercial development and 315 new residential units in the commercial district. Development potential in the remainder of the watershed remains unchanged, so that 350 new housing units still could be developed.
- Under Alternative 3, a *net–flow-neutral approach*, increased mixed-use development potential within the commercial district is balanced with a reduction in the number of homes that could be built on surrounding residentially zoned land. Within the current commercial district, this alternative would increase commercial development, though not to the same level as Alternative 2, and add residential units. To balance this, the proposal also creates a Natural Resource Protection District (NRPD) to encompass surrounding undeveloped residential land within the Pleasant Bay watershed. The NRPD reduces the number of dwelling units that could be built in the outlying area and also increases open space protected from development.

The growth-promoting alternative would increase wastewater flows by 40 percent over the status quo. As a result, collection, treatment, and disposal of added wastewater flow from the growth-promoting approach would cost $10 million more than the status quo alternative. On the other hand, the net-flow-neutral approach results in a mere 2-percent increase in wastewater flows compared to the status quo. By concentrating new growth in the village center and reducing the number of dwellings that would need to be sewered in the outlying NRPD, the cost of providing wastewater infrastructure to serve the net-flow-neutral approach would be $5 million to $10 million less than the status quo.

The case study demonstrates how increased growth and wastewater flow in a village center, coupled with reduced growth and wastewater flow in resource-sensitive areas, can achieve economic development and resource protection goals while reducing overall wastewater infrastructure costs. The

Table 2. Comparison of potential growth in development and wastewater flows under alternative planning scenarios

Alternatives	1 Current Zoning	2 Growth-Promoting	3 Net-Flow-Neutral
Within Village District (EHVC)			
Commercial (sf)	497,000	1,351,000	673,000
Dwelling Units	0	664	315
Wastewater Flow (gpd)	43,000	189,000	93,000
Outside Village District (NRPD)			
Commercial (sf)	35,000	35,000	35,000
Dwelling Units	2,466	2,466	2,146
Wastewater Flow (gpd)	331,000	331,000	288,000
Areas Combined (Totals)			
Commercial (sf)	532,000	1,386,000	708,000
Dwelling Units	2,466	3,130	2,461
Wastewater Flow (gpd)	374,000	520,000	381,000

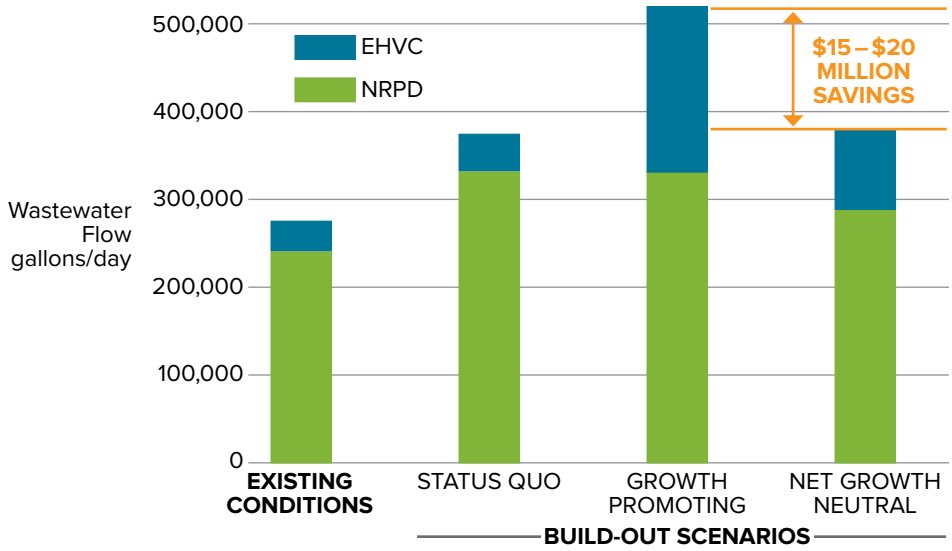

Figure 6. Wastewater flow projections for East Harwich build-out scenarios

alternative of simply increasing growth and wastewater flows results in $10 million more in wastewater infrastructure costs, in addition to the opportunity cost of $5 million to $10 million in lost savings.

Thus, the true difference in cost between the growth-promoting approach and the net-flow-neutral approach is $15 million to $20 million. In addition to costs savings, the net-flow-neutral approach achieves economic and housing goals by allowing for increased commercial development and the same number of housing units compared with the status quo approach.

CONCLUSIONS

Planning for sewers is an opportunity for towns to review community growth projections and ensure that zoning and wastewater infrastructure support the desired amount and location of new growth. Every town should closely project its growth potential as part of both traditional community planning and wastewater management planning.

By coordinating land-use planning and wastewater-infrastructure planning, towns can keep wastewater-infrastructure costs within acceptable limits. In Cape Cod, projected costs for new wastewater infrastructure should be divided: the cost to deal with nitrogen load from existing development and the cost to deal with nitrogen load from future growth. In areas where significant new growth is projected, costs associated with nitrogen from future growth may exceed the cost of dealing with nitrogen from current development. Growth projections used to size wastewater facilities should only be set after planners and the public have discussed the cost of alternative growth scenarios and chosen an acceptable growth-cost scenario.

Changes in zoning may be needed to ensure that wastewater infrastructure reinforces community planning and economic development goals. Where some new growth is desired, towns should seriously consider flow-neutral options to control costs and to show the public that sewering options need not trigger unwanted growth.

As demonstrated by the East Harwich case study, the net-flow-neutral concept should be vigorously pursued. Under this approach, growth is redirected to desired areas such as village centers where sewers are more cost-effective and away from resource-sensitive areas that drive up collection and disposal costs.

In this example, the net-flow-neutral approach reduces overall sewering costs by $5 million to $10 million compared with no change in zoning and generates $15 million to $20 million in savings over the growth-promoting approach. The net-flow-neutral approach accommodates economic development and increased housing production, yet avoids millions in added costs—as well as impacts to sensitive resources—resulting from a growth-promoting approach without a counterbalancing reduction in development and wastewater flow.

REFERENCES

- Barnstable County, 2010, *Comparison of Costs for Wastewater Management Systems Applicable to Cape Cod.* Cape Cod Commission, 2012, Guidance for Local Wastewater Management Plans.
- Ridley & Associates, 2010, *Sewers and Smart Growth: Challenges, Opportunities and Strategies*, report to the Cape Cod Water Protection Collaborative.
- Wright-Pierce, 2012, *East Harwich Village Center: Wastewater Impacts of Build-out Scenarios*, report to Association to Preserve Cape Cod.

ABOUT THE AUTHORS

- Carole Ridley is a principal of Ridley & Associates, Inc., a Massachusetts firm specializing in strategic planning and project implementation. She is the author of "Sewers and Smart Growth," and numerous coastal resource management plans.
- Michael D. Giggey, senior vice president of Wright-Pierce, advises Cape Cod towns and the Cape Cod Commission on wastewater planning issues. He was one of the principal authors of the Barnstable County Cost Report and prepared the technical evaluation of zoning options for East Harwich.