Tie in to update of Town Plan
Map 4 "Protection Zones" p19

THE WESTON ENVIRONMENTAL RESOURCES MANUAL

TECHNICAL APPENDIX

PREPARED FOR THE

PLANNING AND ZONING COMMISSION
Town of Weston,
Connecticut

BY

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INTRODUCTION

The TECHNICAL APPENDIX to the WESTON ENVIRONMENTAL RESOURCES MANUAL contains technical data supporting the conclusions of the MANUAL and special recommendations for the administration of land use policies.

All references cited in the TECHNICAL APPENDIX are listed in the MANUAL pages 44-45. A complete listing of all data associated with the MANUAL is given on MANUAL page 13.

EVALUATION OF LIFE SUPPORT CAPACITY

Water chemistry as indicator of life support capacity

Water chemistry is easy to measure and monitor. Since water flows over and through the entire land surface, it acts as an integrative measure of ecological conditions. Measuring water quality at the discharge point of a watershed is equivalent to doing a general ecological survey of the entire watershed.

Water chemistry is effected by every human activity. Water quality monitoring can indicate erosion, soil contamination and chemistry of storm runoff. It can indicate contamination from sewage disposal, fertilizers, pesticides, heavy metals, road salting, etc.

Water is the most critical element in Weston's life support system. It is tapped from private bedrock wells and public stratified drift aquifer wells and is crucial to the cultural uses of the landscape from fishing and swimming to aesthetic enjoyment.

Critical water quality indices

Holzer (1975) states that in low density residential areas, with relatively shallow soil of glacial origin - mostly till with a small fraction of stratified drift, and with a dense crystalline bedrock - dangers to public water supplies are most likely to come from contamination by microorganisms and nitrate.

A very low count of coliform bacteria (two or more coliform bacteria per 100 ml) is cause for rejection of wells being tested for drinking water according to United States Public Health Service (USPHS) and

Connecticut Health Department standards. The coliform indicates fecal contamination from warm-blooded animals and could either be of animal origin, such as deer feces, or human feces.

Nitrate contamination of well water in Weston could come chiefly from septic tank effluent or fertilizers. A certain amount of nitrate (around 0.4 ppm as nitrogen) is present in precipitation, and in natural surface or ground water, but the concentrations are so low as to pose no danger to public health. The USPHS and Connecticut Health Department standard is 10 ppm nitrate as nitrogen. Some nitrates can be released from land which has been recently cleared from forest cover, but this is likely to be a minor source of nitrates in Weston.

Aside from general contamination from micro-organisms and nitrate, other contaminants can cause problems in special cases. For people on low sodium diets and leaching of salt from road salting or from the regeneration of water softeners to wells can cause health problems; water softener contamination has been reported in Stamford and North Branford, Connecticut. Similarly, landfills can contaminate groundwater with lead and other pollutants.

<u>Prediction of life support capacity from water quality</u>

For the purposes of this study, Weston's life support capacity has been estimated using two complementary methods. In the first, <u>theoretical method</u>, the future water supply is estimated from the calculated ground water recharge and the hydrogeology of the watersheds. The theoretical water quality can be estimated by the amount of wastes being dumped into the soil and a dilution factor based on the flow of water through the soil. For Weston this was accomplished by using a nitrate dilution model.

In the empirical method, the water supply is estimated from actual well yields in bedrock and stratified drift aquifers. Future water quality by the empirical method is estimated by determining how present human activity is affecting water quality, and making a projection based on the present water quality and future land use.

It should be emphasized that these two methods work together and provide a check on each other.

Hydrologic Overview

To interpret observed data on water quality, well yields and disposal of septic waste, it is essential to understand how the hydrologic system is functioning as a whole.

Referring to Table A, the 13.4 inches/year runoff is that portion of precipitation which travels along the surface into the nearest watercourse; it therefore cannot contribute to water supplies. The 23.1 inches of evapotranspiration is the fraction that never reaches the watershed exit. Some of the 23.1 inches is intercepted by vegetation and never reaches the soil or watercourses; however, most of it enters the soil and is evaporated directly from the surface or taken up by plant roots and transpired from leaves. The remaining 10.0 inches enters the ground and eventually appears as base flow of streams or that portion of stream flow having its origin in ground water and maintaining stream flow during dry periods.

