<table>
<thead>
<tr>
<th>County</th>
<th>Town</th>
<th>Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nassau County</td>
<td>Hempstead</td>
<td>Required for development greater than one acre, not including parcels proposed for one or two family dwellings.</td>
</tr>
<tr>
<td></td>
<td>Oyster Bay</td>
<td>Required for all development except for conforming parcels within an approved subdivision.</td>
</tr>
<tr>
<td></td>
<td>North Hempstead</td>
<td>Required for all development greater than one acre, all commercial and industrial development and one and two family dwellings that, on the basis of field inspection, require additional drainage collection facilities.</td>
</tr>
<tr>
<td>Suffolk County</td>
<td>Babylon</td>
<td>Required for all development.</td>
</tr>
<tr>
<td></td>
<td>Brookhaven</td>
<td>Required for all development except for single family dwellings.</td>
</tr>
<tr>
<td></td>
<td>East Hampton</td>
<td>Required for all development except for buildings and structures within retail business districts, commercial-industrial districts and commercial-industrial heavy districts on lots held in single and separate ownership.</td>
</tr>
<tr>
<td></td>
<td>Islip</td>
<td>Required for all development except conforming parcels within an approved subdivision that already has an operable drainage system.</td>
</tr>
<tr>
<td></td>
<td>Huntington</td>
<td>Required for all development, unless it has been shown that drainage structures are present to handle any additional runoff originating from the site.</td>
</tr>
<tr>
<td></td>
<td>Riverhead</td>
<td>Required for all business and industrial zoning districts, residential retirement community districts, residential development community districts and recreational districts. Also required for any special permitted uses within any zoning district.</td>
</tr>
<tr>
<td></td>
<td>Shelter Island</td>
<td>There are no local controls governing stormwater control.</td>
</tr>
<tr>
<td></td>
<td>Smithtown</td>
<td>Required for all development except one or two family dwellings.</td>
</tr>
<tr>
<td></td>
<td>Southampton</td>
<td>Required for all development except conforming parcels within an approved subdivision that already have an operable drainage system.</td>
</tr>
<tr>
<td></td>
<td>Southold</td>
<td>Required for all development.</td>
</tr>
</tbody>
</table>
A summary of municipal stormwater management requirements is provided as follows:

**REQUIRE DRAINAGE PLANS OR A DRAINAGE PROFILE**
- Most towns require a drainage plan or a street profile including a description of the proposed drainage facilities as part of each site plan. If the site is located on an existing street or within a subdivision that is mostly developed, a new drainage facility is generally not necessary.

**RUNOFF MUST BE CONTAINED ON SITE**
- Huntington, East Hampton, Southold, Southampton and Babylon require that either the runoff from each plot be self-contained or that all stormwater be recharged into the ground. In Southampton, stormwater must be recharged into the subsurface groundwater reservoir.

**NO OVERLOAD OF EXISTING SYSTEMS**
- In other towns, such as Smithtown, no water may be diverted so as to overload existing systems.

**NO FLOODING OR NEED FOR ADDITIONAL DRAINAGE STRUCTURES**
- Several towns, including Smithtown, do not allow stormwater systems that would create flooding or a need for additional drainage structures.

**SITES THAT ARE BEING REDEVELOPED ARE REQUIRED TO UPGRADE DRAINAGE SYSTEMS**
- In Babylon, the Town Planning Board requires that the existing drainage system of developed sites now undergoing redevelopment be upgraded to meet new Board specifications.

**PREVENTION OF SITE EROSION AND SEDIMENTATION DURING THE CONSTRUCTION PERIOD**
- In Huntington, the developer must confine runoff to the site during construction operations in order to reduce the site erosion and sedimentation caused during the period of development. Disposal of any runoff onto existing streets or private property is therefore prohibited.

**PREVENTION OF LONG TERM ACCELERATED EROSION AND SEDIMENTATION**
- Both Huntington and Southampton utilize an Erosion and Sediment Control Handbook, compiled by the Suffolk County Soil and Water Conservation District Office. The town can require implementation of its control measures where it is deemed necessary to retard the rate of runoff. The Handbook outlines the following general guidelines to minimize erosion:
  - Choose the land that has the right natural drainage pattern, topography, and soils for the intended development.

- Use areas with soils not well suited to intensified development for parks and other open space uses.
- Save trees and other existing vegetation wherever possible. They enhance the beauty of the subdivision, which has a dollar value; they provide shade for lawns, and they help control erosion.
- Expose as small an area of land as practical at any one time during development.
- Expose the land for as short a period as possible.
- Hold lot grading to a minimum.
- Plan streets to fit the contour of the land in order to avoid long stretches of excessive grade.
- Provide adequate drainage to streets and from streets to storm sewers or other runoff disposal that does not erode the land or flood property below.
- Plant timely, temporary vegetation during development in critical areas subject to erosion.
- Build sediment basins to remove sediment from runoff waters during development.
- Provide for disposing of increased runoff caused by changed land formations.
- Plant permanent vegetation and install structures as soon as possible.
The Handbook also provides specific control measures for Non-Critical Area Stabilization and Critical Area Stabilization. Critical Areas are defined as areas where extensive grading and site conditions may require a combination of planting, grading and other nonstructural controls and structural controls (such as retaining walls) to minimize erosion. The control measures include site grading, short term seeding, semi-permanent seeding, installation of permanent vegetation, outlet channel design and waterway and bank stabilization.

In a further step to control erosion resulting from construction in unstable areas, the Town of Huntington has amended its zoning ordinance to include hillside development and steep slope protection by reducing the density of housing on slopes of ten percent or greater. Strict controls of stormwater runoff before, during and after development are described with requirements for refilling and properly regrading the site, replacing top-soil, and seeding with grass or plants specified in the rehabilitation plan.

VILLAGES

In many of the incorporated villages stormwater controls are very similar to the regulations in the town in which the village is located. In a few cases, village stormwater controls are more stringent. A number of villages, however, presently do not have subdivision regulations that include the review of stormwater runoff control measures.
Recommendations

Legislation, Regulations and Administration

The following recommendations comprise preventive measures that can be used to minimize stormwater contamination of surface waters and groundwater resulting from site development and future land use activities as well as suggestions for reducing or eliminating existing impacts. Criteria are also provided for the selection and installation of appropriate stormwater control measures including both nonstructural and structural techniques. This section also describes a number of management practices, sedimentation and erosion control measures and the suitability of these measures for various types of site conditions.

State, Counties and Municipalities

- Limit development and the establishment of impermeable paving on publicly-owned lands located near surface waters and wetlands.
- Prohibit any new direct discharge of stormwater into surface waters, freshwater or tidal wetlands. Use appropriate control measures for areas near surface waters (See Municipalities).
- Evaluate existing stormwater systems that currently discharge into surface waters to determine whether the systems can be modified to include additional control measures to minimize impacts upon surface waters and adjacent areas.
  - Inventory direct discharges and assign remediation priority ratings based upon environmental impacts.
  - Determine if there is sufficient land area to develop cost feasible energy dissipation areas, and sediment basins or retention areas to eliminate or reduce the direct discharge and accompanying sediment loadings into surface waters and wetlands, or to reduce peak runoff flows before discharge.
    (See Control Measures.)
- Acquire and maintain those streambeds and the surrounding watershed areas that have dried up due to sewering. The retention of these areas will facilitate the recharge of runoff, thus reducing the amount of streamflow following a storm and the subsequent associated high coliform loadings that would otherwise reach the bays. The NURP report indicated that reductions in coliform loadings to the bays can be achieved through the use of streambeds and ponds to retain the sediments thus allowing for the die-off of most of the coliform bacteria.
• Do not remove recharge basin vegetation since plant growth generally enhances infiltration. The root systems keep the soil layer loose and permeable and provide for the infiltration of water.
• Perform shallow (40 foot) test drilling of proposed recharge basin site to determine whether there is a clay unit under the basin.
• Incorporate the erosion control recommendations provided below into State and County agency guidelines (see Municipalities).

Municipalities

• Refer to the recommendations that have been proposed in the other Handbook Chapters to reduce nonpoint sources generated on-site thus reducing contaminant loadings in stormwater.
• Refer to the Land Use Chapter for the following nonstructural stormwater control measures
  - Establishment of Special Surface Water Protection Areas
  - Revision of Comprehensive Plans and Local Zoning Ordinances.
  - Requirement for Site Clearance Permits.
  - Requirement for the Dedication of Conservation Easements.
  - Review and modification of Type I and Type II SEQRA lists.
  - Acquisition of Lands for Preservation
• Amend local zoning ordinances to include a requirement for the establishment of adequate setbacks, 100 feet from the shoreline for areas adjacent to the edge of lakes, ponds, streams, rivers, bays, wetlands and in areas where the depth to seasonal high water table is less than three feet. Such areas should not be cleared of native vegetation except for cat brier, honeysuckle and other destructive vines. Any stormwater runoff generated from the site development upland and discharged into these areas should be discharged at a release rate that shall not exceed the stormwater runoff rate from the area in its natural state and discharged in a manner so that no erosion and loss of vegetation occurs.
• Require adherence to the following performance standards for all new site development:
  - Protect and maintain the natural functioning of the site by maintaining the absorptive, purifying and retentive functions that existed on the site before construction began.
  - Limit the post-construction volume and rate of runoff leaving the site to that calculated on the basis of natural or predevelopment conditions. The peak release rate of stormwater from all developments where retention is required for the designed storm, should not exceed the peak stormwater runoff from the area in its undeveloped state for a storm of any intensity up to and including the 100 year frequency, and for rainfall of any duration. Calculations of the rate should be based upon an assumed runoff coefficient of 0.20, 0.25, and 0.35 for average slopes of 2 percent, 2–7 percent and over 7 percent, respectively.
  - Design the site drainage system so that the runoff release rate from natural drainage channels will not exceed the natural carrying capacity of the channel.
  - Limit the release rate for drainage systems serving new development. The volume and velocity of runoff discharged should not exceed the safe capacity of the existing drainage systems into which the discharge flows.
• Require a stormwater management plan for any property when
  - a plat is to be recorded
  - land is to be subdivided
  - an existing drainage system may require alteration.
  - new development is proposed for more than one residential unit on a
    given plat
  - new development for any use other than single family residence is
    proposed
  - the rate or volume of runoff will be significantly increased
  - on-site water drains to a pond, stream or other surface water body or to
    a wetland

The stormwater management plan may be a part of a site plan or supportive
specifications or other written material, and should indicate the manner in which
the applicant will meet the required performance standards.

• The plan should contain the following information:

  1. A description of the existing site conditions including
     - topography
     - location and description of surface waters, fresh water and tidal
       wetlands, existing woodland or other vegetation, soils, high water
       table areas, the depth to seasonal high water table, location of the
       100 year flood plain
     - existing structures, utilities
     - the direction, flow, rate, and volume of stormwater runoff under
       existing conditions (if partially developed or developed) or natural
       conditions (if not developed)
     - the areas on-site or off-site that currently receive stormwater runoff

  2. All proposed site changes including
     - changes in topography
     - changes in land surfaces (i.e. show locations where vegetation is to be
       removed and lawns or paving installed)
     - proposed site construction and planting areas
     - locations of all buildings and structures

  3. The resultant changes in the volume and rate of stormwater runoff
     (based upon a given year storm to be determined by the municipality
     suggest a 25 year storm) from various locations on the site

  4. The description of the proposed stormwater drainage system including
     - the proposed location of stormwater control measures
     - the designed volume, rate, flow path, detention and retention of
       stormwater on-site
     - the amount and rate of off-site stormwater discharged from the site
     - the location and description of erosion and sedimentation control
       measures
     - the description of the pollutants likely to be generated on-site
     - the potential impact upon groundwater, and surface waters

• Incorporate the following erosion and sedimentation controls into local
  ordinances. The design, construction and maintenance of erosion control
  systems should be consistent with the following proposed local controls:
  - A ban on the commencement of grading, cutting or filling until erosion
    and sedimentation control devices have been installed between the
    disturbed area and waterbodies, watercourses and wetlands.
- A requirement that land which has been cleared for development and upon which construction has not commenced shall be protected from erosion by appropriate techniques designed to revegetate the area.
- A requirement that sediment shall be retained on the site of the development.
- A ban on the use of wetlands and other waterbodies as sediment traps.
- Provision of regular maintenance to insure that erosion and sedimentation facilities continue to function properly.
- A requirement that artificial watercourses should be designed, so that the velocity of flow will not cause erosion.
- The creation of vegetated buffer strips where practicable, and the retention of existing growth along the banks of all watercourses, waterbodies or wetlands. The width of the buffer should be sufficient to prevent erosion, trap the sediment in overland runoff, provide access to the waterbody and allow for periodic flooding without damage to structures.
- The use of retention and detention ponds to retain and detain the increased runoff and sediments that the development generates. Water should be released from detention ponds into watercourses or wetlands at a rate and in a manner approximating the natural flow that would have occurred before development. The banks of detention and retention areas shall slope at a gentle grade into the water as a safeguard against drowning, personal injury or other accidents, and also to encourage the growth of vegetation and to allow the alternate flooding and exposure of areas along the shore as water levels periodically rise and fall.

(The erosion controls listed above were among a number suggested in an article entitled “Stormwater Runoff Control: A Model Ordinance For Meeting Local Water Quality Management Needs” by Maloney, et. al. - which appeared in the Natural Resources Journal. Vol. 20, October 1980.)

- Require an erosion control plan whenever a stormwater management plan is required.
- Withhold the certificate of occupancy until the stormwater control measures and erosion and sedimentation control measures are installed in accordance with this plan.

Site Planning Recommendations

SITE ANALYSIS

Success in the reduction of stormwater related impacts and the costs of installing stormwater systems depends in large measure, on proper site analysis and the selection and placement of development suited to the site.

- Undertake a careful site analysis to identify any developmental constraints affecting the design of a stormwater control system that may be imposed by the location of existing on-site and off-site features. The site analysis process should include the following steps:
  - Prepare a key map locating the site within the watershed or drainage basin
- Prepare a watershed analysis map showing the site drainage system in relation to the watershed (see Figure 22). Locate all natural drainage swales, depressions, slopes, high points, low points, flood prone areas, areas with depth to seasonal high water table less than three feet, areas of existing vegetation, sensitive wildlife habitats, and soil constraints listed in Table 3. Stormwater impacts can be minimized by avoiding soil conditions with severe or moderate constraints.
  - a slight constraint indicates no limitations or a few that can be overcome with relatively little cost.
  - a moderate constraint indicates that the limitations are more difficult and expensive to correct.
  - a severe constraint indicates the soil is very poor and will require replacement filling or modification if used. Filling is not recommended.

- Locate on-site areas suitable for the recharge of stormwater
- Locate on-site areas suitable for development. Site building and paved areas only when the presence of the environmental conditions are favorable. The following soil and slope conditions may indicate soil suitability for development:
  - nearly level or moderately sloped terrain; (less than eight percent slope)
  - moderately to rapidly drained soils; (a moderate to high permeability rate)
  - a coarse or medium textured soil
  - a seasonal high water table more than five feet below the surface.
  - other soils listed under slight constraints in Table 3.

- Consult the County Health Departments for information concerning the movement of groundwater and recorded fluctuations in the water table elevations

SITE PLANNING

Use proper site design as described in the Site Plan Review Chapter, and other chapters and the following:

- Minimize grade changes and site clearing
- Retain native vegetation on steep slopes, in swales, on Carver or other excessively drained sandy-gravelly soils, on soils with a high content of silts, fine sands and clays, and in areas with a high water table or adjacent to surface waters.
- Avoid the use of paved surfaces such as parking lots and roadways where the presence of the following conditions indicate potential problems:
  - severely sloped terrain
  - flood plain areas
  - existing swales
  - lowland areas
  - depressions, kettleholes
  - soil constraints listed as severe or moderate in Table 3.

