COMPREHENSIVE WASTEWATER MANAGEMENT
CITIZENS ADVISORY COMMITTEE (CAC)

January 18, 2006
Town Hall Meeting Room
Main Street, Chatham, Massachusetts - 4:00 pm

PRESENT:

CAC: Fred Jensen, David MacAdam, Burt Segall, Scott Tappan, Bob DePatie, and John Payson
CAC members not present: Chuck Pollard, John Randall, Phil Christophe, Herb Bernard, Didi Lovett
TAG: Bob Duncanson, Bill Redfield, Judith Giorgio
Others Present: Nate Weeks, Colleen Furber, Chuck Bartlett, Jean Young, Al Haven, Ed Sheehan

The meeting was called to order at 4:00 pm.

Item 1: Minutes

Minutes of the December 15 meeting were approved unanimously with the following corrections:

The word "system" was added to the third bullet on page 2 so the sentence reads: The total capital cost of the collection *system* would be . . .
The word "of" is changed to "a" in the next to last line of page 2
The words "pounds per year" were added before "per person" in the "C" paragraph of Item 4 on page 4.

Item 2: Presentation by Brian Dudley: Rationale for estimating septic tank nitrogen loading to a watershed using a per capita methodology vs. septic tank effluent nitrogen concentration.

Brian Dudley, MA DEP/MEP discussed the manner in which DEP arrived at a figure of 2.1 kg/person/year as the nitrogen load to be used in MEP planning calculations. The following information was provided:

1. Critical questions: What load is going into the system? Therefore how do you determine that load? Although previous focus has been on concentration, the underlying premise has always been on a per capita load value; a mass per person.

2. The value determined by DEP is 2.1 kg/person/year (4.63 lbs/person/year) which was borne out by studies.
    - Buttermilk Bay study by Weiskel & Howes. Employed a "stream tube" methodology.
        - Existing monitoring wells were used to establish groundwater contours.
        - A stream tube approximately 25m wide at the shoreline was established.
        - The specific residences within the stream tube were identified. The flow from, and population in, the residences could be accurately determined.

- A monitoring well fence was established across the mouth of stream tube along the shoreline of the water-body.
- Knowing the flow through the stream tube (volume) and the concentration at close intervals (from monitoring well fence) the load going in could be measured against the population.
- Replicated at three locations.
- Based on these studies the value of 2.1 kg/person/year was determined to be a reasonable, valid, and defensible number.

3. How does this value factor into the Mass Load?
   - M = Q x C; where M = mass load, Q = flow, and C = concentration.
     - Q is problematic due to dependence on population; a significant issue on Cape Cod.
     - C is affected by water use; in areas where water conservation is significant the concentration coming from a septic system is more concentrated; in areas with excessive water use the concentration is diluted.
     - To overcome these difficulties DEP looked for an alternative.
   - Based on a review of local and national averages, DEP looked at establishing a value for per capita water use, what's going into the house, not wastewater. National average of 60-65 gals/person/day; Falmouth study 64 gals/person/day; Orleans 64.3 gals/person/day. DEP determined that a value of 64 gals/person/day was a good number to use.
   - Equation becomes:
     - 2.1 kg/person/year = 64 gal/person/day x concentration.
       - 2.1 kg/person/year is a wastewater generated load
       - 64 gals/person/day is a water use number, would normally be a wastewater number. Therefore, must integrate "consumptive use". Consumptive use is that portion of the incoming water that exits as wastewater. Varies by area, watershed, etc.
         - National average = 0.9
         - In original Chatham MEP = 0.9, based on comparing water records vs. flow received at WWTF for homes on sewer.
         - In Barnstable for homes with dual meters = 0.6.
       - As consumptive use value varies so does concentration coming from septic system. As consumptive use value decreases the concentration values increases and vice versa.
   - Equation now becomes:
     - 2.1 kg/person/year = 64 gals/person/day x [consumptive use x concentration].
       - To overcome the inherent variability in consumptive use and concentration DEP combined these terms into a "septic loading coefficient" equal to 23.63 mg/l.
   - To determine the mass load per parcel for the MEP the equation becomes:
     - Mass load/parcel (kg/yr) = water use/parcel (gals/day) x 23.63 mg/l x appropriate conversion factors.

4. In earlier MEP reports the mass loadings were determined on a septic concentration of 35 mg/l whereas for others a value of 26.5 mg/l was used. DEP needed to reconcile those 2. DEP recognized that a poor job of communicating how the calculations were made had occurred.

Burton Segall – Was the 2.1 kg/person/yr values used in all the modeling so there was consistency?

Brian Dudley – Yes.

Dave MacAdam – Asked about value of 23.63 mg/l vs. 23.72 mg/l mentioned earlier, why the difference?