Groundwater recharge is considered to be the amount of precipitation potentially available to be tapped by wells. However, it is impossible in practice to tap this full amount. In Pound Ridge, New York, it was estimated that about half of groundwater recharge might be available to bedrock wells (Pound Ridge, New York, Planning Board, 1976). This would amount to around 300-400 gallons/acre/day.

Table B presents data on yields of bedrock wells in Weston. There was no correlation observed between well yields and geological features. This observation agrees with the statement of Ryder et al. (1970) that depth and yield of bedrock wells cannot be predicted in advance of drilling because its intersection with water-bearing fractures is essentially a chance phenomenon.

Almost every two-acre lot in Weston can support a single dwelling requiring 800 gallons (100 gallons/capita/day). A well flow rate of 0.5 gallons/minute approximates 800 gallons/day.

If really large quantities of water are needed, some locations in aquifers could be tapped. A prime example is the area along Godfrey Road, just east of the Suagatuck River.

There is no evidence that Weston will lack sufficient well water assuming a present zoning saturation of 16,000 people. This is true because of the large yield of wells as compared to expected demand, the fact that well demand would require only a small fraction of groundwater recharge and that septic tank effluent recharges the water table.

It can be concluded that the quality of well water is an issue which supersedes the problem of potential supply.

Septic Dilution Factors

When septic effluent percolates down through the soil profile, it is diluted by groundwater. The fraction of precipitation available to dilute septic effluent is the 10.0 inch/year groundwater recharge which eventually reaches streams and a fraction of the 23.1 inch/year evapotranspiration. When septic effluent is taken up by plant roots, nutrient elements in the effluent such as nitrate, phosphorus and potassium are assimilated into the plant; the water is transpired by the leaves.

In calculating septic dilution factors (Table C), a minimum estimate assumes that septic effluent is diluted only by groundwater recharge; a maximum estimate takes into account the additional dilution by water which is eventually taken up by plant roots, and the biological action of the roots in taking up chemical elements from the septic effluent.

Nitrate as Indicator of Life Support Capacity

When septic tank effluent makes water unsuitable for drinking, it is commonly due either to microbiological contamination from bacteria and virus or to nitrate contamination. It has been suggested by Holzer (1975) that dilution of nitrate from septic tanks can set a limit on life-support capacity.

The potential release of nitrate from septic tanks amounts to 13.28 lb. of nitrate-nitrogen/capita/year (Holzmacher, 1968); this would amount to 0.036384 lb./capita/day. Assuming that per capita water use is 100 gallons/day, the resulting nitrate nitrogen concentration would be 43.6 ppm. Applying the Townwide dilution factors of 12-40 (Table C) would result in a nitrate concentration of 1.1-3.7 ppm. But since ambient precipitation has a nitrate concentration of 0.4 ppm, the expected groundwater concentration should be raised to 1.5-4.2 ppm.

Table D compares the observed nitrate values with the calculated ones. The remarkable fact is the extraordinarily low nitrate concentrations in wells. These are below that observed in precipitation and the theoretical value calculated by nitrate-dilution factors.

There are various explanations for this phenomenon:

1. Nitrogen leaving the septic tanks is not being totally converted to nitrate in the leach fields but is remaining in the ammonium form which can be held by the soil against leaching.
2. Nitrate nitrogen is being converted to gaseous forms of nitrogen within septic tanks and leach fields.
3. Nitrate is being taken up by vegetation in large quantities in the vicinity of leachfields, and in lesser quantities throughout the town.

Low percolation values in hardpan and wetland soils, together comprising 33% of Weston's area would indicate conditions favoring all the above explanations to occur. Low oxygen in impermeable soils would both inhibit conversion of ammonium to nitrate and provide favorable conditions for conversion of nitrate to the gaseous state. Slow percolation rates would hold nitrate in the upper layers of the soil and give vegetation considerable time to absorb nitrate.