- Incorporate the following general stormwater controls checklist into the site design as needed to meet the performance standards listed:
  - Reduce the extent of impermeable surfaces insofar as possible.
  - Use swales and shallow depressions to collect stormwater on-site, wherever possible.
FIGURE 22  Site Analysis Map
**TABLE 3**
Limitations Of Soils For Areas Where Stormwater Runoff Will Be Generated Or Recharged

<table>
<thead>
<tr>
<th>Severe Constraints</th>
<th>Moderate Constraints</th>
<th>Slight Constraints¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Artison sand</td>
<td>Bridgehampton silt loam, till substratum, 8-12% slopes</td>
<td>Bridgehampton silt loam, 0-6% slopes</td>
</tr>
<tr>
<td>Beaches</td>
<td>Carver &amp; Plymouth sands, 8-15% slopes</td>
<td>Bridgehampton silt loam, till substratum, 2.6% slopes</td>
</tr>
<tr>
<td>Mucky sand</td>
<td>Cut &amp; fill land</td>
<td>Carver &amp; Plymouth sands, 0-8% slopes</td>
</tr>
<tr>
<td>Canadice silt loam</td>
<td>Haven loam, 6-12% slopes</td>
<td>Haven loam, 0-6% slopes</td>
</tr>
<tr>
<td>Carver &amp; Plymouth sands 15-35% slopes</td>
<td>Montauk fine sandy loam, 3-15% slopes</td>
<td>Made land</td>
</tr>
<tr>
<td>Cut &amp; fill land, steep slopes</td>
<td>Montauk silt loam, 3-15% slopes</td>
<td>Montauk fine sandy loam, 0-3% slopes</td>
</tr>
<tr>
<td>Deerfield sand</td>
<td>Montauk soils graded, 3-15% slopes</td>
<td>Montauk silt loam, 0-3% slopes</td>
</tr>
<tr>
<td>Dune land</td>
<td>Plymouth loamy sand, 8-15% slopes</td>
<td>Montauk soils graded 0-3% slopes</td>
</tr>
<tr>
<td>*Fill land, made land</td>
<td>Riverhead sandy loam, 8-15% slopes</td>
<td>Plymouth loamy sand, 0-8% slopes</td>
</tr>
<tr>
<td>*Gravel pits</td>
<td>Riverhead &amp; Haven soils, 8-15% slopes</td>
<td>Plymouth loamy sand, silt substratum, 0-3% slopes</td>
</tr>
<tr>
<td>Montauk loamy sands 0-35% slopes</td>
<td>Riverhead very stony, sandy loam, 8-15% slopes</td>
<td>Riverhead sandy loam, 0-8% slopes</td>
</tr>
<tr>
<td>Muck</td>
<td>Wallingston silt loam</td>
<td>Riverhead and Haven soils 0-8% slopes</td>
</tr>
<tr>
<td>Riverhead &amp; Plymouth very bouldery soils 15-35% slopes</td>
<td>Wallingston silt loam</td>
<td>Riverhead very stony, sandy loam, 3-8% slopes</td>
</tr>
<tr>
<td>Tidal Marsh</td>
<td>*Wareham loamy sand and sandy loam</td>
<td>Scioto silt loam, till substratum, 2.6% slopes</td>
</tr>
<tr>
<td>Wallingston silt loam</td>
<td>Whitman sandy loam</td>
<td>Scioto silt loam, sandy substratum, 0-6% slopes</td>
</tr>
</tbody>
</table>

¹ There also may be moderate constraints for recharge of stormwater for these soils in this category. All soils should be checked for permeability rates.

Source: Soil Survey of Suffolk County, United States Department of Agriculture Soil Conservation Service and the Cornell Agricultural Experiment Station, April 1975.

¹ variable constraints
- Preserve swales in their natural state. Avoid disturbance of existing grades, vegetation (particularly ground cover) or soils and the alteration of surface hydrology.
- Provide temporary on-site areas to receive stormwater runoff flows that are generated by construction and other site development activities.
- Do not allow increased sediment resulting from the construction or operational phase of site development to leave the site or to be discharged into stream corridors, marine or freshwater wetlands.
- Minimize the amount of soil area exposed to rainfall and the period of exposure. Cover or plant exposed soils as soon as possible.
- Do not allow the dumping or filling of excess soil or other materials generated from site development into swales and surface waters.
- Detain runoff on-site and direct stormwater from road surfaces to sediment basins before discharge to a sump wherever topography limits or precludes the on-site recharge. At sites where vertical drainage is not feasible, all runoff from a 25 year frequency, 24-hour storm from unstabilized soil areas should be collected, desilted, and released into stable channels at an acceptable design velocity appropriate for channel characteristics.

Once the site plan has been partially completed, undertake the following steps:

- Calculate the amount of stormwater entering the site
- Calculate the amount of natural runoff from the site
- Calculate the additional amount of runoff due to the proposed installation of impermeable paving and other surfaces
- Locate areas on-site for the storage and recharge of stormwater
- Reevaluate the site plan if the storage and recharge area capacity is not sufficient.

Stormwater Control Measures for Site Development

- Minimize on-site runoff and erosion by using the following control measures:

SITE PLAN

The residential development plan in Figure 23 illustrates various stormwater control measures, used in combination to minimize impacts upon water quality. Most of the individual control measures are described in greater detail. See Stormwater Control Measures For Site Development. Recommendations for their use are summarized in Table 4.

COMBINE DEVELOPMENT AND STORMWATER CONTROLS

- Use cluster development as a viable alternative to conventional subdivision layout to preserve environmentally sensitive qualities of wetlands, aquifer recharge areas, swales and woodlands (see Figures 24-26).
- Reduce the length of roadways, thereby reducing the extent of cut and fill areas and stormwater runoff volumes and minimizing the possibility of sedimentation/erosion.
- Reduce the area of other impermeable surfaces such as walkways, patios and recreational facilities.
- Allocate open space for recreation and aquifer recharge.
<table>
<thead>
<tr>
<th>Measure</th>
<th>Structural</th>
<th>Non-Structural</th>
<th>Purpose</th>
<th>Recommendation For Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Permeable Paving</td>
<td>X</td>
<td></td>
<td>Reduce the volume and rate of stormwater runoff; allow for increased infiltration.</td>
<td>Patios and walkways; use on slopes less than five percent where soils have a moderate to high rate of permeability; adequate depth to seasonal high water table.</td>
</tr>
<tr>
<td>In-Line Storage</td>
<td>X</td>
<td></td>
<td>Collect stormwater runoff from parking lots and roadways; allow for percolation of runoff.</td>
<td>In areas where there is adequate depth between the bottom of leaching pools and leaching catch basins and the seasonal high water table.</td>
</tr>
<tr>
<td>Perforated reinforced concrete pipe</td>
<td>X</td>
<td></td>
<td>Allow for recharge of stormwater</td>
<td>General use</td>
</tr>
<tr>
<td>Natural Depressions</td>
<td>X</td>
<td></td>
<td>Collect and detain runoff; slow stormwater velocity to allow for recharge; protect low-lying areas and downstream development from flooding.</td>
<td>Upland areas in or adjacent to drainage areas by streams or waterways.</td>
</tr>
<tr>
<td>Gutters and Downspouts</td>
<td>X</td>
<td></td>
<td>Collect and convey runoff from roofs to leaching pools or other stable outlet.</td>
<td>For residential and commercial structures where roof top storage is not feasible; any site development, especially dense development where large volumes of roof runoff are anticipated.</td>
</tr>
<tr>
<td>Natural Vegetation</td>
<td>X</td>
<td></td>
<td>Control runoff and erosion/sedimentation; slow stormwater velocity to allow for increased infiltration; trap sediment particles; roots hold soil particles in place.</td>
<td>Upland areas, slopes, land area adjacent to surface waters and bluffs, streambanks, drainageways.</td>
</tr>
<tr>
<td>Wetlands</td>
<td>X</td>
<td></td>
<td>Buffer and stabilize lowland areas; slow runoff velocity and retain runoff, filter and trap suspended debris.</td>
<td>Along rivers, streams, and other surface water systems.</td>
</tr>
<tr>
<td>Sediment Ponds/ Basins</td>
<td>X</td>
<td></td>
<td>Protect surface waters from increased sediment loads; reduce the potential of flooding for downstream lands.</td>
<td>Construction sites; areas of highly erodible soils and sloped terrain.</td>
</tr>
<tr>
<td>Energy Dissipation</td>
<td>X</td>
<td></td>
<td>Slow stormwater velocity to a non-erosive level; trap debris, permit the settling of suspended solids and accompanying contaminants.</td>
<td>Adjacent to culverts, outlets, and drainage channels, and along streambanks; to prevent erosion and/or scouring.</td>
</tr>
<tr>
<td>Sediment Filter</td>
<td>X</td>
<td></td>
<td>Trap suspended particles and debris from stormwater runoff.</td>
<td>Adjacent to culverts, outlets, and drainage channels, and along streambanks; to prevent erosion and/or scouring.</td>
</tr>
<tr>
<td>Stormwater Retention (Ponds/basins)</td>
<td>X</td>
<td></td>
<td>Retain sediments (and runoff) to allow for the die-off of bacteria; reduce peak runoff flows and protect downstream properties from flooding; protect streams from increased sediment loadings.</td>
<td>To receive stormwater from drainage channels in areas where recreational and water amenities are desired; (permanent pond) and in areas where heavy sediment loads are not anticipated.</td>
</tr>
<tr>
<td>Measure</td>
<td>Structural</td>
<td>Non-Structural</td>
<td>Purpose</td>
<td>Recommendation For Use</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>------------</td>
<td>----------------</td>
<td>--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td>-------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Stormwater Detention (Ponds/basins)</td>
<td>X</td>
<td></td>
<td>Temporarily detain runoff with gradual release to surface or groundwaters; reduce peak runoff flows; protect downstream development from flood potential.</td>
<td>Upland sites and other sites where there is sufficient distance to seasonal high water table, drainage areas adjacent to streams and waterways; can function as a recreation area when properly vegetated and designed to drain completely.</td>
</tr>
<tr>
<td>Surface Drainageway</td>
<td>X</td>
<td></td>
<td>Direct runoff from areas where it could cause flooding, erosion and/or sedimentation.</td>
<td>Along slopes where soils are exposed during construction; newly constructed fill slopes; and in areas of highly erodible soils.</td>
</tr>
<tr>
<td>Grass or Vegetated Waterway</td>
<td></td>
<td>X</td>
<td>Convey runoff to a stable outlet; grasses can reduce energy of flow, permitting infiltration.</td>
<td>Areas where slopes are moderate and runoff velocities are non-erosive; areas where increased stormwater volumes will not exceed the capacity of the channel.</td>
</tr>
<tr>
<td>Bare Channel</td>
<td></td>
<td>X</td>
<td>Convey and/or direct runoff on construction sites.</td>
<td>Areas where the slope gradient is minimal and the runoff velocity is low; avoid use in areas with highly erodible soils.</td>
</tr>
<tr>
<td>Structurally-lined Channel (riprap, asphalt, concrete)</td>
<td>X</td>
<td></td>
<td>Convey and/or direct runoff; channel outlet must be well-stabilized, there is little or no energy dissipation along an impervious-lined channel.</td>
<td>Drainage areas having a high slope gradient or where runoff velocities are erosive, prohibiting the establishment of vegetation.</td>
</tr>
<tr>
<td>Man made Drainage Swales</td>
<td></td>
<td>X</td>
<td>Convey and/or recharge stormwater runoff.</td>
<td>Recommended for most sites where control of low volume stormwater flow is required.</td>
</tr>
<tr>
<td>Biofiltration Systems</td>
<td>X</td>
<td></td>
<td>Minimize pollutant loadings carried in stormwater runoff to surface waters; aquatic plants absorb contaminants (coliform, metals, nutrients) and trap suspended solids.</td>
<td>Where there is adequate area to construct such a pond; drainage areas that empty into surface waters; where construction of a recharge area is not feasible due to the shallow depth of the water table.</td>
</tr>
<tr>
<td>Soil/Slope Stabilization</td>
<td>X</td>
<td>X</td>
<td>Protect exposed soils from runoff impacts, erosion and sedimentation (see Table 3), reduce runoff velocities allowing for infiltration; hold vegetation in place until roots are established.</td>
<td>Slopes and other areas where soils are exposed during construction, newly constructed fill slopes; soil stockpile areas.</td>
</tr>
</tbody>
</table>
FIGURE 23  Site Plan Of Stormwater Control Measures
FIGURE 24  Sample Study Site - Undisturbed

Shows a vacant parcel of land which is a mature, undisturbed woodland. It is a 21 acre site, containing two major swale areas, steep slopes (greater than 15%), natural depressions, and kettle holes.
FIGURE 25 Sample Study Site—Conventional Subdivision

This is the same parcel of land as shown in Figure 24 but developed as a conventional subdivision. The preservation of environmentally sensitive features (swales, steep slopes, depressions) has been ignored in order to obtain the maximum allowable density. The 21 acre site has been subdivided into 39 half-acre lots, allowing for a recharge basin.
This is the same parcel of land as shown in Figure 24 but developed as a cluster development (townhouse and attached units) at the same overall density of two units per acre. Cluster development permits a variety in the siting, shape, and orientation of the dwelling units while the allowable density of a particular cluster or group of clusters remains the same as conventional single lot development. Flexibility in site design provides the opportunity to protect the natural features (swales, steep slopes and natural depressions) as open space for stormwater recharge and recreation. Clustering allows the site designer to achieve reduction in the amount of impermeable paving, utilities, vegetation disturbance. Stormwater is collected and recharged close to its source by using swale and natural depressions for drainage and recharge.
NATURAL VEGETATION

- Use natural vegetation as an important nonstructural alternative in the control of stormwater runoff and erosion/sedimentation. Natural vegetation includes woodlands, free standing trees, old fields, grasses, and wetlands. When left undisturbed, vegetation stabilizes steep slopes, streambanks, and drainageways by
  - Reducing stormwater velocity, allowing for absorption of water to occur, thus recharging the aquifer below.
  - Acting as a filter by trapping sediment particles.
  - Holding soil particles in place.
- Identify site locations where existing vegetation will not be disturbed by grading, filling or removal. Removal exposes valuable topsoil, making it highly susceptible to erosion/sedimentation (see Figure 27).
- Do not store top soil on the vegetation.
- Stabilize exposed slopes during and after construction, by using temporary and/or permanent, structural or nonstructural stabilization measures. (See Municipalities-Erosion and Sedimentation Controls and Table 6 for appropriate measures to use for site conditions.) All areas not to be covered with an impervious surface should be temporarily stabilized immediately following disturbance. Permanent stabilization measures should be installed as soon as possible.

NATURAL DEPRESSIONS

- Use natural depressions to collect runoff from the surrounding development and slow its velocity, allowing for recharge. Natural depressions consist of gently sloping land, vegetated with grasses, understory vegetation, and/or trees. Depressions also function as holding areas of runoff, allowing sediment particles and debris to settle out before discharge to nearby surface waters. Except during storm events, depressions may also serve as recreational open space. They are visually pleasing and may be preferable to recharge basins, where the depressions can provide sufficient retention capacity. (See Figure 28).

WETLANDS

- Do not discharge stormwater directly into freshwater or tidal wetlands.

STORMWATER DETENTION

- Use stormwater detention (temporary detainment of stormwater runoff, with gradual release to surface or groundwaters) to maintain the same volume and rate of site runoff after development as that which existed prior to the development. Detention areas are designed to drain completely after a storm. An emergency spillway should be provided to allow release of runoff during storms that exceed the design capacity of the retention area. Except during storm events, detention areas may also serve as recreational open space and should be visually pleasing.
- Provide for maintenance of the control facility to insure sustained flow rates and its visual attractiveness. Prevent standing water which could be a hazard, and remove debris (see Figure 8).
FIGURE 27  Natural Vegetation is Used As A Recharge Area For Stormwater
STORMWATER RETENTION PONDS

- Use stormwater retention for the permanent holding of stormwater runoff on the site or for long term detention to allow for the die-off of coliform bacteria. Retention ponds can provide recreational and aesthetic benefits for a development by supporting certain native plants and aquatic life. They also can provide a habitat for wildlife when the pond area is planted with upland and aquatic vegetation. The retention pond should be sized to contain both the normal dry weather water volume and expected runoff flows. It is recommended that the retention pond be designed to accommodate a 100 year-24 hour storm. In areas where heavy sediment loads are anticipated, the aesthetic value of the permanent pond and its surroundings will be severely reduced by deposited sediment and debris, therefore maintenance will be required (see Figure 29).

DRAINAGE CHANNELS

- Use man made swales and other types of drainage channels to carry and recharge stormwater.
- Use bare channels only as a temporary measure for construction sites in areas where the slope is minimal, and the runoff velocity is low. Do not install bare drainage channels in areas with highly erodible soils. The permanent use of bare channels should be avoided.
• Use structurally-lined channels as necessary in drainage areas where the slope is high or runoff velocities and concentrations are erosive, particularly in areas of highly erodible soils that preclude the establishment of vegetative cover. The most common structural linings include concrete, rip-rap and asphalt (see Figure 30).
• Use shallow detention and recharge areas upgradient of the natural swales as required so that the existing volume and velocity of runoff into the swales shall not be exceeded. If this is not possible due to a lack of land area or the presence of a high water table, etc., then vegetative and/or structural stabilization measures will be required to provide the swale with the capability to carry and/or recharge runoff without risk of erosion/sedimentation.
• Use grassed or vegetated waterways in areas where design velocities are low and soils have a low erosion potential. Stabilized vegetation also reduces the energy of flow, allowing for infiltration of runoff. Vegetative waterways are usually preferred over structurally-lined channels for reasons of aesthetic value (see Figure 31).
• Protect the channel until a uniform vegetative cover has been obtained, eliminating the risk of erosion and/or sedimentation damage. Common channel stabilization methods include the use of seeding, mulches, and sod. Jute netting and other mulching techniques are frequently used to protect channels until vegetation is established (see Figure 32-Channel Stabilization Measures).
FIGURE 30  Rip-Rap Drainage Channel

FIGURE 31  Grassed Drainage Swale
DIVERSION CONTROL MEASURES

- Use diversion control measures to direct stormwater away from an area where it could cause damage from flooding erosion and/or sedimentation. A surface drainageway is one type of a diversion control measure. It is a natural or constructed channel or waterway used to divert stormwater runoff. A berm is another type of diversion control measure. Surface drainageways and berms should be used to divert stormwater away from natural slopes, bluffs, areas where slopes or soils were exposed during construction, and newly constructed fill slopes. Channels and waterways should have the capacity to provide a path for flow to move at non-erosive velocities to a stable outlet. Diversion control measures should not direct stormwater runoff to an adjacent property (see Figure 33).