BD – The 23.72 mg/l value was based on population numbers in Falmouth, it was subsequently refined. The difference in the numbers is insignificant relative to the sensitivity of the model. DEP is carrying forward with the 23.63 mg/l value.

Fred Jensen – Asked for clarification of consumptive use.

BD – Consumptive use is the difference between water that comes into the facility and water that goes into the septic system (or sewer); e.g. if the consumptive use ratio is 80% then 80% of the water coming in goes into the septic system, the remainder could be used of irrigation, car washing, etc.

Fred – Commented that original Chatham MEP did not reference 2.1 kg/person/year but did reference 35 mg/l as concentration.

BD – Basis of calculation for load was always based on per capita load but was not explicit in report, was implicit value that was carried through. In original Chatham MEP report value was 35 mg/l, in subsequent MEP reports was revised to 26.25 mg/l because of the need to reconcile the variability in consumptive use and concentration in order to maintain the 2.1 kg/person/year load.

Fred – Where did the 2.1 kg/person/year come from?

BD – The 2.1 is the kg/person/year generated through wastewater. The mass of nitrogen from the stream tubes measuring flow and concentration. With monitoring wells across the narrow mouth of the stream tube this provides a high degree of confidence in the concentration and therefore, a reasonable estimate of what is discharged to the embayment (concentration). The limited area of the stream tube allowed the volume of water and concentration (= mass), and population to be calculated with some certainty.

Brian Dudley agreed to provide copies of the underlying studies to the CAC for review.

Fred – Prominent wastewater engineering texts don't talk about load per person, they talk about the effluent from various sources, it's all in terms of concentration.

BD – Disagrees, there are sources that talk about per capita load. When dealing with this kind of analysis the concentration doesn't matter it's the load going in.

Fred – Easier to measure water volumes and the amount of wastewater going into the watersheds than it is to measure average population of Chatham.

BD – That's why this is still based on water use.

Fred – This is based on population, i.e. 2.1 kg/person/year. To get the load don't you need the number of people?

BD – The 2.1 kg/person/year is not a population figure. What has been done is to use the 2.1 kg/person/year and the 64 gals/person/day water use and the unknown is the concentration. The concentration is represented, even though not truly a concentration, by 23.63 mg/l the "septic loading coefficient", because in reality you would look at 64 gals/person/day x consumptive use ratio to arrive at wastewater flow; wastewater flow x concentration give kg/person/day. The consumptive use ratio and concentration can vary; therefore combining the consumptive use ratio and concentration to arrive at the septic loading coefficient overcomes the variability. Mass/parcel = coefficient x specific water/parcel. Example:

Parcel water use of 150 gpd.

Mass load/parcel (kg/year) = 150 gpd x 23.63 mg/l x appropriate conversions

All individual parcels are then added to achieve the watershed load.

Fred – Does that mean instead of 35 we're using 23.63?

BD – 23.63 is a loading coefficient that is representative of a concentration even though it is not the specific concentration.

Fred – Previous method would have taken 150 gpd/parcel x consumptive use x concentration (35 mg/l), therefore this revised calculation will yield a lower loading.

BD – Not necessarily. Yes, it will yield a lower loading, but 35 is a rough planning number with a lot of variability in concentration from the septic system (out of soil absorption system (SAS) that enters groundwater); data from Otis test center indicates a 20-25% reduction of nitrogen from septic tank effluent; septic tank effluent normally 40-50 mg/l TN; using 45 mg/l as rough average with 25% reduction yields 33 mg/l; depending on water use and consumptive ratio and holding 2.1 as constant load/person then high consumptive use will result in lower concentration due to dilution. Within certain constraints can agonize over what is specific number of consumptive use or concentration from septic system, therefore, this concept removes guesswork and yields reasonable estimate of mass loading going into system.

Dave – Where did 35 mg/l come from? Doesn't seem that we're measuring the same thing as being measured in calculations used to derive 2/1 kg.

BD – 35 mg/l came about historically based on certain removal rates as waste moved through the septic system. Conventional wisdom says that there is little nitrogen removal in a typical septic system except what settles in the septic tank with little, if any, reduction in SAS. However, recent research indicates that some septic systems remove as much as 20 to 25% of the nitrogen. Otis data indicates about 26 mg/l from bottom of SAS, based on influent with 33 mg/l. Typical septic system effluent (from tank) is 40-50 mg/l (average 45 mg/l) then a 20-25 % reduction yields 29-33 mg/l.

Dave – What you're saying is someplace in the vicinity of a 25% reduction in nitrogen between the septic tank and the aquifer or embayment?

BD – Yes.

Dave – Previous work was based on no attenuation, no loss of nitrogen between septic system and embayment?