The nitrate values in surface water are slightly higher than those expected under completely natural conditions, but still lower than that predicted by calculation of nitrate dilution. The lower values can be explained by the same reasons as the low nitrate levels in wells. We would conjecture that wetlands in Weston may play an important role in reducing the nitrate concentrations in surface water. Large amounts of vegetation uptake of nitrate and denitrification could occur in wetlands (Deevey, 1970; Grant and Patrick, 1970).

The low magnitude of nitrate concentrations in Weston as compared with a nitrate dilution model, indicates that the model provides a conservative estimate of life support capacity. Since 4.5 ppm of nitrate-nitrogen groundwater concentration predicted in Weston is approximately half the federal standard of 10.0 ppm, it can be inferred that nitrate contamination and population could approximately double before the federal standard is reached. This would coincide with the predicted zoning saturation density of 16,000 (Weston Town Plan, 1969).

From our current data on actually observed nitrate concentrations, it appears that the 10.0 ppm federal standard would not be reached if Weston doubles its population. This estimation assumes that Weston's vegetative cover and wetlands are kept fairly intact.

Since nitrate is one of the most sensitive monitors of water quality, it would be essential to carefully monitor town nitrate concentrations as Weston develops.

The overall conclusion reached from our data on nitrate is that

Weston's relatively impermeable soils and heavy vegetation cover, and its wetlands are crucial factors in maintaining its water quality.

Weston's fortunate ecological position with regard to water quality can be contrasted to that of Huntington, Long Island, where nitrate from septic tanks leaches readily into the deep sand aquifers from which it draws its well supply. In these kinds of situations the actual nitrate concentration in groundwater more closely follows that of the nitrate dilution model (Huntington Environmental Planning Group, 1974).

Data from Pound Ridge shows most wells have nitrate levels between 1-5 ppm, and one well tested exceeded the 10 ppm federal standard (Pound Ridge, New York Planning Board, 1976). Although Pound Ridge's geology and population density is similar to that of Weston, the difference in the occurrence of nitrate may be due to differences in the depth or permeability of soils or in the depth of wells. Unfortunately, the Pound Ridge data were not completely analyzed with regard to soil factors and possible fertilizer inputs.

Future River Water Quality in Weston

An indication of Weston's potential river water quality at zoning saturation can be obtained by studying the data of Bongiorno (1975) on Fairfield, Connecticut, rivers. Fairfield adjoins Weston and has a similar geological configuration and has population densities in its three river basins ranging from 0.4 to 3.6 people/acre. Table E shows the relationship between population density and river nitrate levels in Weston and Fairfield. From this data it may be concluded that at zoning saturation sources Study, 1975), used for public water supply. The rising nitrate levels have been attributed to nitrate from cess pools, septic tanks and lawn fertilizer and in some cases have risen near or above the 10 ppm federal standard for drinking water. The Huntington Study recommended that in areas served with water from private wells, development densities should be limited to one house (assumed occupancy 3.8 people) every 1.1-2.2 acres to protect sand aquifers from nitrate contamination. The higher density (1.1 acre/house) figure assumes a ban on nitrogen fertilizers.

The difference between Weston and Huntington in nitrate pickup by aquifers is due to a number of hydrological and geological factors. Weston's aquifers have soil which is less permeable and with a heavier vegetation cover, which prevents production of nitrate and nitrate leakage from the soil to the water stored in sand and gravel deposits below a depth of 4 feet. Moreover, Weston's aquifers transmit considerable quantities of water to surface streams, providing for a flushing action within the aquifer. In Huntington, runoff constitutes only 2.5% of total precipitation of 48 inches/year. Thus, nitrate contaminants stay within the aquifer and accumulate from year to year.

Weston's fortunate position with regard to stratified drift aquifer contamination by nitrate implies that more development can safely take place on the aquifers. Since only a small proportion of the aquifers are undeveloped, it would be safe to develop the small areas of remaining aquifer parcels at occasional local densities ranging up to two or three times the densities in the rest of town. This higher density is possible because of the excellent drainage conditions in these areas and because of the ability of the aquifer land units to retard nitrate contamination.

Water Softeners

In some areas of Connecticut, discharges of brine into septic tanks has resulted in contamination of wells. Although the practice is illegal according to the Connecticut State Health Code, it is still common practice. The widespread use of water softeners discharging brine into the ground in Weston could result in well contamination. This can be illustrated by a sample calculation shown below.