ENERGY DISSIPATION

- Use energy dissipation devices to slow the velocity of stormwater runoff to a non-erosive rate. This can be done by establishing a control area immediately adjacent to an outfall or other discharge point. Usually a pile of rocks, stones, gravel/ crushed stone or boulders is used to reduce the velocity of the stormwater as it moves through the area. Energy dissipators may also serve as sediment filters, trapping suspended particles and debris.
SEDIMENT BASINS

- Use sediment basins to protect surface waters from increased sediment loads by trapping the suspended solids before the runoff is released. Figure 34 illustrates how a sediment basin functions, from the collection of runoff to its release to surface waters.
- Remove accumulated sediment and debris periodically, so that the basin will function properly and its visual attractiveness will remain. Wherever possible, retain vegetation, since the roots can increase soil permeability.

SEDIMENT FILTER

- Use a sediment filter to trap suspended particles and debris from stormwater runoff. A sediment filter may consist of a pile of rocks, crushed stone or boulders (see Figure 34).

FIGURE 34  Sediment Basin

*May later be converted to permanent retention pond upon completion of construction*
BIOFILTRATION SYSTEMS

- Use a biofiltration system to detain runoff and reduce contaminant loadings. Biofiltration by a combination of physical and biological processes, can minimize concentrations of coliform bacteria, heavy metals, and nutrients carried in stormwater runoff. A biofiltration system is essentially a man-made pond or wetland of approximately five foot depth. The system includes an energy dissipator, located below the inlet pipe, to reduce water velocity and trap suspended solids, (sediment and debris). The entire basin is lined with an impermeable vinyl sheet to prevent leaching of trapped contaminants to groundwaters. The vinyl liner is covered with clean sand and loam, and planted with indigenous aquatic plant species, such as Typha angustifolia, or cattails. All above water areas are stabilized by plantings of rye grass, Lolium multiflorum, or Tall Fescue, Festuca arundinacea, or Red Fescue, Festuca rubra, to name a few. Removal of pollutants is accomplished as the runoff moves across the plants. After a detention time of five to seven days, during which the contaminants are absorbed by the plants, significant reductions in contaminant levels occur. The treated runoff is then released to adjoining surface waters. The overflow chamber, located at the pond outlet, (equipped with backflow and adjustable weir) controls the storage capacity (see Figure 9-11).

Maintenance involves the periodic cleaning of the surge tank and overflow chamber of floating debris and sediments, and biannual harvesting of aerial portions of the aquatic plants.

RECHARGE BASINS

- Design recharge basins so that they blend in with the site topography. Consider the use of free form or natural forms and natural slopes for the recharge area instead of using a rectangular basin with steep side slopes. Use convex slopes instead of consistent slopes. See Figures 6 & 7 for an existing recharge basin and Figure 8 for a recommended recharge basin. Consider the use of natural vegetative species instead of exotic landscaping species (see Figure 35 for an ecological recharge basin).

IN-LINE STORAGE (Nationwide Urban Runoff Program)

- Use an in-line storage system for the collection of stormwater runoff from parking lots and roadways. Such systems are suitable in areas where there is adequate distance between the bottom of the leaching pools and top of the water table (minimum of 2 feet). This system consists of a series of catch basins and leaching pools connected by perforated reinforced concrete pipe (see Figure 15). The catch basins in the system in use in Bayville are located every 200 feet at low points and intersections. (The distances between the catch basins vary according to site conditions). Any overflow from the basins enters the perforated pipes (where some leaching occurs) allowing the stormwater to flow from one leaching pool to the next, as each fills. If the stormwater runoff is of sufficient volume to fill all the leaching catch basins and pools, then the excess volume will flow into surface waters or other designated areas.
FIGURE 35  Ecological Recharge Basin
PERMEABLE PAVING

- Use permeable paving for patios and walkways to reduce the volume of stormwater runoff by increasing infiltration to the ground below, thus allowing for recharge of the aquifer. Permeable paving may be used in areas where permeability of the soil is sufficient to allow rapid drainage and where a seasonally high water table is not anticipated (see Figure 36).

DOWNSPOUTS

- Use downsouts to collect and convey runoff from roofs to leaching pools (see Figure 37).

SOIL AND SLOPE STABILIZATION MEASURES

- Use stabilization techniques to prevent erosion. The options include mechanical, vegetative, impervious and either temporary or permanent measures depending upon the slope and length of time between temporary stabilization and installation of a permanent stabilization measure (see Table 5 for the recommended techniques for given site conditions and Figures 38 - 40).

---

FIGURE 36  Permeable Paving
FIGURE 37  Plan of Downspouts

FIGURE 38  Soil/Slope Stabilization Measure
FIGURE 39  Soil/Slope Stabilization Measures
Source: Evergreen Systems, Inc., Kings Park, N.Y.
The photo was reprinted from Architect and Builder, May 1983.

FIGURE 40
Soil/Slope Stabilization Measure
<table>
<thead>
<tr>
<th>Measure</th>
<th>Temporary</th>
<th>Permanent</th>
<th>Purpose</th>
<th>Recommendation For Use</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impervious Surfaces</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Asphalt</td>
<td>X</td>
<td></td>
<td>Use as roadways and walkways</td>
<td>Use on slopes less than 10 percent.</td>
</tr>
<tr>
<td>Concrete</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mulches</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Salt Hay or Straw</td>
<td>X</td>
<td></td>
<td>Protection of seeded areas until vegetation is established; slow the velocity of runoff, increase the capacity of the soil to hold water, and hold seeds in place. Salt hay is preferred because it does not contain seeds.</td>
<td>Use on steep and other unstabilized areas, where erosion/sedimentation is anticipated, due to rainfall and runoff impacts.</td>
</tr>
<tr>
<td><strong>Wood Chips/Ground Bark</strong></td>
<td>X</td>
<td></td>
<td>Improve soil structure and fertility while holding soils in place.</td>
<td>Use in flat areas to protect soil from impact of rainfall, and provide weed control.</td>
</tr>
<tr>
<td><strong>Manure</strong></td>
<td>X</td>
<td></td>
<td>Fertilizer; hold soils in place; use with hay or straw; (see above “Salt Hay and Straw”).</td>
<td>Use in areas where odor will not be objectionable. Use on slopes less than eight percent. Do not use on slope adjacent to surface waters.</td>
</tr>
<tr>
<td><strong>Gravel/Crushed Stone</strong></td>
<td>X</td>
<td></td>
<td>Protect soils from erosion impacts; can also serve as a permeable road/walkway surface.</td>
<td>Short slopes; including road and walkways.</td>
</tr>
<tr>
<td><strong>Haybales</strong></td>
<td>X</td>
<td></td>
<td>To trap sediment and retard erosion along drainage channels during the construction period.</td>
<td>Construction sites, on gentle almost flat exposed areas, subject to stormwater runoff impacts.</td>
</tr>
<tr>
<td><strong>Composted Materials</strong></td>
<td>X</td>
<td></td>
<td>Improve soil structure and fertility while holding soils in place.</td>
<td>Use on slopes less than eight percent; use to prepare soil for planting.</td>
</tr>
<tr>
<td><strong>Vegetative</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sod (Grass) Seeding Plantings</strong></td>
<td>X</td>
<td>X</td>
<td>Stabilize soils on slopes; minimize the effects of stormwater runoff and erosion/sedimentation, and provide a natural aesthetic value.</td>
<td>See Fertilizer Chapter for usage. Do not use sod on steep slopes.</td>
</tr>
<tr>
<td><strong>Structural</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Scarification</strong></td>
<td>X</td>
<td></td>
<td>Reduce runoff velocity and increase infiltration rates, hold soil particles in place.</td>
<td>Use on slopes left unstabilized during construction; slope is roughened by running tracked construction equipment across or up and down a slope face creating grooves in the soil, grooves should be perpendicular to slope direction.</td>
</tr>
<tr>
<td><strong>Retaining Walls</strong></td>
<td>X</td>
<td></td>
<td>Reduce extremely steep slope gradients.</td>
<td>On slopes too steep to establish vegetation or hold existing vegetation in place.</td>
</tr>
<tr>
<td><strong>Benching</strong></td>
<td>X</td>
<td></td>
<td>Reduce the length of slopes, reduce runoff velocity and provide access for slope maintenance.</td>
<td>Steep slopes (15 percent or more) construction sites; slopes of highly erodible materials.</td>
</tr>
<tr>
<td><strong>Jute Netting</strong></td>
<td>X</td>
<td></td>
<td>Stabilize soils which become exposed during construction, until permanent stabilization measure is implemented.</td>
<td>On slopes and unstabilized areas subject to erosion/sedimentation due to rainfall impacts or overland runoff.</td>
</tr>
<tr>
<td><strong>Fibrous Mats</strong></td>
<td>X</td>
<td></td>
<td></td>
<td>Use as a retaining wall for steep cuts.</td>
</tr>
<tr>
<td><strong>Wood Fiber</strong></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Gabions</strong></td>
<td>X</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Chapter Three

Introduction

Definition of On-Site Systems

On-site systems treat and dispose of sanitary wastes where the wastes are generated. On-site systems include:

- septic systems
- small sewage treatment systems (package plants)
- drainage fields
- lagoons
- cesspools and other on-site devices

They provide varying degrees of waste treatment. The on-site systems approved for use in Nassau and Suffolk Counties, are generally employed wherever communal sewage collection and treatment systems are neither suitable nor available, and where construction of a new facility or connection to an existing system is economically or technically infeasible. In many situations, particularly in rural or low density areas, septic systems are the best alternative.

Individual on-site systems are used either as a temporary or permanent means of sewage disposal depending on their design. Properly designed, constructed and maintained septic systems can last many years.

Importance of On-Site Systems

Septic systems and cesspools are the most commonly used on-site treatment systems on Long Island. An estimated 150,000 on-site systems contributed 120 million gallons of sewage per day to the ground in 1981. These systems dispose of 30% to 80% of the human wastes in Nassau County and Suffolk County, respectively. Figure 1 indicates areas in Nassau-Suffolk that are presently served by sewers and treatment plants. The remaining areas are not serviced.
Advantages and Disadvantages of On-Site Systems

On-site systems have several advantages over sewage treatment plants including:
- relatively inexpensive installation
- generally low pollution loadings to groundwater in low density residential areas
- recharge of the groundwater.

When sewage treatment plants discharge to groundwater, plumes of contaminants may be generated due to improper operation or inadequate treatment capability. The construction of large sewage treatment systems that discharge to marine waters has resulted in increased pollutant loadings to these waters and the drying up of streams and the loss of wetlands due to the consumptive use of groundwater.

Major disadvantages of on-site systems include:
- nitrate-nitrogen and other pollutant contributions to groundwater and nearby surface waters
- unsatisfactory performance in areas with a high water table or poor soil conditions
- the need for regular maintenance to insure proper functioning
- public health problems associated with system failures
- scavenger waste disposal requirements.

Contaminants Associated With On-Site Systems

Pollutants from on-site systems include:
- nitrogen
- organic chemicals
- metals
- bacteria
- viruses

Table 1 identifies the most significant known contaminants associated with on-site systems and the resulting groundwater and surface water problems.

NITROGEN

Nitrogen is considered a key indicator of water quality on Long Island since high levels of nitrogen are often associated with the presence of other groundwater contaminants. According to the
federal standard, drinking water supplied to the consumer may not contain more than ten milligrams of nitrate-nitrogen per liter. Nitrate concentrations that exceed or are close to the federal standard have been found in Upper Glacial and Magathy wells.

The amount of nitrate-nitrogen in the groundwater has increased concurrently with urbanization of the region. Approximately 25 percent (or 43,000 tons) of the total estimated annual nitrogen load to groundwater has been attributed to on-site systems. Fertilizers applied to farm crops and lawns are another major source of nitrogen. In developed areas, high nitrate-nitrogen concentrations in groundwater may be the result of past agricultural activities or the more recent contributions of nitrogen from the discharge from small sewage treatment plants, on-site systems, and fertilizers applied to the lawns of moderate density residential neighborhoods. Nitrogen from on-site systems can pose a threat to groundwater if housing densities exceed one house per acre and if the nitrate applications to lawns exceed recommended levels.

A portion of the nitrate-nitrogen loading found in the septic system influent is reduced in the average septic tank and leaching field. Initial testing of the super septic system by the Suffolk County Department of Health Services (SCDHS) indicates that it could be more effective in removing nitrogen. (See Super Septic System Discussion in this chapter).

The nitrate found in the effluent from on-site systems is highly soluble and moves easily through the soil to groundwater while most nitrogen in domestic sewage is discharged as ammonia. Some organic nitrogen and ammonia may be retained in the soils and taken up by plants. Organic nitrogen is mineralized to ammonia, which can then be oxidized to nitrite and nitrate. Regardless of the initial form, nitrogen in the unsaturated zone is ultimately subject to leaching to groundwater as nitrate.

Nitrates discharged in deep aquifer recharge areas remain in the groundwater almost indefinitely. Nitrates discharged in shallow recharge areas can contaminate shallow aquifers and surface waters. At the present time, the impact of septic systems upon surface waters and associated aquatic biota is not totally known.
### TABLE 1
Impacts of Pollutants From On-Site Systems Upon Surface Waters and Groundwater

<table>
<thead>
<tr>
<th>CONSTITUENT</th>
<th>PROBLEM</th>
<th>Surface Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Nitrate-Nitrogen</td>
<td>High concentrations of nitrate have been known to produce a bitter taste. Water containing nitrogen as NO₃ in excess of 45 ppm has been reported to cause methemoglobinemia in infants.</td>
<td>High concentrations of nitrate-nitrogen may be a problem in marine waters.</td>
</tr>
<tr>
<td>2. High Phosphate Concentrations</td>
<td>NONE</td>
<td>Eutrophication may result if there is sufficient concentration of phosphorus in fresh surface waters from sources such as on-site systems and fertilizers.</td>
</tr>
<tr>
<td>3. Lead, Tin, Iron, Copper, Zinc, Manganese</td>
<td>These constituents are toxic in excessive concentrations</td>
<td>Causes foaming in surface waters.</td>
</tr>
<tr>
<td>4. Chloride, Sulfate</td>
<td>These constituents can present health hazards to some individuals ranging from laxative effects to aggravated cardiovascular or renal disease, if concentrations exceed recommended limits.</td>
<td>Causes foaming in surface waters.</td>
</tr>
<tr>
<td>5. Foaming Agent</td>
<td>A nonbiological detergent constituent and an indicator of contamination. Appearance and taste of the water may be unacceptable.</td>
<td>In extremely localized situations, excessive BOD in septic fluid discharged to surface water can deplete dissolved oxygen supplies necessary to aquatic life.</td>
</tr>
<tr>
<td>6. Biochemical Oxygen Demand</td>
<td></td>
<td>Same as above.</td>
</tr>
<tr>
<td>7. Chemical Oxygen Demand</td>
<td></td>
<td>Impacts freshwater species.</td>
</tr>
<tr>
<td>8. Sodium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Synthetic organic chemicals, including 1,1,1 trichloroethane, tetrachloroethylene, trichloroethylene and chloroform (halogenated hydrocarbons)</td>
<td>These constituents found principally in cesspool additives are suspected carcinogens.</td>
<td>Failing systems may contribute to high total coliform counts. Bacteria and virus may cause disease in humans. Problems include gastro-intestinal illnesses and rashes.</td>
</tr>
<tr>
<td>10. Bacteria and Viruses associated with the presence of fecal coliform</td>
<td>Some private wells may contain significant amounts of pathogens</td>
<td></td>
</tr>
</tbody>
</table>

The blank areas in the above table indicate a lack of identification of a problem-constituent interface. Items 3, 4, and 9 have not been identified as having an impact upon surface waters and items 6 and 7 do not affect groundwater.
INORGANIC POLLUTANTS

Both domestic and industrial on-site systems are also a source of other inorganic pollutants including:
- lead
- tin
- iron
- copper
- zinc
- manganese
- sodium
- chloride
- sulfate
- potassium
- calcium
- magnesium

ORGANIC POLLUTANTS

The presence of organic chemicals in Long Island's Upper Glacial and Magothy aquifers has been recognized as a significant groundwater quality problem. Private and public water supply wells in both counties have been closed due to the presence of organic chemicals found in concentrations that exceed recommended state and county guidelines. The sources of these chemicals are numerous and include:
- residential
- commercial
- industrial septic systems
- cesspools

ORGANIC POLLUTANTS ASSOCIATED WITH RESIDENTIAL ON-SITE SYSTEMS

Organics from residential on-site systems include those in:
- cesspool cleaning liquids
- solvents and degreasers
- gasoline and petroleum products
- foaming agents
- other organic chemicals identified in federal and state laws and regulations.