BD – Previous estimates were based on what was coming out of the septic system. There is removal between the septic tank and SAS, but what comes out of SAS, if it travels unimpeded

(i.e. doesn't intercept freshwater or organic rich, anoxic environment) there won't be attenuation from bottom of SAS to embayment. That hasn't changed; measuring point has always been what comes out of SAS not the septic tank.

Dave – All the nitrogen that comes into a septic tank doesn't necessarily leave the septic tank?

BD – All that comes into a Title 5 system does not leave, that has always been accounted for.

Dave – Can't attribute the difference between 35 and 23 to just that?

BD- No, the 23 is a representation, it is not a concentration. It is a combination of concentration and consumptive use ratio.

Dave – Comparing the 35 and 23 is comparing apples to oranges?

BD – Yes, a table of consumptive use and concentration values will change but the product will always equal 2.1 kg.

Burt – 2.1 kg/person/year has always been used; always basis for models and determination of TMDLs. Haven't used septic tank effluent concentration, flow rates, consumptive use; that hasn't been in equation at all in terms of modeling and establishment of standards.

BD - They all come into the mix at some point, but are all based on 2.1 kg.

Burt – Referring to stream tube method. Monitored groundwater flow velocities, cross-sectional area of stream tubes and periodically monitored concentration of nitrogen, and accounted for population. There are other variables: time in residence of people, possible de-nitrification, etc. With such small population studied leads to great deal of variability or of low level of confidence in 2.1 number which eventually leads to low level of confidence in the model results and resulting TMDLs.

BD – Dealing with small population, but manageable one that you can actually take measurements on. In terms of de-nitrification that may occur, stream tube area was sandy substratum that was constant throughout stream tube, therefore, conditions were not favorable for in-situ de-nitrification; therefore conservative transport. EPA research references and Proceedings from national symposia on septic systems yielded numbers in comparable range to the 2.1. The 2.1 was validated by (1) the experiments performed; (2) the supporting body of literature; and (3) results of load calculations when 2.1 is used with actual measured concentrations found in embayments (calibrated, validated model). 2.1 is number that has been determined and verified through various sources, then as applied to the model it correlates with what is seen in the embayments. These factors provide a high degree of confidence in the 2.1 number.

Fred Jensen - Asked Nate Weeks of Sterns & Wheler if he had any comments.

Nate - Responded that Sterns & Wheler has been closely following the changes and information generated by the MEP. Indicated that they will be checking the references and research mentioned earlier.

Fred Jensen – Will this approach result in a lower amount of nitrogen that will have to be removed from a watershed?

BD- This is not necessarily the result. Number in the original MEP report will change due to the change from 3 to 4 quarters of water use data. The average water use numbers went down

about 15%. That will change the calculated loads, will also have a proportional affect on build-out loads, etc. Can't say in general that it (the use of 2.1 kg) will reduce loads, but that everything will shift proportionally. Regardless of the resulting number, the embayments are stressed and the report will generate appropriate removal requirements.

Item 3: Evaluation of Wastewater and Nitrogen Management Strategies for the Stage Harbor Complex.

Bob Duncanson explained that the town is working to move forward as quickly as reasonable on implementation strategies in response to feedback from the Board of Selectmen and the community. Sterns & Wheler has been asked to look at various areas of town with regard to sewering needs/possibilities.

Nate Weeks explained that they looked at the Stage Harbor area because it is near the present sewer infrastructure, and because the quality of Stage Harbor waters is important to the town.

Nate Weeks' presentation (copy attached) included the following slides/information:

A map of the town showing watersheds and recommended nitrogen removal percentages.
- Types of Wastewater Management Options:
- Title 5 systems
- Individual nitrogen-removal systems
- Community or cluster systems
- Centralized treatment/nitrogen-removal system

Title 5 Systems
- Septic tanks; can be bunkered if high water table is an issue
- Typical nitrogen removal is only 20 to 25%
- Required by town and state sanitary code
- These systems are not designed for nitrogen removal, but basically enable effluent to percolate in the ground. Disease prevention and health issues are primary reasons for Title 5 requirements. Comparisons were made to Third World countries that do not require sound sanitation practices.

Individual Nitrogen-removal Systems
- Many technologies are available (Bioclear; FAST; Ruck)
- Approximate removal of nitrogen: 50%
- Must be inspected/sampled once a year

Community/Cluster Systems (ex. Bailey's Path and Chatham Bars Inn)
- Components are: collection, treatment, effluent recharge
- Approximate removal of nitrogen: 75%

Centralized System: Collection, treatment effluent recharge
- Approximately removal of nitrogen: 88%

Proposed Facility Upgrades:
- Expanded collection system

Upgrade of treatment plant
Expansion of recharge system
These will result in approximate removal of nitrogen: 93%
Proposed is a carousel system which can remove nitrogen to a level of 3 mg/l. This is the limit of current wastewater treatment technology. "Drinking water" technology can provide even better results but is very expensive.