If we assumed that every house in Weston used five pounds of salt (sodium chloride) and 1200 gallons of water every three days (Renn, 1972), to regenerate water softeners, the resulting additions of sodium and chloride in septic effluent would be 196 ppm and 303 ppm respectively. Applying the townwide dilution factors (Table C) of 12-40 for septic waste, the resulting concentrations would be 5-16 ppm in sodium and 8-25 ppm in chloride. The State Health Department standard for sodium is 20 ppm; the recommended standard for chloride is 30 ppm and the maximum limit is 250 ppm. Considering the town background sodium levels of 4-8 ppm (Nexus Engineering, 1975) and normal septic effluent sodium content of 40-70 ppm (which is diluted to 1-6 ppm by groundwater), it can be concluded that additions of sodium from water softeners could cause well water to exceed the State standard.

In actuality there is unlikely to be a situation where there is universal use of water softeners. However, this calculation suggests the danger to water supplies when several houses with water softeners are in the same neighborhood.

Using Urban Hydrology Handbook (UHH) to do Sample Drainage Calculation for "Heavenly Lane" Subdivision (Ref. Manual, p. 51).

Procedure:

1. Soils are mapped in detail (see Manual, p. 51).
2. Areas occupied by soil type are calculated (Table F).
3. The average slope of watershed is determined. In this particular case the quadrant method is used. Over the site plan a square is drawn and divided into four equal subsquares (Figure 1).

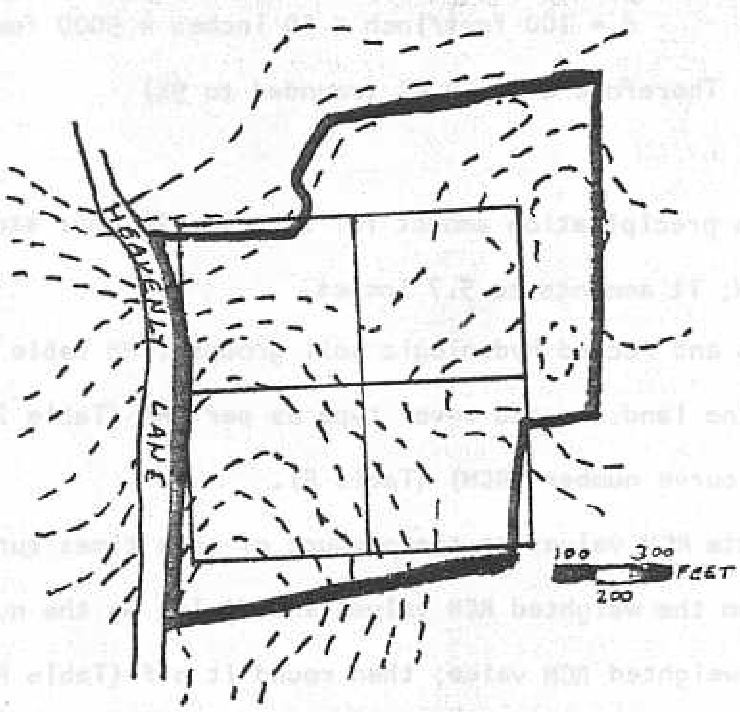

Figure 1. A grid constructed of six equal lines, total scaled length 5000 feet, is drawn on property. The contours cross the grid a total of 30 times.

Then the average slope is calculated by the following formula:

$$S = \frac{k \quad N \quad Z}{d}$$

Where

k = constant = 1.57
N = number of times the contour intervals cross the grid of four squares
Z = contour interval (feet)
d = scale of map X distance along grid (feet)
(feet/inch) = (inches)

For "Heavenly Lane"

N = 30
Z = 10 feet
d = 100 feet/inch X 50 inches = 5000 feet

Therefore S = 9.4% (rounded to 9%)

4. Look up precipitation amount for 25 year, 24 hour storm in Appendix C-3 UHH; it amounts to 5.7 inches.
5. Look up and record hydrologic soil groups (UHH Table B-1, Table F).
6. Determine land use and cover type as per UHH (Table 2.2 and determine runoff curve number (RCN) (Table F).
7. Calculate RCN values as the product of area times runoff curve number; sum the weighted RCN values and divide by the number of acres to get weighted RCN value; then round it off (Table F).
8. In Table 2-1 UHH using curve number RCN = 68 and rainfull = 5.7 inches (25 year storm) interpolate in table to get 2.40 inches for runoff depth.
9. In Figure D-2 UHH steep slope - greater than 8%) using RCN = 70 and area of 25 acres, get peak runoff of 30 cubic feet per second (30 cfs).