Cesspool cleaning liquids have historically constituted the bulk of the halogenated hydrocarbons in household discharges. Although Suffolk County banned these additives in September 1980 and subsequently New York State banned them in both Nassau and Suffolk Counties, these chemicals can still be purchased. Organic chemical ingredients found in cesspool cleaners have included:
- 1,1,1-trichloroethane
- methylene chloride
- dichlorobenzene

Past extensive use of cesspool cleaners containing these compounds virtually guarantees their continued presence in the aquifers for many years. Different chemicals are found in the cesspool cleaning products now sold legally.

Other household products that are disposed of through on-site systems contain ingredients that may contaminate the groundwater. Table 2 presents a list of organic chemicals associated with consumer products that are frequently disposed of into residential on-site systems.

<table>
<thead>
<tr>
<th>Type of Product</th>
<th>Contaminant</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Household Cleaners:</td>
<td>petroleum distillates&lt;br&gt;glycol ethers&lt;br&gt;xylenols&lt;br&gt;isopropanol</td>
</tr>
<tr>
<td>Drain Cleaners:</td>
<td>1,1,1-trichloroethane</td>
</tr>
<tr>
<td>Toilet Cleaners:</td>
<td>chlorinated phenols&lt;br&gt;xylene sulfonates</td>
</tr>
<tr>
<td>Laundry Soil and Stain Remover:</td>
<td>petroleum distillates&lt;br&gt;tetrachloroethylene</td>
</tr>
<tr>
<td>Spot Removers and Cleaning Fluids:</td>
<td>petroleum hydrocarbons&lt;br&gt;benezene&lt;br&gt;trichloroethylene&lt;br&gt;1,1,1-trichloroethane</td>
</tr>
<tr>
<td>Paint Brush Cleaners:</td>
<td>aliphatic hydrocarbons&lt;br&gt;toluene&lt;br&gt;acetone&lt;br&gt;methyl ethyl ketone&lt;br&gt;methanol&lt;br&gt;glycol ethers&lt;br&gt;carbon tetrachloride&lt;br&gt;trichloroethylene</td>
</tr>
<tr>
<td>Rug and Fabric Cleaners:</td>
<td></td>
</tr>
</tbody>
</table>

TABLE 2
Organic Chemicals Associated With Consumer Products Disposed Into On-Site Systems
Residential on-site system installed. Note septic and cesspool covers.

Severe coastal erosion exposed an on-site system.
ORGANIC POLLUTANTS ASSOCIATED WITH COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL ON-SITE SYSTEMS

There are numerous organic chemicals associated with a wide range of commercial, industrial and institutional establishments. Some organicss may be peculiar to one or two types of enterprise. For instance, metal degreasers and press cleaners are associated with lithographers; photo processing chemicals are associated with photographic establishments.

Commercial laundries and launderettes are a source of soil and stain removers. Commercial dry cleaners usually try to recycle their dry cleaning solvents, but they do have a solid residue from the dry cleaning process that must be disposed of.

Some of the older, smaller commercial and industrial establishments may still dispose of organic chemicals into their septic systems. Laboratory wastes associated with educational facilities may also be discarded into septic systems.

On-Site Systems Used On Long Island
SEPTIC SYSTEMS

A septic system contains two basic units:

- a watertight tank through which wastewater flows and where removal of solids and grease occurs
- a leaching system which receives and discharges effluent from the septic tank into the ground. (See Figures 2 and 3.)

The wastewater is first discharged to a septic tank where the heavier solids settle on the bottom and the lighter greases and scum rise to the top. Digestion by bacteria and liquefaction of solid materials occurs. In the tank's anaerobic environment, the settled sludge decomposes slowly; therefore, over a period of time a sludge and grease layer accumulates. This must be pumped out periodically by a licensed waste hauler, or it may overflow into the adjoining leaching pool or back up the system. The effluent flows into the leaching pool or, in a few locations on Long Island, through a tile field and then filters downward through the unsaturated zone of the soil.

BACTERIA, VIRUSES AND OTHER PATHOGENS

Septic Systems can be a source of viruses and other pathogens to groundwater and water supply wells. Bacteria from septic systems do not appear to be a significant problem because most bacteria are trapped in the soil or material within the leaching field area. Very little work has been done on viruses. The impact of viruses upon groundwater is still under study and there is some indication that viruses may migrate farther than bacteria.

Plants, soil, subsurfaces and subsurface materials in the unsaturated zone can capture or partially retain organic pollutants, heavy metals, nitrates and other nutrients, and microorganisms. This occurs through

- filtration
- sorption
- precipitation
- ion exchange

The unsaturated zone allows for some aerobic biological degradation. Therefore, a portion of these contaminants that might otherwise reach the saturated zone may be treated within the unsaturated zone providing that the distance between the leaching system and the groundwater is sufficient to allow for adequate filtering by subsurface materials. It can be as-

Source: Suffolk County Department of Health Services

FIGURE 2 Typical On-Site Residential System
sumed, however, that the sorptive capacity of these subsurface materials diminishes over time. It can also be assumed that some non-conservative contaminants may also be removed in the saturated zone due to the long residence time. Generally speaking, once a contaminant reaches the saturated zone, it will move through the aquifer systems relatively intact.

CESSPOOLS

A cesspool is a unit, similar to a leaching pool, that receives raw sewage from the household drain. Solids tend to settle at the bottom of the cesspool while the liquids seep out through the openings located in the sides and bottom. The groundwater contamination potential from cesspools is higher than that of septic systems.

Although the installation of new cesspools is no longer permitted in Nassau and Suffolk Counties, many cesspools installed prior to the changes in County Health Department requirements remain as the sole means of waste treatment for residences located in unsewered areas. Some of the cesspools, primarily those installed prior to 1962, do not function properly due to poor soils, fluctuating or rising high water tables, and improper system maintenance. This problem is quite common in shoreline areas or near lakes, ponds and streams, where on-site systems may contribute to surface water contamination.

SUPER SEPTIC SYSTEMS

The experimental use of modified on-site systems is a logical next step to establish a factual basis for the development of cost-beneficial septic systems that can achieve marked reductions in the inorganic nitrogen and total nitrogen concentrations in the system effluent. Detailed measurements of the influent and the effluent in a super septic system absorption field were taken over a twelve month period. It was observed that the average concentration of total nitrogen in the septic system influent was reduced by approximately 50% in the absorption field.

Presently, the SCDHS is approving the experimental use of a number of these sanitary waste disposal systems for commercial and industrial establishments. (See Figure 4.) These systems will be monitored to determine their effectiveness and future use will be decided on the results of the monitoring. It should be noted that the modified systems are only being accepted for non-residential structures that exceed the population density equivalency set forth in Article 6; and with total daily sewage discharges of less than 15,000 gallons per day. Their use is being limited to existing single and separate parcels and in no case will a modified system be accepted where a division of land is occurring.

COMMUNAL SYSTEMS

Communal systems are essentially large septic systems that serve a group of residences or commercial establishments. They are appropriate where maintenance districts will be established in the future. (See Figure 5).

SEPTIC SYSTEMS WITH TILE FIELDS

The substitution of tile fields for sewage leaching pools is not recommended or permitted. The installation of several shallow leaching pools can generally compensate for the limited depth to groundwater. Tile fields have several disadvantages:

- improper installation generally results in system failures
- clogging frequently occurs over time
- altered site conditions often cause the systems to fail

They also require a large area, and are subject to damage if a vehicle is driven over the field area.
Alternative On-Site Systems

Other types of on-site systems have been installed in various parts of the country. Some evaluation of these systems has been made, and both the negative and positive aspects of these systems have been assessed. EPA has encouraged research into the effectiveness of alternative systems.

Although the use of alternative on-site treatment systems may be appropriate in certain locations in Nassau and Suffolk Counties, the standard septic system is the only approved on-site system at the present time.

Details:
1. Three or more compartment septic tanks shall be constructed on a common reinforced concrete slab at least 6 inches thick.
2. Each compartment shall be constructed of approved reinforced precast concrete solid rings, solid domes or slab tops.
3. Crossover pipes must be of 8 inch O.D. pipe. 20 inches on center, with center line 18 inches below the liquid level.
4. When using 3 or more compartments, the inlet flow must be split using a minimum 4 foot diameter manhole.
KEY PROBLEMS

Improper Siting

In the past, septic systems and cesspools were sometimes poorly sited, but now revised health department regulations tend to eliminate this problem. However, because much of the new development is taking place in sensitive areas, and available controls are not entirely adequate, some of the following mistakes that have occurred in the past may occasionally be repeated.

STORMWATER IMPACTS UPON SEPTIC SYSTEMS

Septic systems are sometimes located at low points or in swales on the property; as a result, they may not function properly due to stormwater flooding of the leaching field. Improper stormwater system design may compound the problem if stormwater is directed towards the septic system area. (See Figure 6).

INADEQUATE DEPTH TO GROUNDWATER

Many septic systems or cesspools were installed during the drought of the sixties when the depth to groundwater was much greater than it is now. With the recurrence of normal rainfall in the seventies, the water table rose and many leaching systems were flooded by groundwater and ceased to function. The existing regulations only require a two foot minimum depth between the leaching pool and the highest recorded groundwater level. In areas where groundwater levels tend to fluctuate, flooding of leaching fields may occur (See Figure 7). It may be difficult to determine the highest groundwater level due to a lack of site specific information. In the case of new development, the test borings required by the health departments may only indicate the present groundwater level.

FIGURE 6 Stormwater Runoff Impacts on On-Site Systems

Septic systems located near natural depressions or stormwater retention basins can be flooded by stormwater runoff and malfunction.
Septic systems or leaching pools that were installed when the water table was lower may be flooded and malfunctioning due to rising groundwater levels.

FIGURE 7 Rising Groundwater Levels

FAILUERE TO REMOVE IMPERMEABLE SOILS

Some of the soils on Long Island have low permeabilities or are underlain with clay. (See Figure 8) When leaching systems have to be installed in low permeability soils, regulations require removal of the clay and its replacement with more permeable soils. Where this is not adequately done, the system cannot function properly.

SEPTIC SYSTEM CONTAMINATION OF PRIVATE WATER SUPPLY WELLS

On-site systems and private water supply wells are sometimes located too close to one another with the consequent contamination and abandonment of wells. In some areas, where single family development is still occurring on substandard lots due to the legally established rights to develop parcels in single and separate ownership, septic systems are allowed within 100 feet of private water supply wells.

Prior to 1962 clay lens allowed.

Soils with low permeability, subsurface clay lens can cause septic systems to malfunction and can cause the sewage to deflect back towards the surface.

FIGURE 8 Failure To Remove Impermeable Soils
CONTAMINATION OF PUBLIC WATER SUPPLY WELLS
Residential or commercial building on substandard parcels in non-sewered areas outside of Zones III and VI is still permitted at densities capable of producing nitrate (or organic chemical) loadings from septic systems and lawns that could lead to the closure of public supply wells (See Figure 9).

CONTAMINATION OF SURFACE WATERS
In shoreline areas, landowners may be illegally discharging a portion of their household wastes directly into surface waters because the high water table limits the capacity of the leaching field (See Figure 10).

BLUFF EROSION
The siting of leaching pools close enough to the edge of the bluff to cause the discharge of effluent through the bluff face may result in undercutting and slumping of the bluff. (See Figure 11)

FIGURE 9  Contaminant Movement To Water Supply Wells

Nitrates from extensive lawn areas and septic system effluent can be drawn into public water supplies where these sources are located too close to well fields.

Direct discharge of residential sanitary wastes, and or wastes from washing machine or dishwasher is illegal.

FIGURE 10  Illegal Discharges To Surface Waters
Improper Site Management

There are several important site management problems.

- Stormwater runoff that would normally be discharged elsewhere may flow to the on-site system leaching field, causing it to fail.
- Over time, leaching pools or other drainage structures that handle stormwater from buildings and on-site paving may become clogged and cease to function. Excess runoff from these leaching pools, landscaping, and/or paving may result in increased stormwater flow to the sewage leaching area.
- The septic system may also be damaged if heavy equipment is allowed to pass over the system.
- Tree roots may enter the piping and leaching pool and eventually prevent proper functioning.

Improper Use of On-Site Systems

The cumulative impacts of discharging small amounts of a number of organic pollutants into septic systems can pose a threat to groundwater.

Improper Maintenance

Many owners of on-site systems do not follow a preventive maintenance program. More often than not, homeowners do not have the septic tanks pumped out as frequently as needed, thus allowing the sludge and the scum to flow to the leaching pool where it clogs the infiltration surface of the leaching pool and field. As a result, the system begins to malfunction.

Unnecessary or toxic chemicals that contaminate groundwater and harm beneficial bacteria may be poured into the system in an effort to avoid a pump out.

SEPTIC SYSTEM FAILURE

System failure is usually due to

- Improper siting
- Inadequate depth to groundwater
- Poor site management
- Maintenance problems described above.

Scavenger Waste Disposal

The wastes pumped from septic tanks or cesspools (scavenger wastes) are an anaerobic slurry that usually contains large quantities of grit and grease. Scavenger wastes vary in the percentage of solids, water, and organic content.

The disposal of scavenger waste presents several water quality and logistic problems:

- the lack of conveniently located scavenger waste treatment and disposal sites sometimes leads to illegal dumping in order to avoid the long distances to approved disposal sites and costs of disposal
- haulers may combine industrial waste with scavenger wastes and illegally dispose of the combined waste. Trucks carrying scavenger waste are not clearly labeled as to the type of waste being carried
- the lack of manpower limits enforcement of existing controls, including the requirements for the inspection and sampling of scavenger wastes delivered to disposal sites.
Legislation, Regulation and Administration

The term management includes legislation and/or regulations, ordinances, and agency guidelines and policies that relate to the control of pollution from on-site disposal systems.

New York State

Table 3 provides a summary of the State laws affecting on-site systems.

County

The two county departments of Health, act as agents for the NYS Departments of Health and Environmental Conservation in the administration and enforcement of laws controlling on-site treatment systems and scavenger wastes. In addition, each county has local legislation affecting the management of on-site systems. Accordingly, each county health department has developed rules, regulations, and standards which guide agency actions.

See Tables 4 and 5 for the summary of county controls affecting on-site systems.

TABLE 3
New York State Legislation Affecting On-Site Waste Disposal Systems

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Major Relevant Provisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Article 17, Title 15 New York State Environmental Conservation Law (NYS-ECL)</td>
<td>Authorizes NCDH and SCDHS to review proposed and existing sewage disposal systems.</td>
</tr>
<tr>
<td>Article 17, Title 7 NYS-ECL</td>
<td>Requires State Pollution Discharge Elimination System permit for discharge of sewage from:</td>
</tr>
<tr>
<td></td>
<td>- a residential building occupied by three or more families;</td>
</tr>
<tr>
<td></td>
<td>- a residential building occupied by more than 10 persons;</td>
</tr>
<tr>
<td></td>
<td>- any facility with a design flow of 1,000 gallons or more per day;</td>
</tr>
<tr>
<td></td>
<td>- any future alteration of existing systems that</td>
</tr>
<tr>
<td>Article 27, Title 3</td>
<td>Authorizes NYSDEC to regulate and require registration of all persons engaged in the business of cleaning septic tanks, cesspools, or marina sanitary wastes.</td>
</tr>
<tr>
<td>Article 39, Sec. 39-0105</td>
<td>Prohibits the sale of septic system cleaners and additives containing halogenated hydrocarbons and aromatic hydrocarbon chemicals in Nassau and Suffolk Counties.</td>
</tr>
<tr>
<td>Article 8, NYS-ECL (SEQRA)</td>
<td>Prohibits the discharge of above-mentioned chemicals into groundwater and surface waters.</td>
</tr>
<tr>
<td>Article II, Title II Public Health Law</td>
<td>Under SEQRA, various review agencies at the state and local levels have the opportunity to review and comment on proposed projects involving sanitary facilities. This provides an opportunity to comment on the impacts of proposed septic system densities and siting problems.</td>
</tr>
<tr>
<td></td>
<td>Similar to Article 17, Title 15, NYSDEC</td>
</tr>
</tbody>
</table>
### TABLE 4
Nassau Controls Affecting On-Site Systems

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Major Relevant Provisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>NASSAU COUNTY Ordinance #157, 1953</td>
<td>• Planning Commission may require developer to furnish all utilities (including sewage systems) in and to the development.</td>
</tr>
<tr>
<td>Public Health Ordinance, General Sanitation—Article II, Section 4</td>
<td>• Planning Commission may require changes to plans based on comments from NCDPW and NCDH.</td>
</tr>
<tr>
<td>Charter, Art. XII</td>
<td>• Construction of on-site systems must be in accord with NCDPW specifications.</td>
</tr>
<tr>
<td></td>
<td>• Prohibits construction of on-site systems in sewered areas.</td>
</tr>
<tr>
<td></td>
<td>• Prohibits discharges from on-site systems, that endangers a water-body or public water supply.</td>
</tr>
<tr>
<td></td>
<td>• Enables County to design, construct, lease, own, operate and maintain any sewer facility in the county.</td>
</tr>
<tr>
<td></td>
<td>• City, Town, Village, district and private sanitary systems are subject to approval of NCDPW.</td>
</tr>
<tr>
<td></td>
<td>• Authorizes Board of Supervisors to establish sewage disposal districts, and prepare a general sewage facility plan.</td>
</tr>
</tbody>
</table>

### TABLE 5
Suffolk County Controls Affecting On-Site Systems

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Major Relevant Provisions</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUFFOLK COUNTY Sanitary Code, Art. 3</td>
<td>• Authorizes SCDHS to regulate the design and construction and issue approvals for on-site systems.</td>
</tr>
<tr>
<td></td>
<td>• Prohibits construction of on-site systems in sewered areas.</td>
</tr>
<tr>
<td>Sanitary Code, Art. 6</td>
<td>• See text for Discussion.</td>
</tr>
<tr>
<td>Sanitary Code, Art. 12</td>
<td>• Regulates discharges of toxic and hazardous materials.</td>
</tr>
<tr>
<td>Local Law No. 12-1980</td>
<td>• Prohibits sale of organic chemicals or compounds for the purposes of cleaning or unclogging on-site systems or sewer drains.</td>
</tr>
<tr>
<td>Sanitary Code, Art. 7 (proposed)</td>
<td>• Would declare it county policy to maintain ground and surface water resources as near to natural conditions as possible, methods of preventing or controlling water pollution.</td>
</tr>
<tr>
<td></td>
<td>• Prohibit discharge of industrial, toxic, or hazardous materials into on-site systems.</td>
</tr>
</tbody>
</table>

15
NASSAU COUNTY

The Nassau County Department of Health (NCDH) is responsible for the administration and/or enforcement of the New York State Laws affecting on-site systems. In accordance with NYS-ECL Article 17, Title 15, NCDH reviews proposed subdivision maps to determine the adequacy of the proposed sanitary and drainage facilities. Approval is valid for a period of five years and any construction of the realty subdivision undertaken after that time will be required to conform to the NCDH standards in effect at the time of construction.