Map of Stage Harbor watershed showing sub-areas indicating percentage of needed nitrogen removal.
Examination indicates that the only technology which would meet the removal percentages for this area is centralized sewering.

Nate Weeks indicated that the next step will be to examine the most logical way to extend sewers in this area. This will be done based on topography and the location of existing sewer lines. Other considerations in planning: cost; fiscal fairness; avoiding raised and/or bunkered systems.

David MacAdam asked about the eastern section of the Stage Harbor area (Chatham Harbor shoreline). Bob Duncanson indicated that they are awaiting results of the Pleasant Bay MEP study as some of the eastern area drains into Pleasant Bay rather than Stage Harbor; the Southway is not included in the Pleasant Bay MEP study.

Burt Segall asked if there were any considerations regarding hydrogen-sulfide generation in the closed-pump systems which will likely be needed in this area. Nate Weeks indicated that this is certainly a consideration and that pump stations will be designed to control/mitigate sulfides.

John Payson asked about the earlier concern for the Cockle Cove Creek area as related to this presentation regarding Stage Harbor. Nate Weeks noted that Cockle Cove Creek remains an important concern. We are still awaiting results of the Cockle Cove saltmarsh study of that area and will address concerns there once the report is received. He added that the order of presentation of information about various watersheds does not indicate a prioritization for implementation of work in those areas.

John Payson asked about "checkerboarding" and its possible application in Chatham, expressing concern regarding properties that contribute little nitrogen. Nate Weeks indicated that it is probably not an applicable approach to use in Chatham. It was noted that future uses and loads will be considered when sewers are designed.

Item 4: Review of Ongoing Sewer Usage Charges for Properties Connected to the Central Sewer

Bill Redfield offered a presentation (copy attached) to explain the rationale/methodology in calculating water and sewer charges in Chatham. He first noted that state statute requires that a "just and equitable" rate be established for water and sewer services. Operations and Maintenance (O&M) costs should be recovered under the sewer rate.

Included in the presentation were the following visual charts:

- Sewer Rates (rates based on water usage – on a cu. ft. basis; billed quarterly for different sections of town)
- Allocations for charges based on wastewater budgets
- Allocations of debt services to wastewater loadings (this is not currently included in the rate but could be a factor in future calculations of sewer rates)
- Sewer rate for FY 2006 – based on function costs and loading to develop a cost per 100 cu. ft. Functions included: Collection, Flow, BOD, TSS
- Sewer Revenues based on FY 2004 Water Consumption = $2,588,802
- Average Chatham Household Annual Sewage Disposal Cost = $398.40
- Town of Chatham Future Sewer Revenues – 1,814,138 gpd will yield $2,788,800 in revenue
- Sewage Flow by Area/Existing and Future
- Totals = 1,099,697 gal (existing); 1,806,095 gal (future)
- Sewage Flow Revenues by Area – Existing = $2,588.801
- Sewage Flow Revenues by Area at Buildout - $2788,798

Bill Redfield noted an earlier proposal, discussed by some members of the CAC, to add a charge to the water rates to help pay for sewer expansion. The CAC proposal involved a 1 cent/gallon surcharge which would equate to a tripling of the current 0.5 cent /gallon charge. In addition, such a surcharge would most likely require special legislation. He also noted that Town Manager William Hinchey is developing an alternative proposal to assist with financing the sewer expansion program which will be presented to the Board of Selectmen at the February 14, 2006 meeting.

Burt Segall noted that increased water rates will especially impact those who do extensive irrigation. Bill Redfield noted that the use of a two-meter system, one for interior uses and one for irrigation, may be a solution for some homeowners.

David MacAdam asked about the use of quarterly figures vs. monthly water use figures in our planning. Bill Redfield responded that it is a major manpower issue to do monthly meter readings and develop monthly data. Bob Duncanson added that most wastewater planning is done based on annual figures, so he asked that the CAC provide input as to why they would like to have monthly reporting data. Fred Jensen asked that those committee members who feel monthly data is important to send their rationales for this to him or to Bob Duncanson.

Item 5: Updates on Work in Progress

Bob Duncanson provided the following information:

Cockle Cove Creek Salt Marsh Study - not yet provided to DEP; lasted word from Brian Howes is end of January.

MEP's study of Pleasant Bay – due to DEP this Friday; expected to be received by the town approximately a month later.

Re-Runs of MEP's water quality model for Chatham south-side embayments – A contract between the Town and SMAST has been signed with the work to be completed by April, 2006.

RFP for analysis of Lovers Lake and Stillwater Pond – The RFP is under review and should be out in January or February.

There being no other business, the meeting was adjourned at 6:50 pm

Recorder: Marie Williams