10. Measure longest length from source to watershed exit = 1350 feet. Enter 1350 feet in Figure E-1 UHH and get 22.5 acres for equivalent drainage area (EDA).

11. In Figure D-2, (UHH steep slope) using RCN = 68 and EDA = 22.5 acres, get 27 cfs for peak runoff; divide total area of watershed (25 acres) by EDA (22.5 acres) and multiply the quotient by the 27 cfs value to get 30 cfs for equivalent peak discharge per runoff inch (EPD).

12. In Table E-1 UHH using slope equals 9% and drainage area (DA) equals 25 acres, obtain slope adjustment factor of 0.90.

13. Determine area where ponding occurs in watershed to be 11 acres. Calculate the ratio of total area (25 acres) to the 11 acres ponded area to be 2.1. Since the ponding occurs in central parts of the watershed use Table E-3 to obtain factor of 0.50 (by extrapolation to a point off of table).

14. To get adjusted peak discharge take the product of runoff, the EPD, the slope adjustment factor and the ponding adjustment factor to obtain a value of 34.3 cfs. This value represents drainage in the natural condition.

15. To adjust natural drainage calculation for development calculate the areas of impervious surfaces to be created and develop a new listing of soils in the natural condition. To make this calculation, it was assumed that at a minimum 20% of the total lot areas would be covered by impervious surfaces, with a corresponding new RCN = 98. Then the above procedure is followed as before (Tables G, H).

Significance of the Drainage Calculation

According to the calculations the two acre subdivision on "Heavenly

Lane" would increase peak runoff rates by 60%; the 27% value for the one acre clustered subdivision represents a significant improvement.

The calculation did not take into account the extra channelization of flow which would occur under the two acre plan, since the main access road would require curbing. In the alternate plan the main access road lies in a gently sloping area along a wetland and the runoff can simply flow from the curbless road, and across the margin of the wetland and into the wetland. In this process the sediments can be filtered from the water and some of the water will be absorbed by the wetland margin.

In summary the alternate plan is far better ecologically than the original two acre subdivision. However, the picture could further be improved by the specification of porous paving such as crushed rock within the alternate plan and the provisions of drywells to receive runoff from driveways, roofs, sidewalks, etc.

SPECIAL RECOMMENDATIONS

Zoning Strategy for Development Density

Current Weston water quality data indicates that there was only slight mixing of septic tank effluent and well water. This fortunate circumstance can be explained by favorable geological conditions and low overall population density.

Weston's surface water shows slight contamination from the combination of septic effluent and storm runoff. However, the quality of surface water overall was quite satisfactory.

The overall satisfactory water supply (except for the area immediately surrounding the sanitary landfill) and surface water indicates that Weston is currently functioning within the limits of its ecological carrying capacity, under the prevailing private wells and septic tanks. However, since the remaining developable land is in the main ecologically sensitive - wetland linkage areas, shallow soiled areas, and steep areas, it is questionable whether environmental quality can be maintained in the face of the current development trend and technology.