Section 0701 of NYS-ECL Article 17, Title 7 requires that a SPDES Permit be obtained from the NYSDEC to create a groundwater discharge, or construct a new or modified on-site sewage disposal system that meets the threshold criteria listed in Table 3. The NCDH assists in the administration and enforcement of the permit process. NCDH administers and enforces the rules and regulations of the NYS-ECL Article 27, Title 3 which requires that sanitary waste haulers handle, transport and dispose of such wastes in an approved manner.

Nassau County is responsible for the enforcement of the recently enacted State legislation, NYS-ECL Article 39 which prohibits the sale of specific septic system cleaners.

In addition to the enforcement of state laws, NCDH enforces or assists in the administration and enforcement of the local laws summarized in Table 4.

Discharges from commercial establishments are under town or village jurisdiction if the anticipated system flow is less than 1000 gallons per day. (See Existing Town Controls).

If a change in usage of an existing establishment occurs, the NCDH reviews the case to determine if the sewage flow has been increased enough so that a permit is required. If the change in usage results in a significant increase in flow volume, such as the conversion of a card shop to a restaurant, a SPDES permit must be obtained.

If construction of the sewage disposal system does not occur prior to the expiration date of the SPDES permit, an application to renew the permit is required and the sewage disposal system must be installed in accordance with the NCDH standards in effect at the time of renewal.

Past efforts to control pollution from on-site systems in Nassau have focused on the extension of collection and treatment systems. Currently about 90% of the county population resides in sewered areas. However, evaluations performed as part of ongoing 201 Wastewater and Facility Planning Studies suggest that some areas in the northwest portions of Nassau County will continue to use septic systems. A large portion of northeastern Nassau is expected to remain unsewered.

SUFFOLK COUNTY

The SCDHS is responsible for the implementation of the NYS-ECL Article 17, Title 15, Article 17, Title 7 (in cooperation with the NYSDEC), Article 27, Title 3, Article 39 Section 39-0105; and Article 8. In addition, Suffolk County’s involvement in on-site disposal systems includes a number of water pollution control activities of the SCDHS summarized in Table 5.

Article 6, of the Suffolk County Sanitary Code, 'Realty Subdivisions and Developments, effective November 19, 1980, closes the loophole in the State law, which exempted subdivisions of fewer than five lots from the provisions of the code. The Suffolk County Board of Health now has the authority to control the density of on-site systems in new developments. Where development occurs at higher densities, approved community or public treatment systems are required. The minimum lot requirement for new homes with septic systems, for all areas outside Hydrogeologic Zones III and VI is 20,000 square feet; in zones III and VI, 40,000 square feet. (See the Land Use Chapter for the 208 Hydrogeologic Zone boundaries). Another important provision, Section 605, Reg. 82, requires developers of new commercial establishments, apartments, shopping centers and individual buildings to provide treatment for the removal of nitrates to meet effluent standards if the density equivalency of these non-residential properties exceeds comparable allowable densities for residential on-site systems.* Enforcement of this provision should result in reduced contaminant loadings from on-site systems.

*If their estimated yearly effluent loading in gallons exceeds that produced by an average unit on 1/2 acre. (or on one acre for Zones III and IV.)

Public Information

The counties provide guidelines for the permit approval process and site installation procedures. These may be obtained from the respective Health Departments.
In both Counties, the Health Departments are the primary regulatory and enforcement agencies for on-site systems. In Nassau County, however, each town building inspector inspects systems installed in residential developments of four units or less and commercial establishments that generate less than 1000 gallons per day. The developer is required to hire a professional engineer to inspect the installed sewage disposal system for a subdivision development or for a commercial development that uses 1000 or more gallons a day. In Suffolk County, some towns have imposed more stringent controls or review procedures within their respective jurisdictions. Traditionally, the town's primary responsibility toward on-site systems is related to general site plan and subdivision plat approval. Town recommendations are passed along to the SCDHS and the County Board of Health which considers them before granting approval or proposed septic systems. Table 6 summarizes the various town functions in regard to On-Site Systems.

### TABLE 6
Town Controls And/Or Review Procedures For On-Site Systems

**NASSAU**
Oyster Bay
Oyster Bay is the only Nassau County town that contains extensive unsewered areas. The Town Division of Environmental Control acts in an advisory capacity to the Town Board with regard to on-site disposal systems.

**SUFFOLK**
Babylon
The Town Planning Board reviews site plans. The building department issues the building permit after it has received SCDHS approval for the on-site system.

Article VIII, Plumbing Code: Sewers and Drains Sects. 7-181 to 7-201, specifies construction standards for on-site systems.

**Brookhaven**
The Brookhaven Code of Ordinances, (Chap. 81, Wetlands) requires Town Board approval for construction of on-site systems located near or impacting wetlands. The Planning Board will grant a development permit only if on-site systems are located to avoid impairment of wetlands or contamination of wetlands in the event of flooding.

All proposed subdivisions must locate and construct on-site systems so as to minimize flood damage. (Brookhaven Code of Ordinances, Chap. 33, Flood Damage Prevention).

The Town also requires that whenever there is any change in a building structure or use, the building owner must submit an evaluation form to the Department of Environmental Protection. If the Department determines that an impact upon groundwater could occur, the new owner must complete a new site plan prior to receiving a new Certificate of Occupancy.

**East Hampton**
The town board reviews all applications for on-site systems located within the 100 Year Flood Plains.

**Huntington**
The Town Planning Board reviews site plans after SCDHS and Town Department of Environmental Control (DEC) approve plans. They may advise the Planning and Engineering, Building and Housing Departments.

Huntington prohibits cesspools and septic tanks in town sewer districts unless undue hardship or physical impossibility prevents compliance hook-up to sewers. (Huntington Code of Ordinances, Chap. 164, Sewers and Sewage Disposal).

**Islip**
The Environmental Control Dept., Division of Environmental Services may advise and make recommendations to any division of Town government.

**Riverhead**
The Planning Board is authorized to approve preliminary and final subdivision plats outside incorporated cities or villages. (Riverhead Code of Ordinances, Chap. 30).

**Smithtown**
The Town Board reviews each development proposal after SCDHS has approved the proposed on-site system. The Conservation Advisory Council reviews site plan applications in environmentally sensitive areas.

**Southold**
The Building Department issues construction permits, provided applicants meet SCDHS specifications. The Town Board may hold hearings on permit applications. The Planning Board can advise on approval of a permit.

The Town Trustees and Town Conservation Advisory Council can advise if the proposed on-site system could affect a Town waterway.
Legislation, Regulations and Administration

State

- N.Y.S. legislative action is recommended to amend Article 17, Title 7 of the NYS Environmental Conservation Law to require sewage treatment for sewage discharges greater than 1,000 gallons per day in the deep aquifer recharge areas in Zones I, III, IV and V and in important shallow aquifer recharge areas in Zones IV, V and VI (See the Land Use Chapter for the 208 Zone descriptions, Figure 2.)

- The NYSDEC should complete the review process for SPDES permits prior to granting NYSDEC and/or the health department approval for the construction of an on-site system.

County

- Nassau County should adopt a provision similar to Suffolk County’s Article 6 for those undeveloped areas where sewers are not planned.

- Suffolk County should amend Article 6 of the Suffolk County Health Code to extend the 40,000 square feet minimum lot residential requirement and the density equivalent requirements for commercial and industrial development now in effect within Hydrogeological Zones III and VI to include other primarily undeveloped deep aquifer recharge areas within Zones I, IV, V and critical shallow aquifer recharge areas within Zones IV and V.

- In non-sewered areas, the impact of the conversion of single family to two family units should be carefully evaluated by the county health departments. In Suffolk County the density change should be consistent with the density requirements of Article 6. The health departments should require a new on-site system permit for any residential conversion that would result in a significant increase in density.

- Suffolk County should take all feasible measures to limit further residential development of substandard lots. Where appropriate, it should dedicate County-owned old file map parcels as forever wild, subject to Article 1 of the Suffolk County Charter; elsewhere, it should negotiate the sale of substandard lots to the owners of contiguous parcels.
• The county health departments should evaluate the total predicted potential nitrate (and organic) loadings to groundwater for proposed major developments. (For potential nitrate loadings see the Site Plan Review Chapter). Whenever the total anticipated nitrate loading exceeds 6 mg/l of nitrates, restrictions should be placed on the size of the lawn area (See town recommendations) and the health departments may need to require treatment systems with nitrate removal for development within the unsewered deep aquifer recharge areas and selected shallow aquifer recharge areas.

• The County Health Departments in cooperation with the towns and villages should identify priority areas for additional septic system maintenance district pilot programs and should assist in the formulation of preliminary pilot program plans. (A maintenance district can be administered by the local municipality or county).

• The County Health Departments, in cooperation with the towns and villages, should identify candidate areas for future maintenance districts. In areas where alternative systems are required or where communal systems have been installed or where existing or proposed on-site systems are subject to failure, the towns or the county health departments should consider whether or not maintenance districts should be required. (See Amendments to the NYS Local Enabling Laws to Allow Creation of Wastewater Disposal Districts). Proposed maintenance districts should be located where the population density is greater than one or more units per acre and where septic systems or cesspools will continue to be the method of sewage disposal. Those areas with numerous existing problems should receive first consideration. Priority locations for maintenance districts should include areas where organic chemical concentrations in groundwater are increasing due to use of cesspool cleaners, the soils are poor and/or the depth to seasonal high water table is minimal. If it is determined that a district is required, the administering agency, designation, district boundaries, regulations governing wastewater disposal and maintenance procedures, and charges or user fees should be included in local legislation.

• Suffolk County should consider extending the existing Southwest Sewer District boundary to permit inclusion of adjacent intensively developed industrial-commercial areas.

• The County Health Departments should encourage developers, whose properties are located outside, but are accessible to existing sewer districts to connect to these districts. (In a few cases, it may be determined that a package treatment plant is more appropriate, particularly if the maintenance of recharge is critical).

• The County Health Departments should request the assignment of additional personnel to monitor and to work with the towns to evaluate changes in commercial and industrial building use in the deep and critical shallow recharge areas. The Health Departments should require all new building occupants to obtain a permit for sewage and any other waste disposal and all new industrial occupants to provide for monitoring access to the effluent discharge.

• The Counties should require commercial and industrial establishments to sign an agreement and to post a bond to guarantee adequate pollution control. The Counties should urge owners of such establishments to obtain long term pollution liability insurance when available.
Municipal

- The towns should consider rezoning unplatted proposed residential areas where nitrate-nitrogen levels approach 6 mg/l, in order to reduce densities in accordance with the 208 WTMP recommendations for the various hydrogeologic zones. The towns should consider prescribing still lower densities for Critical Environmental Areas or Groundwater Protection Districts. (See Land Use Chapter).

- The towns should not allow the conversion of single family homes to two family units in unsewered deep recharge or critical shallow recharge areas.

- The towns should take all possible measures to prevent further development of substandard lots on old filed maps and should adopt local laws for the acquisition, replatting and resale of substandard lots. A sample law adapted from the town of East Hamptons' law is outlined as follows.

Sample Local Law for Acquisition of Substandard Undersized Building Lots:
Section 1. The Town Board pursuant to the provisions of Article 15 of the General Municipal Law of the State of New York, may acquire lots or parcels within the confines of maps filed in the Suffolk County Clerk's Office prior to the creation of the Planning Board of the Town of __________ including but not limited to a list of such maps which is on file in the Suffolk County Clerk's Office pursuant to the provisions of Section 276 of the Town Law of the State of New York, under conditions as set forth in this Local Law.

Section 2. Definitions:
Acquisition: Acquisition of title by the Town of __________ of lots or other portions of old filed maps either for public purposes or for resale as provided in this Local Law.
Lot: A parcel of ground under one sole or undivided ownership separate from that of any adjoining lots.
Old Filed Map: Any map filed in the Suffolk County Clerk's Office without Town of Planning Board approval.
Plan: Comprehensive treatment of an old filed map or portion thereof which shows building lots, roads to be improved for access, roads to be widened, roads not necessary for access to be abandoned, possible scenic easements, possible acquisitions for public purposes, including parks, drainage areas, acquisition of substandard lots to be joined with other lots for possible future resale, and other customary features shown on a modern subdivision map, and which may show topography if required by the Planning Board.
Substandard Undersized Building Lot: Any lot which does not meet minimum area and width requirements of the zoning district in which it is situated and any lot so designated by the Planning Board in its official report.

Section 3. From time to time, upon report and recommendation of the Planning Board, the Town Board may designate an old filed map as an area appropriate for urban renewal in accordance with Section 504 of the General Municipal Law of the State of New York.

Section 4. The Planning Board shall submit a plan for the renewal of an old filed map, or portion thereof.

* Adapted from the Town of East Hamptons' Local Law No. 2, 1976.
- The local municipalities and cities should develop ordinances to require the retention of natural vegetation and consequent reduction of high nitrate loading from lawns in the deep recharge zones I, III, IV and V and in the shallow recharge areas in zones IV and VI, where septic systems are to be installed (See Fertilizer Chapter Recommendations).

- The towns should consider modifications of local laws to require the submission of information on the changes in use for industrial and commercial buildings. The SCDHS has developed the covenants that have been used in the past. These covenants require enforcement. They should be adopted into formal regulations or codes. (See the Land Use Chapter Recommendations for Covenants).

Site Planning and Development

Adherence to the following procedures should enable the owner or developer to avoid many of the problems described previously in this chapter.

FOLLOW COUNTY HEALTH DEPARTMENT GUIDELINES

The site plan should meet with the standards as shown in the plan and section shown on Figures 12 and 13. Follow the Guidelines provided by the Nassau and Suffolk County Health Departments for the site layout and installation of an on-site system.

FIGURE 12  Plan—County Distance Standards
FIGURE 13  Section — County Distance Standards

LAYOUT SUBDIVISION PLATS TO MINIMIZE FUTURE SEPTIC SYSTEM PROBLEMS

When developing a subdivision plat, the site planner should provide deep lots or large lots near wetlands, surface waters, bluffs and steep slopes to maximize the distance between the leaching pool and the environmental resource. Cluster developments, public land acquisition and dedication may also provide opportunities for reducing septic system pollution.

Note: A community sewerage system is now required by the SCDHS when a proposed subdivision is to be located in a marsh-lowland area, where fill is placed over subsoils containing meadow mat, bog, silts, clays or other impervious materials that lie at or extend below the groundwater table, or in an area where the subsoils or groundwater conditions are not conducive to the proper functioning of an individual sewerage system or when any lot in any subdivision is less than 20,000 square feet in area. Areas adjacent to wetlands and surface waters are not recommended for development. If development is to occur, the lot sizes should be increased so that all developable properties are at least one acre in area.
DETERMINE THE DEPTH TO SEASONAL HIGH WATER TABLE FOR THE SITE.

Use the maps and text of the most recent Nassau and Suffolk County Soil Surveys (Nassau-1982, Suffolk-1975) to obtain information about the site. If the depth to the highest water table elevation was less than three feet at the time the soil survey was prepared, the site may not meet the requirements for a septic system installation (See Figure 14). If the soil survey indicates a depth to groundwater in excess of three feet, consult the most recent health department or USGS water table maps. In order to determine the depth to water table for a property, determine the location of the property on the water table map. Record the water table elevation from the map and subtract this number from that for the elevation of the property. If the property includes steep slopes, several calculations may be required.

DETERMINE IF THE PROPERTY IS LOCATED WITHIN THE 100 YEAR FLOOD PLAIN

If it is, delineate the flood plain on the site plan map (See Figure 15). Do not place the septic system within 100 feet of the 100 year Flood Plain area or within 100 feet of the high water mark of an adjacent water body. Flood plain maps are on file at the town Planning Departments.

LOCATE PRIVATE WELLS TO MINIMIZE CONTAMINATION FROM SEPTIC SYSTEMS

The developer must consult with the county health departments to determine the best location for the well. If a private water supply well is to be installed on the site, locate the well at the highest groundwater elevation of the site and at the maximum distance from the on-site system and from septic systems on upland-adjourning properties. (See Figures 13 and 14).

MAXIMIZE THE DISTANCE FROM THE SEPTIC SYSTEM TO A PUBLIC WATER SUPPLY WELL

Although the State law currently requires 100 feet between the well and the on-site system, the health departments require a minimum of 200 feet between a glacial public water supply well and the septic system. However, when the well is to be installed in the Magothy, a minimum distance of 100 feet is allowed. (See Figure 16).

DETERMINE THE FINISHED FLOOR AND SEPTIC SYSTEM ELEVATIONS

Locate the building and the approximate locations for the septic tank and leaching pools on the site plan map. Determine the bottom elevation of the leaching pool. This elevation should be a minimum of two feet above seasonal high water table. In high water table areas, determine the elevation of the lowest floor level that will have plumbing. Then determine the length and the slope of the pipes to the septic tank and to the leaching pools. The slope of the pipe from the house to the tank and from the tank to the pool is critical and must be within an acceptable range. The slope should not be reduced to gain depth in the unsaturated zone. If it appears that there will be less than two feet between the bottom of the leaching pool and the water table, then the elevation of the lowest floor containing plumbing should be raised to maximize the distance between the bottom of the leaching pool and groundwater. If necessary, eliminate the basement or raise the portion of the house that contains plumbing.
AREAS INDICATED HAVE A DEPTH TO SEASONAL HIGH WATER TABLE OF LESS THAN THREE FEET.
FIGURE 15  Sample 100 Year Flood Plain Boundary Map
The distance from the septic system leaching pool to a public or private water supply well should be maximized.

FIGURE 16  Maximize Distance Of Septic Systems To Wells

DIRECT STORMWATER AWAY FROM THE SEPTIC SYSTEM AREA

Septic systems should not be installed in locations where stormwater collects, such as topographic depressions or low points, kettle holes, or swales. In order to reduce the potential for system failure, the site designer should direct all stormwater runoff away from the land area located above the on-site system. All roof, cellar and footing drainage and surface water should be excluded from the on-site system area. Roof downspouts should drain away from the septic system. If the stormwater runoff from higher ground is draining towards the disposal system, install a ditch or berm to intercept the surface water.

LOCATE THE SEPTIC SYSTEM NEAR A ROAD OR DRIVEWAY

Septic systems should be installed on a portion of the site that will always be accessible for *pump-out*. They should not be installed under the driveway or any other place that may be paved or covered with a structure or where heavy equipment may be permitted in the future.

REMOVE LOW PERMEABILITY SOILS OR CLAY LENS TO PROVIDE FOR AN ADEQUATE LEACHING AREA

(See Figure 17.)
Soils with low permeability, subsurface clay lens can cause septic systems to malfunction and can cause the sewage to deflect back towards the surface unless the lens is removed as shown.

**FIGURE 17** Remove Clay Lens To Allow For Proper Leaching Field Area

**LOCATE SEPTIC SYSTEMS THE MAXIMUM POSSIBLE DISTANCE FROM A BLUFF**

Septic systems should not be installed within 100 feet of the top of a bluff. Common leaching pools installed for multiple residential units should be placed the maximum possible distance from the bluff to avoid undermining and erosion of the bluff face. The site developer should consult with an engineer of the Cooperative Extension Sea Grant Office (See Figure 18).

**FIGURE 18** Maximize Distance From Bluff

Maximize distance of septic system from bluff or steep slopes.
MAINTENANCE PROCEDURES

AVOID ADDITIVES

Septic tanks do not require additives for effective operation. Various products (enzymes, etc.) marketed for that purpose do not improve the performance of the septic tank nor do they reduce the need for routine maintenance.

MINIMIZE DISCHARGE OF CHEMICALS

Care should be taken to minimize discharges of chemicals into the tank. A slug of a toxic chemical that kills anaerobic bacteria can cause partial or complete loss of treatment for up to three weeks.

DO NOT DISCHARGE GREASE INTO SEPTIC SYSTEM

PUMP OUT THE TANK AS NEEDED

The septic tank should be pumped every two or three years to prevent clogging of the leaching pool and leaching field.

KEEP THE LEACHING SYSTEM IN GOOD REPAIR

Leaching field repairs are needed once the infiltrative surface of the leaching pool and or the leaching field becomes clogged. Acids used to unplug the leaching field are of dubious value, present a safety problem and at best, offer only a temporary solution. Usually a more permanent repair such as providing an alternative leaching area is needed. This procedure is also necessary in many cases because the original designed leaching area was too small. The old leaching area may be ready for re-use once it has been allowed to recover its infiltration capacity through natural oxidation of the soil clogging materials. Where the volume of the leaching field is limited, the system owner should devise a time schedule for the use of the alternative leaching pools.

PUBLIC EDUCATION

The Cooperative Extension Service (CES) should acquaint the public with the harmful effects of the use of banned cesspool additives.

The CES should increase awareness of the proper use and disposal methods for the many consumer products used in Nassau and Suffolk Counties. This should include the safe disposal of unused containers of cesspool cleaners that are currently banned.
This chapter mentions water quality problems related to highway deicing activities, describes and evaluates management practices and recommends techniques to reduce the impacts of highway deicing materials upon the groundwater underlying Nassau and Suffolk Counties. Highway deicing materials are used to minimize ice build-up on highways and roads in order as to facilitate the safe flow of traffic during severe winter storms. Deicing materials include salts (primarily sodium chloride) gravel, sandy soils and other materials.

Salts are applied to road surfaces to lower the melting temperature of ice. Sodium chloride, the most extensively used salt on Long Island, is used either separately, or combined, in varying ratios, with sand and gravel. Calcium chloride is used only occasionally. Urea is used on airport runways because it is less corrosive to aircraft than salt (See Table 1 for the frequently used highway deicing materials).

Most highway deicing problems result from improper salt storage and highway application of salts. Highway deicing salts are highly soluble in stormwater. A significant impact upon the environment occurs when salts from unprotected salt storage piles and salts applied to highways percolate through soils and subsurface materials to the water table. Some of the leachate may be absorbed by soil particles or it may be taken up by plants. Once in the groundwater, both sodium and chloride ions are conservative (non-reactive) and can persist for centuries. They move with the general groundwater flow and can be carried down to deeper aquifers that are used for public water supply.
Increases over ambient chloride in groundwater can also be attributed to the discharge of sewage effluents, and industrial wastes; leachate from sanitary landfills and fertilizer use, especially in agricultural areas; and saltwater intrusion caused by the over-pumping of aquifers. Local precipitation, particularly in the shoreline areas, and land disposal of dredge spoils from marine waters are also sources of chloride.

From a public health standpoint, the leaching of salts, particularly sodium chloride, to groundwater is the primary concern since drinking water contaminated by sodium can pose a health risk to individuals on sodium restricted diets. The New York State Health Department guideline for sodium in public water is 20 mg/l, which is designed to protect individuals on diets requiring minimal sodium intake. However, the State standard for the chloride in drinking water is 250 mg/l.

Monitoring of public supply wells has indicated the presence of sodium in low concentrations in the majority of the wells sampled. In Nassau, the average sodium content of untreated well water from 47 water supply districts ranged from a low of 2.5 to a high of 25.6 mg/l. This range included withdrawal averages from different aquifers. In Suffolk County, sodium concentrations in glacial water supply wells range from 8-10 mg/l; 2.4 mg/l are found in Magothu wells.

Although sodium levels do not rise in direct proportion to increases in chloride levels, it is expected that with the continued use of conventional deicing materials sodium concentrations will increase in both the Glacial and Magothu aquifers. In some areas sodium concentrations are expected to exceed the health standard for persons on sodium restricted diets.

The average chloride content of groundwater concentrations has already been increasing in some portions of Nassau and Suffolk. The Nassau County Department of Health observed rising concentrations in approximately 50% of the wells in the Glacial and Magothu aquifers and in one-third of the Lloyd wells. A few glacial wells in Nassau County have been rendered non-potable as a result of leachate from nearby uncovered salt storage piles. In particular, wells in Mineola and Valley Stream have shown chloride concentrations greater than 300 mg/l as a result of salt storage practices in that area.

In Suffolk County, statistically significant trends have not been identified, although some glacial wells have indicated an increase in chlorides. The most notable problem in Suffolk County occurred recently in Medford, where 21 shallow wells located downgradient of three salt piles (two of which are still in existence) were found to be contaminated with chloride. Homeowners reported that chlorides in the water supply from their private wells caused severe corrosion of their plumbing systems. Groundwater investigations revealed the existence of contaminant plumes moving in a southerly direction from each of the salt piles.

In a separate case, also in the Medford area, a number of wells were closed due to percolation from a recharge basin which receives chloride contaminated stormwater runoff from the Long Island Expressway. These wells are located south of the recharge basin and seven were found to contain excessive chloride concentrations. The highest reported concentration (154 mg/l) occurred in a well on California Avenue, southeast of the recharge basin. In both instances, the affected wells were located in the glacial aquifer. It seems likely that additional nearby private wells will be contaminated in the future.

At the present time, no public water supply wells in Nassau or Suffolk Counties have been closed due to chloride contamination.

As part of the Nationwide Urban Runoff Program (NURP), samples drawn from the groundwater monitoring wells located beneath recharge basins were analyzed. Stormwater runoff was identified as a seasonally significant source of chlorides to the groundwater beneath the recharge basins serving the Long Island Expressway and a nearby major shopping center.
KEY PROBLEMS

Salt Storage Piles

GENERAL SALT STORAGE LOCATION

In Nassau and Suffolk Counties, salt storage piles are located for easy accessibility, usually on or near the Island’s major roadways. Some of these piles are located in the deep aquifer recharge zones, Zones I, II and III, and portions of IV and V. (See the Land Use Chapter for a description of the zones and Figure 1 for map of the major roadways within the hydrogeologic zones). Other piles are located in shoreline areas, where stormwater runoff is permitted to drain to or is directly deposited in estuarine or marine waters.

In Nassau County, there are approximately 67 salt or sand/salt piles, including State, County, town and village managed storage sites. In Suffolk County, there are a total of 79 State, County, municipal and privately owned salt storage piles. Of this total, eight or nine are privately owned. The twenty-two salt piles currently subject to SPDES permits are located in the Towns of Babylon (1), Brookhaven (12), Huntington (6), Southampton (1), Southold (1) and the Village of Lake Grove (1). There are five sites (Islip [3] and Riverhead [2]) for which permit applications are being processed.

SALT STORAGE FACILITY DESIGN AND OPERATION

The municipalities and agencies that are responsible for road maintenance use different techniques for building salt storage structures, grading and paving of storage sites, controlling stormwater runoff, and managing brine to minimize the impacts upon the groundwater and the environment. Although a number of salt storage sites now have permanent structures and stormwater control measures, high costs have prevented or delayed the building of structures and the implementation of appropriate management practices at the remaining salt storage sites. Many piles in both counties still remain uncovered, with limited or no stormwater control measures in effect and, therefore, permit leaching and uncontrolled runoff.

Deicing salts are stored in a variety of structures including unused buildings, garages, covered sheds, abandoned barns, elevated storage bins, domed structures, and cribs. (See Figures 2 through 5 for examples of existing salt storage facilities).

Inadequately protected salt storage piles generate a leachate containing relatively high levels of chloride. The New York State effluent standard for chloride concentrations from salt piles is less than 500 mg/l. This standard is exceeded at many storage sites, because salt storage piles have been placed uncovered on the ground or on asphalt paving without provision for stormwater or brine control. Improper site design, a lack of site facilities and insufficient site maintenance remain significant problems on Long Island. Some sites are covered with a tarpaulin or plastic that must be removed when the salt is being used during a winter storm. (See Figure 6). Throughout the year temporary covers are subject to wind removal and damage, thus allowing stormwater contact with the salt pile.

Highway Deicing

Highway authorities in the United States generally subscribe to the bare pavement philosophy, whereby all roads and highways should be clear of snow and ice so as to insure the safety and lives of motorists. In the interest of road safety, approximately 63,000 tons of road salt are applied to Long Island roads each year. In Nassau County, in 1971, 32,400 tons of road salt were applied to 8,990 lane-miles of road. In Suffolk County, during the period of 1969-72, 30,989 tons of road salt were applied to approximately 7,024 lane-miles of road each winter. Parking lots are also included in the deicing programs of the counties, towns and villages. (See Figure 7).
FIGURE 2 New York State Facility located within Town of Oyster Bay

A New York State Dept. of Transportation building
FIGURE 1  Major highways located within Aquifer Recharge Areas

FIGURE 3  New York State Facility

A New York State Dept. of Transportation building, located just west of Exit 55 of the Long Island Expressway, is of wood construction with a peaked roof covered by asphalt shingles. The building is situated on a concrete base while the area immediately surrounding the building is paved with asphalt.
The Town of Babylon's salt storage site is a comprehensive facility where storage, stormwater runoff control, mixing and loading are all performed on-site. (See Figures 12-14 for brine control at this site.) This salt storage facility includes a building which formerly belonged to Zahn's Airport. The building is constructed of wood and is situated on an asphalt base.

Within the interior, there are 5 ft. high metal sides with 8 ft. high metal braces. The building holds up to 700 tons of salt. The aluminum door at this facility is situated on a track for ease of opening and closing. Forty yards of material can be loaded at one time.

The New York State Dept. of Transportation recently constructed a salt storage structure in Port Jefferson Station adjacent to the intersection of Route 547 and Route 112. The construction of the building was done in-house and utilizes telephone poles for its major supports. The structure will hold a maximum of 250 tons of salt and is situated on an asphalt pad.
FIGURE 6  Salt Storage Pile

A tarpaulin partially covering a salt storage pile. The uncovered portion shows leaching of salt onto surrounding pavement.

FIGURE 7  Salt Remaining on Pavement

A view showing salt remaining on pavement after spreading. Some of this salt will eventually runoff into recharge basins and surrounding areas.
DEICING MATERIALS

On Long Island, at the present time, the most frequently used highway deicing material is a mixture of abrasives and salt. On occasion, straight salt (sodium chloride) is applied separately. (See Table 1 for a description of advantages and disadvantages of using a mixture or using straight salt).

The amount of salt mixed with sand or gravel and the application procedures vary by jurisdiction. The towns generally use a mixture with a 3:1 to 7:1 ratio of sand to salt (See Figure 8).

The N.Y.S. Department of Transportation (NYSDOT) uses only salt on highways. The NYSDOT believes that by applying straight sodium chloride as opposed to a mixture, the

TABLE 1

Frequently Used Highway Deicing Materials

Abrasives (sand, etc.) Mixed with Salt
Include sand, cinders, granite chips, limestone, other crushed stone.

Method:
Spread with use of trucks.

Advantages:
- a. Initial price ton for ton is lower than for sodium chloride.
- b. No temperature barrier (when stockpiled, must be in heated dry area to prevent freezing).
- c. Improves traction.
- d. Most effective immediately on ice and hard packed snow.

Disadvantages:
- a. Sedimentary material acts as a major water pollutant.
- b. Does not melt ice and snow.
- c. Requires extensive cleaning after snow ends; clean-up costs are high.
- d. Must be spread over entire roadway; 4-7 truckloads to treat same number of lane miles as for one truckload of salt.
- e. Frequently blown or brushed away by wind or traffic or covered by falling snow.
- f. Freeze and thaw cycles nullify effect.
- g. Continued use will usually create a thick uneven mat of ice.
- h. Builds up in catch basins and sewers.
- i. Impacts roadside vegetation.
- j. Wind blown dust from abrasives can affect persons with respiratory problems.
- k. When abrasives are mixed with salt, more salt is required to melt the ice than if straight salt is used.
- l. The use of abrasives with salt traps salt laden moisture in crevices and continues corrosion on metal surfaces long after salt would have been washed away by rain. It is especially detrimental to structures (ie. bridges, etc.)