It is our opinion that the present Zoning Ordinance for Weston is not the optimal vehicle for protecting environmental quality, as the town doubles its population. We believe that its effectiveness can be increased by the following measures:

1. Institute a comprehensive monitoring system which can record increases in well and surface water pollution in time to take corrective action in the form of land use and engineering controls.
2. Amend the present Zoning Ordinance to allow concentration of development where appropriate, to decrease density on ecologically sensitive areas, and to manage ecologically fragile areas to townwide advantage. This strategy can be favorably pursued by either of the following options:

Adaptive two-acre zoning

Within the framework of two-acre zoning, we recommend the following:

1. That the total permissable number of dwelling units be calculated by the acres of land being subdivided, divided by two.
2. That decreases in the size of lots be allowed in proportion to open space set aside up to a certain percentage, this to vary depending upon mapped soil and geolgoical conditions.

   a) Appropriate open space is wetlands, wetland linkage areas,

areas over 10% slope, areas identified on Protection Zones Map and areas of accessible community open space within the development itself.

b) In areas of deep (over 10 feet) and well drained soils, lot sizes could be reduced to one acre with the remaining 50% of the site being set as permanent open space. In other geological conditions - steep slopes, shallow soils, deep soils with fair drainage, up to 25% of the site could be set aside as open space and minimum lot size would be 1.5 acres.

Ecological Zoning

A proposal for ecological zoning for Weston is embodied in the Critical Units Map and the Protection Zones Map. Ecological Zoning limits development below the two acre level in Protection Zones, and assigns a development density according to capacities for water supply and waste disposal in undeveloped upland tracts.

Under ecological zoning, all designated protection zones are strictly managed so that development does not encroach upon their natural functions. We recommend that all the potential open space shown on the Critical Units Map be considered for recreational zoning: top priorities are the buffer strip surrounding the Saugatuck Reservoir, the possible wildfowl conservancy area between Langner Lane and Cannondale Road and the area around Lamazzo's gravel pit.

Large tracts of remaining undeveloped upland, would, under ecological zoning, be re-zoned according to the relative capacity of the land to treat septic effluent. Thus, zoning in these areas, shown on Critical Units Map, would be based on allowable gallons of septic effluent per acre per day, rather than dwelling units per acre. The recommended amounts are listed below and are based on present day technology of private wells and septic tanks:

1. Lands within watershed of the Saugatuck Reservoir - 270 gallons/acre/day.
2. Steep units - 270-400 gallons/acre/day.
3. Shallow soils; moderate slope, deep soils with fair drainage (ML-SM, SM soils) - 400 gallons/acre/day.
4. Moderate slope, deep, well drained (ML, GM soils) - 400-800 gallons/acre/day.
5. Special development district, i.e., along Godfrey Road - 800 or more gallons/acre/day depending upon ecological/engineering design.

It should be noted that the values listed above do not represent the ultimate limits of these areas, but are relative to present day knowledge and are set with ecological and engineering margins of safety. Upward or downward revisions of these values must be dependent upon the results of the town's monitoring system and evaluation of the performance of alternate technologies of water supply and septic waste disposal.

Management of Town Hydrology

1. Implement a zero-extra-runoff policy. The strongest possible support for this policy is the report by Bongiorno (1975) on the effect of storm drainage on Fairfield, Connecticut, rivers. In this report the ecologic and economic argument is brought together in a way that is most useful to the Commission. It indicates the probable course of events in Weston if urbanization proceeds to any great degree without a zero-extra-runoff policy and a policy of keeping development out of wetlands and flood

zones. This report is must reading.

2. Keep development out of flood-prone areas. Structures should be kept above the 100 year flood levels. Channelization measures used to protect flood prone structure cause ecological damage by destroying stream banks and increasing stream flow rates.
3. A Town Drainage Plan should be adopted to coordinate engineering alterations of the environment such as dams, culverts, storm sewers with the ecological goals set forth in the manual especially with the zero-extra-runoff goal.
4. Ponds should not be placed in such a way that they either singificantly limit downstream flow, or create a situation promoting flooding and bank erosion. However, occasional ponds should be encouraged for use as fire holes and for areas in which sediment from storm drainage can settle; it is crucial that such ponds be maintained.

Comprehensive File, Environmental Planning Officer

Environmental protection in Weston must have central direction. Top priority is the establishment of a comprehensive file, which encompasses the Manual and all supporting environmental data including data from regular town monitoring. Development applications and wetland activities would be processed with supporting materials drawn from this file.

We recommend that the services of a professional environmental planning officer be made available to Weston in coordination with the Aspetuck Valley Health District. The duties of the officer would be as follows:

1. Direct the environmental protection program in Weston.
2. Maintain comprehensive file and provide material needed for applications.