Comments:
- a. Increase in use, 65.64% increase in ten year period (1969-70 compared to 1978-79).
- b. Can be used in combination with salt but it still does not provide clear pavement.

Sodium Chloride (salt)

Method:
Spread with use of trucks; sometimes mixed with sand, cinders, granite chips, limestone, other crushed stone.

Advantages:
- a. Cheaper than calcium chloride (1/4 the cost).
- b. Effective deicer over a longer period of time.
- c. Minimum clean-up required.
- d. When straight sodium chloride is used rather than a mixture of sand-salt, less total salt is required to melt the ice.
- e. Eutectic temperature – 6 F. (lowest point at which sodium will melt ice) which will handle most ice and snow storms. Sodium chloride must be in a 23.8% concentration in order to melt ice at its eutectic temperature.

Disadvantages:
- a. Narrower melting temperature range than calcium chloride.
- b. Impacts vegetation, surface water and associated habitats, and groundwater.
- c. Corrosive to metals.
the actual amount applied can be reduced. Another benefit is that the amount of sand and gravel that must be removed from highways and eventually from storm drains is reduced. Table 2 presents a comparison of the total amount of salt used when it is used alone or when it is mixed with sand.

Sometimes sodium is replaced with ammonium or nitrogen based compounds such as urea. Although urea is used on airport runways it is not used on roads and highways. Urea costs five to ten times as much as sodium chloride and one and one-half times as much must be used. It also can cause severe localized effects due to nitrate accumulation in surface waters and groundwater.

RATE OF APPLICATION

Existing highway application practices vary depending upon the storm characteristics, highway conditions, the type and availability of equipment, town policy, and the judgment of the foreman of the salting crew. Salt is not spread uniformly. In actuality, road intersections, hills, curves, low points, and areas with poor drainage receive the greatest attention.

All mixing is done on-site with a portable screening operation consisting of two hoppers, one for salt and one for sand, to achieve the 7:1 ration (sand/salt) which the Babylon Highway Department uses for deicing.

![Figure 8: Town of Babylon Portable Screening Operation](image)

### TABLE 2

**Comparison of Use of Salt and of a Sand-Salt Mix**

The following table shows the comparison between the amount and application rate of salt only vs. a sand/salt mixture, used to handle the same storm emergency.

<table>
<thead>
<tr>
<th></th>
<th>Salt Only</th>
<th>Sand/Salt Mix (1:1 by Volume)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Unit Weight</strong></td>
<td>2160 C.Y. (salt)</td>
<td>1080 salt &amp; 1350 sand = 2430 C.Y.</td>
</tr>
<tr>
<td><strong>Number of Applications</strong></td>
<td>3 1/3 avg.</td>
<td>3 1/3 avg.</td>
</tr>
<tr>
<td><strong>Application Rates</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>First</strong></td>
<td>200-250 lbs./la.mi.</td>
<td>750 lbs./la.mi.</td>
</tr>
<tr>
<td>(Avg. 225 lbs./la.mi.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Additional</strong></td>
<td>100-150 lbs./la.mi.</td>
<td>750 lbs./la.mi.</td>
</tr>
<tr>
<td>(Avg. 125 lbs./la.mi.)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Average Rate/ Application</strong></td>
<td>157 lbs./la.mi.</td>
<td>750 lbs./la.mi.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(333 lbs./la.mi.)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(417 lbs./sand/la.mi.)</td>
</tr>
</tbody>
</table>

**Conclusion: Ratio of Salt:**

\[
\frac{\text{Sand/Salt Mixture}}{\text{Salt only}} = \frac{333}{157} = 2.12 \text{ times salt is used when the sand/salt mixture is applied.}
\]

**NOTE:** C.Y. = cubic yards

lbs./la.mi. = pounds per lane mile

la. = lane

mi. = mile

Source: Thomas Gibbons, Regional Highway Maintenance Engineer, New York State Department of Transportation, File J921 Chemical Application Data, August 1981.
Tables 3 and 4 indicate the annual averages for total amount of salt applied, the number of lane miles treated and the approximate average amount of salt applied per lane mile, by jurisdiction. In general, a greater volume of salt is used per lane mile in the more densely populated than in the sparsely populated areas. Densely populated areas have a greater percentage of intersections and other conditions that need attention due to higher traffic volumes. The average amount applied per lane mile may be higher due to older equipment. These machines do not have control spreaders and may deposit too little salt, which would require an additional application later. They also may apply more than is required.

**TABLE 3**

Road Salting Information For Nassau County

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Average Total Amt.</th>
<th>Approx. Average Year Amount/ Lane Amt.</th>
<th>Lane Miles Treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York State</td>
<td>7,000 tons</td>
<td>7.4 tons</td>
<td>950</td>
</tr>
<tr>
<td>Nassau County</td>
<td>14,900 tons</td>
<td>10.7 tons</td>
<td>1,400</td>
</tr>
<tr>
<td>Town of:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oyster Bay*</td>
<td>1,500 tons</td>
<td>0.9 tons</td>
<td>1,600</td>
</tr>
<tr>
<td>N. Hempstead</td>
<td>3,000 tons</td>
<td>5.6 tons</td>
<td>540</td>
</tr>
<tr>
<td>Hempstead</td>
<td>6,000 tons</td>
<td>1.3 tons</td>
<td>4,500</td>
</tr>
<tr>
<td>County Total:</td>
<td>32,400 tons</td>
<td>3.6 tons</td>
<td>8,900</td>
</tr>
</tbody>
</table>

*The Town of Oyster Bay mainly services less traveled roads (residential areas) in comparison to the other two towns in Nassau County. This town is currently revising their guidelines for application rates.


**TABLE 4**

Road Salting Information For Suffolk County

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>Average Total Amt.</th>
<th>Approx. Average Year Amount/ Lane Amt.</th>
<th>Lane Miles Treated</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York State</td>
<td>12,000 tons</td>
<td>9 tons</td>
<td>1,300</td>
</tr>
<tr>
<td>Suffolk County</td>
<td>5,000 tons</td>
<td>5 tons</td>
<td>1,000</td>
</tr>
<tr>
<td>Town of:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Brookhaven</td>
<td>4,151 tons</td>
<td>2 (sand &amp; salt mixed)</td>
<td>1,750</td>
</tr>
<tr>
<td>East Hampton</td>
<td>300 tons</td>
<td>6 tons</td>
<td>50</td>
</tr>
<tr>
<td>Huntington</td>
<td>3,409 tons</td>
<td>13 tons</td>
<td>65</td>
</tr>
<tr>
<td>Islip</td>
<td>900 tons</td>
<td>3 tons</td>
<td>205</td>
</tr>
<tr>
<td>Riverhead</td>
<td>610 tons</td>
<td>1 ton</td>
<td>55</td>
</tr>
<tr>
<td>Shelter Island</td>
<td>60 tons</td>
<td>3 tons</td>
<td>360</td>
</tr>
<tr>
<td>Smithtown</td>
<td>1,200 tons</td>
<td>1.5 tons</td>
<td>400</td>
</tr>
<tr>
<td>Southold</td>
<td>600 tons</td>
<td>1.76 tons</td>
<td>1,000</td>
</tr>
<tr>
<td>Babylon</td>
<td>1,759 tons</td>
<td>4.2 tons</td>
<td>7,224</td>
</tr>
</tbody>
</table>


**TYPE OF EQUIPMENT**

Many agencies in Nassau and Suffolk Counties are already using or are planning to use ground control spreaders. These agencies include the N.Y.S. Department of Transportation, Nassau County Department of Public Works, and the towns of Oyster Bay, Smithtown, Babylon and Islip. The most important feature about these spreaders is their ability to regulate the amount of salt that is deposited on the roadway. The regulatory device, which is located in the cab of the truck, controls conveyor belt and spinner speed. The salt in the truck bed is carried along on a metal or rubber belt system and is deposited in a hopper. The spinner, located in the hopper, is set to accommodate the width of the road. The truck's speed regulates the rate at which the salt is distributed. This system reduces the amount of salt used and increases the area that one truck can cover. The amount of salt saved through spreader controls offsets the cost of these spreaders.
Legislation, Regulations and Administration

There are few laws controlling highway deicing activities. Those that exist attempt to manage salt storage site impacts upon groundwater and the disposal of brine to surface waters. There are no laws that regulate highway application of deicing salts. Tables 5 and 6 provide a summary of the State, County and Town management affecting highway deicing practices.

### Table 5

<table>
<thead>
<tr>
<th>Agency</th>
<th>Control</th>
<th>Description</th>
<th>Deficiencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York State Dept. of Environmental Conservation (NYSDEC)</td>
<td>1. State Pollutant Discharge Elimination System (SPDES) NYCRR, Part 703, Title 6</td>
<td>Permits issued only for sites with discharge of groundwater. Numerical limitations for chloride of 250 mg/l for ambient groundwater and 500 mg/l for effluent discharge.</td>
<td>Does not address limitations on siting, design or construction of facilities. The SPDES permit system should require inspection and monitoring of salt storage sites for enforcement particularly in Nassau County. The SPDES standard can be applied in legal suits to enforce compliance with state standards. Due to a lack of funds and personnel the system has not been effective in preventing salt contamination.</td>
</tr>
<tr>
<td></td>
<td>2. General Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Proposed Controls</td>
<td></td>
<td></td>
</tr>
<tr>
<td>New York State Dept. of Transportation (NYSDOT)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The Department has developed a no-discharge to groundwater policy for NYSDOT sites.
### TABLE 5... Cont'd.

<table>
<thead>
<tr>
<th>Agency</th>
<th>Control</th>
<th>Description</th>
<th>Deficiencies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nassau County Health Dept. (NCHD)</td>
<td>State Pollutant Discharge Elimination System (SPDES)</td>
<td>Regulation of uncovered salt piles. Agencies follow a compliance schedule along with guidelines for brine containment and disposal. NCDH will sample based upon reported violations.</td>
<td>At the present time the permit system to be administered by NCDH is not in effect. Once the system is in effect, all county, town and village sites must be in compliance.</td>
</tr>
<tr>
<td>Suffolk County Department of Health Services (SCDHS)</td>
<td>Article 12 (Section 1216-Bulk Storage of Toxic or Hazardous Materials) of the Suffolk County Sanitary Code</td>
<td>All of the towns and villages are subject to Article 12 which regulates salt storage. Road salt must be stored in a roofed facility or on an impervious pad equipped with a means of collecting or removing brine. Holding tanks must hold 4 inches of precipitation. The asphalt pad and stormwater system should hold another 2 inches. Salt may be stored in areas without brine control as approved by the DEC. Approved brine disposal techniques include: discharge to secondary or tertiary sewage treatment plant outfall pipes, primary sewage treatment plants and stormwater systems, all of which discharge to open marine waters, as approved by the DEC.</td>
<td>Article 12. Does not presently require that salt storage piles be covered by a permanent structure. It doesn't set implementation priorities for enforcement of controls in important aquifer recharge areas. Manpower shortages in County Health Dept. staff limit inspection and enforcement programs.</td>
</tr>
<tr>
<td>Nassau County (Towns)</td>
<td>General Guidelines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suffolk County (Towns)</td>
<td>General Guidelines</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### TABLE 6

Existing Snow and Ice Control Guidelines

<table>
<thead>
<tr>
<th>Agency</th>
<th>Control</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>New York State Dept. of Transportation (NYS DOT)</td>
<td>State Highway Maintenance Guidelines (Section 5000) (See Table 5)</td>
<td>Sets forth standards and operating procedures for snow and ice control. Recommendation for optimal content mix of materials and application rates.</td>
</tr>
<tr>
<td>Nassau County (Towns)</td>
<td>General Guidelines</td>
<td>The Towns follow NYS DOT guidelines on the State roads which they maintain under contract with the State.</td>
</tr>
<tr>
<td>Suffolk County (Towns)</td>
<td>General Guidelines</td>
<td>None of the towns follow specific guidelines for application of deicing chemicals. Generally the respective highway departments establish their own policies on the basis of NYS DOT's guidelines.</td>
</tr>
</tbody>
</table>
RECOMMENDATIONS

Legislation, Regulations
and Administration

State and Municipalities

The following recommendations comprise remedial and preventive measures that can be used to reduce or minimize further salt contamination of the region's water supply. The remedial measures include the relocation of existing salt piles, immediate improvement of salt pile sites where necessary to prevent contamination of downgradient water supply wells, and changes in mixing, loading or other operational practices. Preventive measures include best management practices for new sites, and operational and highway salt application techniques.

Salt Pile Management

REMEDIAL MEASURES

- **Inventory and Classify Existing Salt Piles**
  The health departments should compile an inventory of the existing salt storage piles within each county and hydrogeologic zone. These sites should then be evaluated in terms of their impacts upon groundwater. The permanent and temporary salt storage sites should be mapped, and the type of chloride should be indicated as follows: unacceptable chloride discharge to groundwater, acceptable discharge to groundwater and no discharge to groundwater. Those sites that have extra storage and treatment capacity to accommodate additional salt piles should also be identified.

- **Relocate Salt Piles**
  The jurisdictions should then analyze highway deicing needs to determine which salt piles could be relocated without impairing storm response time. Wherever possible, the counties and the jurisdictions should identify nonessential piles located in the deep aquifer recharge zones and should move them to other sites where they will be less likely to impact water supply wells or the environment. Not only vacant land, but vacant buildings surrounded by asphalt paving should be considered for conversion to salt storage facilities. Do not locate new salt storage facilities adjacent to fresh surface water, in flood-prone areas, critical aquifer recharge areas and where steep slopes occur.
• Upgrade Existing Salt Pile Sites in Important Aquifer Recharge Areas
  Establish priorities for the improvement of the salt pile sites that must remain in the critical recharge zones (including the Special Groundwater Protection Areas), and/or are located upgradient of water supply wells. The priorities should be based upon documented or probable near term and long term impact upon water supply.

• Develop a Priority System and a Schedule for Clean-up
  - Develop a schedule for the elimination or reduction of discharges to groundwater. Those sites that are identified as top priority should be improved within a year, while other sites should be improved soon thereafter.
  - Implement all possible measures to minimize runoff or leachate generation, including temporary measures where necessary. Erect permanent structures to protect salt storage piles from precipitation and moisture. Cover all exposed salt piles during the periods when they are not in use and install stormwater and brine control measures for these sites. (See the Stormwater Chapter).
  - Investigate the feasibility and cost effectiveness of utilizing smaller, but more numerous facilities as opposed to larger, but fewer facilities in the densely populated areas. Smaller facilities might serve as satellite loading stations. These stations should be strategically located so that trucks could be reloaded on or near their routes in order to minimize the length of time that they would be traveling empty. The costs of effective stormwater and brine controls should be considered in the calculations for all sites.

PREVENTIVE MEASURES
• Cost Reduction Techniques for Salt Storage Facilities
  - Consider the use of standardized salt storage facilities. Standardized salt storage structures are used in several other states to cut costs, and may be appropriate for Long Island. (See Figure 9 for a typical salt storage structure used by the State of Maryland and other states). Designs for acceptable salt storage buildings should be studied to determine whether one or two lend themselves to standardization and consequent cost savings. The NYSDOT has recently constructed several buildings that are of the same design. The cost, size, advantages and disadvantages of this building type should be compared with other possible alternatives.
  - Choose appropriate and economical materials. Use salvaged materials or mass-produced items, such as telephone poles and railroad ties wherever appropriate. Use other commercially available, mass-produced structures such as structures with a suitable floor and interior load-bearing bulkhead. The municipal highway department may be able to provide the labor for design and construction, thus eliminating the need for an outside contractor (Figure 5).
  - Existing commercial, industrial or transportation buildings may be suitable for salt storage. (See Figure 10). Some structures with multiple bays are ideally suited for deicing operations.
A plywood dome currently being utilized in many areas in the United States and Canada. This structure is widely used in Maryland because it is the best method of storing salt both due to its effectiveness and the low cost of construction and maintenance. The plywood frame comes in prefabricated units and is assembled on the site. Site work includes pouring the concrete base pad and a concrete ring to support the dome. One access door is located on the leeward side of the dome.

This sketch depicts a steel barrel vault frame to which various exterior materials may be attached. Steel doors are connected to the rigid frame and allow access from either side. The covered frame creates a large unobstructed interior. There are a number of existing buildings on Long Island similar to the one shown that may be suitable for conversion to a salt storage facility.
Consider joint (inter-municipal) use of existing storage facilities. Provisions should be made for possible rental of space on existing salt storage areas for nearby municipalities, which find it less costly to rent space than develop their own facility (i.e. acquisition of land, stormwater runoff controls, etc.)

**Facility Design and Construction Guidelines**

**Storage Structures**

Design salt storage buildings to provide needed capacity, maximum protection of salt, easy access, and to facilitate environmentally acceptable operations. Central salt storage facilities, that serve major highways, should be large enough to accommodate ten wheel trucks and pay loaders. The holding capacity of the building should be large enough to accommodate an average of 5,000 to 7,000 tons or an adequate supply of salt.

Locate large or multiple doors on both ends or sides of the building for easy access. All doors used on buildings containing salt should be moisture proof.

Raise the floor elevation of the salt storage building above the 100 year flood level (based upon future maximum stormwater runoff from the upland watershed). This precaution should be taken to prevent any leaching of salt to the groundwater. Assure the impermeability of the floor. Either provide a concrete floor and apply a water-resistant or waterproof sealant and reseal as needed; or provide an asphalt or cement floor with a clay or plastic liner sealed with epoxy placed underneath it. Regardless of the alternative selected, make adequate provision for the containment of contaminated water in the event of a fire.

Plan for the inevitable accidents or mishandling of mechanical loaders, as well as the considerable wear and tear of normal operations. Any portion of the structure within reach of the front-end loader is vulnerable to damage. Therefore, appropriate choice of construction materials for these areas and providing maximum reinforcement are very important. The corners of any salt enclosure are particularly vulnerable when the front-end loader is working close to the walls. Use a concrete curb or parapet extending up the walls as far as four or five feet. A lighter, more vulnerable wood or metal structure may be used above. Timber bulkheads or bumpers can be used for protecting corners and lower walls in concrete block sheds or in wooden structures, especially those with arched or conical roofs within reach of the front-end loader.

Protect door jambs and lintels, natural targets for damage during loading and unloading operations. Both can be reinforced structurally by using double timber or metal posts. In addition, the surfaces can be protected by metal pipe columns, or in the case of door jambs, by cast iron wheel guards.
- **Open Storage Sites**
  Equip open storage sites (no structure) with a waterproof concrete base treated with sealant as needed to prevent leaching of salts to the base and soils below. The loading area surrounding the base should be made of concrete or an asphalt with the lowest possible permeability. The sub-base and base for the main traffic area should meet New York State Highway Standards; that is, sufficient to withstand the weight of loaded trucks. The size of this area should be minimized to reduce costs and the amount of stormwater to be contained.

  Maintain a windrow shaped storage pile in order to minimize the impact of northwesterly winds upon the salt pile. Plant conifers in north, northwestern and northeastern locations to reduce the effect of winds.

  Minimize the amount of salt mixed into the pile. The minimal amount required to prevent a salt pile from freezing is 80 lbs. of sodium chloride to one (1) ton of sand (4% mixture).

  Cover the pile with an acceptable tarpaulin (tarp) material throughout the year, except when in use. The cover should be sufficiently strong to resist tearing during high winds and should be completely moisture proof. It should be secured so that the salt is never exposed to wind or rainfall while the tarp is in place. The upper layer of the pile should be covered with sand, which should be continually replaced.

  Prevent salt contaminated stormwater from reaching the soils beneath or adjacent to the salt pile (see Site Grading).

  Consider the use of a retaining wall to confine a portion of the salt pile and minimize stormwater runoff from several directions (see Figure 12).

- **Site Grading**
  Develop and implement a detailed grading plan to prevent salt contaminated stormwater runoff from the salt pile area from coming into contact with unpaved areas. Minimize the disturbance of existing soils and vegetation. Paved areas should not contain slopes greater than 2 1/2 or 3 percent. Grades may be slightly increased in areas where trucks are stored and in paved areas not used by traffic. Avoid or correct low spots in the pavement surface (see Figure 11).

- **Site Paving**
  Use a mix that has the lowest permeability for any site paving that will come in contact with salt or salt-contaminated stormwater. Maintain the paving with the most skid resistant sealant designed to resist salt solutions and to minimize the leaching of salts to the soils beneath the subbase.

- **Site Stormwater Management**
  Provide control and storage for the maximum runoff that can be expected during a 60 hour period.

  The stormwater system should be designed to contain all salt contaminated stormwater generated on site so that no salt contaminated stormwater will reach the unsaturated zone (see Brine Control).

  Design and size drainage channels for maximum volume of stormwater. Drainage channels should be made of impervious materials. All drainage facilities should be made of non-corrosive materials.
This figure illustrates how a typical salt storage pile should be designed to prevent contact of salt with stormwater runoff. The salt pile is enclosed within a permanent structure. Prevailing winds on the site are blocked by coniferous trees. The storage site and any area needed for vehicular access is covered with bituminous concrete and provided with stormwater controls to contain the maximum rainfall occurring within a 60 hour period.

**FIGURE 11** Site Section—Stormwater and Wind Control Recommendations

At the Town of Babylon facility in Lindenhurst, the sand is mixed and deposited on a pile located directly adjacent to the salt storage building. The salt/sand mixture rests on an asphalt base with a 2 foot retaining wall that extends 5 ft. below the ground. There are also two drainage pits for runoff for brine control.

**FIGURE 12** Salt Pile Supported By A Retaining Wall
Locate observation or monitoring wells on site down gradient of the holding tank and catchment area to monitor for possible leaching of salt to the groundwater.

* Brine Control*

Require brine control for all salt storage facilities. See Figures 11, 13, 14 for an example of an existing recommended brine control system.

There are two primary methods of brine control in use at the present time: storing the brine in a holding area, such as a storage tank, until the tank becomes relatively full and then removing the brine for disposal, or storing it on site and pumping it back onto the storage pile. The brine management practices at the Town of Babylon’s storage site at North Indiana Avenue in Lindenhurst is an example of the second alternative. The management practices are described in Figures 12, 13, 14. *Never dispose of brine into the soil or fresh surface waters!*

Provide a brine holding tank of sufficient capacity so that it will not overflow with several minor storms, and so that frequent pumping is not required.

If the holding tank is not large enough to contain several winter storms, than an overflow containment pond or adequately sized impermeable lagoons should be provided. The holding tank should be of an impermeable material capable of withstanding the pressures of the brine solution. (An exoxy-coated plastic is sometimes used.)

Remove the brine solution from the holding tank at regular intervals during the year. Dispose of brine by discharging to one of the following:
- a secondary or tertiary sewage treatment plant outfall pipe (not directly into the treatment plant that discharges to marine waters)
- primary treatment plants where it may be discharged into marine waters
- into storm drainage systems discharging to marine waters
- directly into marine waters

Discharges must be approved by the DEC

* Storage Site Operation
- Salt Supply and Mixing
  Store salt or salt mixed with sand at central sites located outside the deep aquifer recharge area and at a sufficient distance from fresh surface waters and wetlands. The mixture should then remain at these sites until the beginning of the winter storm season and then be transported to numerous smaller facilities. This technique will minimize the potential for groundwater or surface water contamination.

- Mixing and Loading
  Perform all mixing and loading operations within an area where stormwater and brine controls are in effect. (See Figure 8).

*These recommendations apply specifically to the type of deicing materials now in general use on Long Island. Any significant change would require reassessment and possible revision.
At the Babylon facility a 3 foot berm protrudes out of the back of the salt storage building. There are three 6,000 gallon brine holding tanks contained within the berm. The tanks are square, made of plastic and sealed with epoxy. An electric pump, located adjacent to the back wall of the building, is used to recycle the brine solution back onto the salt storage pile. The brine solution travels up a hose which runs up one end of the pile and into a pipe which runs along the top of the pile.

The brine solution is recycled back onto the pile through holes in the pipe, which acts as a "sprinkler".
- **Maintenance**
  Sweep the site after all loading or mixing operations.
  Clean salt spreading equipment on the loading pad where stormwater and brine control measures are in effect.
  Repair the salt storage structure roof, walls and doors as needed to prevent moisture from entering the building.
  Seal the asphalt site paving and the concrete floor of the building required to maintain the impermeability of the surface.
  Repair potholes, washouts and cracks in the asphalt and/or concrete paving as soon as possible.
  Replace or repair the berms constructed to contain and direct stormwater immediately if they are destroyed or damaged.
  Check the brine circulation system frequently to assure proper operation.
  Replace or repair any damaged tarps.

- **Operator Training**
  Provide in-service education programs for salt mixing and spreading personnel, to insure operator awareness of the environmental impacts of salt spreading.

### Management of Road Salt Application and Plowing

#### PLANNING AND MAPPING OF ROUTES
- Develop and post a master map and chart showing routes, snowplowing and deicing schedules and equipment and operator assignments.
- Each driver should have a pre-set familiar route so that he/she may be aware of special problems which exist in the area, and to prevent duplication of salt application by other drivers.
- Update maps periodically to show new roads, interchanges, streets, bridges, and jurisdictional boundaries.

#### CONSTITUENTS AND CONSTITUENT MIX(ES)
- Evaluate various salt/sand ratios currently used for maintaining highways to determine which mixture offers the maximum safety for the public with the minimum impact upon groundwater under most storm conditions. The use of straight salt should be considered. (See Table 7 for the NYSDOT recommended snow and ice treatment for two lane roads).

#### APPLICATION
- Adjust application techniques to reflect traffic density and highway design since they generally determine the type of spreading pattern that should be used. A windrow of salt applied in a 4-8 foot strip along the center line is effective on two-lane pavements with a low to medium traffic count. Less salt is wasted with this pattern and clear pavement is quickly available under at least two wheels of the vehicles. The traffic will soon move some salt off the center line and the salt brine will move toward both shoulders for added melting across the entire width of the road. The full width spreading pattern is used most often on multiple lane pavements with medium to high traffic volumes where all lanes carry equal traffic. Melting action occurs over the full pavement width.
### TABLE 7*

**Recommended Snow and Ice Treatment for Two Lanes (24' Width)**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Temperature</th>
<th>Highway Class A-1 or A-2</th>
<th>Highway Class B</th>
<th>Highway Class C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sleet or</td>
<td></td>
<td>Salt — 500 to 600 lbs./Mile</td>
<td>Salt — 500 to 600 lbs./Mile Repeat Application (if Necessary) at 200 lbs./Mile</td>
<td>Salt — 500 to 600 lbs./Mile Repeat Application (if Necessary) at 200 lbs./Mile</td>
</tr>
<tr>
<td>Freezing Rain</td>
<td></td>
<td>Repeat Application (if Necessary) at 200 lbs./Mile</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Snow</td>
<td>25° or Above</td>
<td>Salt — 400 lbs./Mile</td>
<td>Salt — 400 lbs./Mile</td>
<td>Salt — 400 lbs./Mile</td>
</tr>
<tr>
<td>Snow</td>
<td>20°-25°</td>
<td>Salt — 500 lbs./Mile</td>
<td>Salt — 500 lbs./Mile</td>
<td>Abrasive — Chemical Mix 1 Part Salt to 3 Parts Abrasive — Apply cinder mix at 1,000 lbs./Mile</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Chemical Mix — 2 Parts Salt to 1 Part Calcium Chloride — Apply 400 lbs. of Mix/Mile</td>
<td>Chemical Mix — 2 Parts Salt to 1 Part Calcium Chloride — Apply 400 lbs. of Mix/Mile</td>
<td>Sand mix at 1,500 lbs./Mile</td>
</tr>
<tr>
<td>Snow</td>
<td>10°-20°</td>
<td>Chemical Mix — 2 Parts Salt to 1 Part Calcium Chloride with 3 Parts Abrasive — Apply cinder mix at 800 lbs./Mile Sand mix at 1,100 lbs./Mile</td>
<td>Abrasive — Chemical Mix 1 Part Salt to 6 Parts Abrasive — Apply cinder mix at 1,000 lbs./Mile</td>
<td>Abrasive — Chemical Mix 1 Part Salt to 4 Parts Abrasive — Apply cinder mix at 1,000 lbs./Mile Sand mix at 1,500 lbs./Mile</td>
</tr>
<tr>
<td>Snow</td>
<td>Below 10°</td>
<td>Chemical Mix — 2 Parts Salt to 1 Part Calcium Chloride with 3 Parts Abrasive — Apply cinder mix at 800 lbs./Mile Sand mix at 1,100 lbs./Mile</td>
<td>Abrasive — Chemical Mix 1 Part Salt to 6 Parts Abrasive — Apply cinder mix at 1,000 lbs./Mile</td>
<td>Abrasive — Chemical Mix Normally on hills, curves &amp; intersections — 1 part Salt to 6 parts Abrasive — Apply cinder mix at 1,000 lbs./Mile Sand mix at 1,500 lbs./Mile</td>
</tr>
</tbody>
</table>

1. **For Rising Temperatures** use the recommendations in the temperature range above the range the present temperature falls in.

2. **For Falling Temperatures** use the recommendations in the temperature range below the range the present temperature falls in.

3. **Dry Blowing Snow** — If pavement is dry and dry snow is lightly falling, do not apply chemicals — plow as necessary and treat icy spots, if they develop, as recommended in the table above.

4. All mix proportions are on a volume basis. Salt estimated at 2,000 lbs./Cubic Yard (CY), flake calcium chloride at 1,200 lbs./CY, sand at 3,000 lbs./CY, and cinders at 1,800 lbs./CY.

**NOTE:**

1. If snow has become hard-packed on pavement, use 1 part calcium chloride, 2 parts salt and 2 parts of any of the abrasive-chemical mixes. Apply early in the day & blade off with grader as the packed material softens.

2. When the temperature is below 20° and chemical mixes are shown above, be sure to use them early in the day to avoid the danger of night-time freezing.

3. Apply chemicals and mixes early in the storm so that brine develops on the pavement and prevents buildup of packed snow. If the snow continues to fall & accumulates on the pavement, plow and follow this with chemical or mix treatment in the plowed area.

4. The light 200 lb/mile applications shown above may have to be repeated several times through the duration of the storm — plow as necessary ahead of the application of chemicals.

5. Apply chemicals and/or mix to middle 1/3 (maximum) of pavement width and on the high side of banked curves.

Source: New York State Department of Transportation, 1981.

*These are statewide guidelines, calcium chloride is very rarely used on Long Island.
- Use abrasives with little or no addition of chemicals in locations where traffic is not heavy enough to remove them rapidly from the road. A mixture of 20 parts sand and one part salt (the minimum amount of salt needed to keep a sand pile from freezing) often supplies enough melting action to provide an adequate level of service on secondary roads and in residential areas.

- Consider the type of road surface to be cleared. Asphalt reacts differently to snow and salting than does concrete or blacktop.

- Apply increased amounts of salt or salt/sand to steep slopes, road intersections, sharp curves and bridges where necessary to prevent hazardous situations.

**TIMING**

- Apply deicing materials early before traffic becomes heavy or the storm becomes too severe.

**RECORD KEEPING OF HIGHWAY APPLICATION**

- Supervisors and the spreader operators should complete and retain reports detailing weather and road conditions, lane miles covered and types and amounts of deicing materials used.

**EQUIPMENT**

*Spreaders*

- Use ground control spreaders for highway salt application to achieve long-term savings. The replacement of older less efficient equipment by ground control spreaders has been found to pay for itself through reductions in the amount of salt, sand and gravel used in numerous applications.

- Consider the following factors when choosing new equipment:
  *Drive configuration (hydraulic or electric) controls located inside the truck because they are more efficient; there is more control over the amount of salt applied, and the driver does not have to get out of the truck to adjust the controls.*

  *Durability of the materials used in spreader construction.* One of the more durable materials is stainless steel.

  *Versatility of the spreader.* Some spreaders are of a highly specialized nature while others may be removed and placed on other types of trucks. (An ordinary dump truck may be used with slip-in spreaders or tailgate spreaders) (Figure 15).

  *Calibrated spreaders should be used* (i.e. bin spreaders). A spreader may also be chosen for the degree of precision required. Some spreaders dispense a set amount of salt regardless of the truck speed while others respond to changes in the speed of the truck.

  *Suitability for intended use.* Equipment should meet road needs adequately. Certain equipment is more readily adapted to highway usage while other equipment is more suitable for use on two-lane roads.

**PROPER OPERATION OF EQUIPMENT**

- Train staff members to properly use spreading equipment.

- Train personnel to follow appropriate application guidelines for various storm and road conditions. Authorize field crews to adjust within pre-arranged limits as required.
These slip-in spreaders can be stored in off season and trucks utilized for other highway purposes.

PLOWING PROGRAM
- Develop a comprehensive plowing program to help minimize the amount of salt or salt/sand that must be used in a storm. Begin plowing as soon as a one-half inch or more of snow starts to accumulate on roadways.
- Avoid dumping material from overhead bridges into roadway or railroad tracks below. The snow should be hand shoveled, if necessary, to make sure all drains in the bridge floor are open and free draining.
- Keep roadway drains and catch basins open to allow melting ice and snow to run off the road. When water forms ponds and puddles around drains, falling temperatures may cause it to refreeze.
- Mark curbs, protruding manholes, catch basins and other obstacles in order to attract the attention of plow operators and prevent injury to personnel and equipment.

Road Cleanup
- Perform road cleanup as soon as is practical. Avoid sweeping or otherwise depositing salts and other abrasives into freshwater or tidal wetlands, natural swales, stormwater systems, fresh surface waters or in aquifer recharge areas.

FUTURE ALTERNATIVES
- Continue to evaluate new deicing materials. If these materials meet safety standards and if the related environmental, social, and economic impacts compare favorably with those of salt, consider them for possible use on Long Island.

Public Education
- Inform the public of the benefits as well as the disadvantages of using salt and other deicing materials needed to maintain highway safety.