3. Appear at Town meetings as an environmental ombudsman.
4. Supervise percolation tests and inspect all well and septic installations.
5. Inspect grading and clearing of sites to insure compliance of contractor with ecological design criteria.
6. Administer Weston's environmental monitoring program.
7. Advise the town commissions and the general public on any matter relating to environmental impact of past and proposed development. He would be instrumental in generating local site criteria at all Preliminary Environmental Reviews.

The officer would need expertise in the fields of ecology, public health and engineering.

The Health Codes

Water softeners

We recommend that the town act to prevent the dumping of water softener brine into septic systems. The salts can migrate to water supplies creating a potentially severe health hazard.

Health standards for wells and septic tanks

The state health codes are by themselves adequate. However, problems occur in uniform interpretation of the code and in insuring satisfactory workmanship. Central supervision for testing of wells and septic systems and inspection of their installation is essential. This function could be performed by an Environmental Planning Officer.

Fill for septic systems

It would be highly desirable to limit the number of septic leach fields placed in fill. The amount of fill needed on shallow to ledge soils to insure adequate treatment of waste is presently in question. It is best to be conservative and require at least a four foot depth for filtration of the effluent (in addition to the two feet of soil covering the leaching surface).

Septic system monitoring

Presently, data on the performance of septic systems is scattered and incomplete. Systematic documentation of the performance of septic systems and their ecological impact must be performed under central direction for the Town.

TABLE A Hydrologic Overview

Sources: Bridgeport Hydraulic Precipitation Data: 1894-1971 (inclusive)

Ryder, *et al*., 1970. Fig. 22, p. 28. Holzer (1975)

	inches/year	gallons/acre/day
direct runoff	13.4	997
evapotranspiration	23.1	1719
groundwater recharge*	10.0	744
total mean annual precipitation	46.5	3460

*as measured by groundwater fed to streams as base flow.

TABLE B Data on 179 Bedrock Wells from Aspetuck Valley Health District

Flow (gal/min)	# wells	% wells
0-0.5	1	0.5
0.5-2.0	35	19.6
3.0-6.0	74	41.3
7.0-10.0	54	30.2
20.0+	15	8.4
	179	100.0

TABLE C Septic Effluent Dilution by Groundwater

	Townwide Scale	Site Scale
Groundwater recharge (A) (gal./acre/day)	744	744
Evapotranspiration (B) (gal./acre/day)	1719	1719
A + B (gal./acre/day)	2463	2463
Septic effluent (C) (gal./acre/day)	62*	400**
Minimum dilution factor (A/C)***	12	1.9
Maximum dilution *** factor (A + B)/C	40	6.2

*Assuming population = 8000 and 100 gal./capita/day water use

**Assuming 2 acre lots with four bedroom houses and 200 gal./bedroom/day water use.

***Factors will be approximately halved for the 30 year minimum precipitation levels.

TABLE D Nitrate Dilution in Weston: Theoretical Versus Observed

Nitrate-nitrogen values observed in Weston in study

deep wells	0.06-0.40 ppm
shallow wells	0.05-0.20
surface water	0.60-1.20
precipitation	0.4 ppm

Theoretical value in groundwater

1.9-4.5 ppm

TABLE E Nitrate Data for Weston, Connecticut and Fairfield, Connecticut. Surface Water Versus Population Density

	Nitrate-Nitrogen (ppm)	Population Density (people/acre)
Fairfield		
Rooster River	4.5	3.6
Mill River	1.2	1.2
Sasco Brook	1.1	0.4
Weston		
All surface water	0.6-1.2	0.63

WORK SHEET
Trial Form

U.S. DEPARTMENT OF AGRICULTURE
Soil Conservation Service

PEAK RATES OF DISCHARGE FROM SMALL WATERSHEDS

Landowner or
Cooperator ________ Sheet 1 of ________
Location HEAVENLY LA. Computed by ________ Date ________
SCD ________ Checked by ________ Date ________

LAND USE PRACTICE NATURAL CONDITION -- UNDEVELOPED

Rainfall Freq. 25 Yr. 24-hour Rainfall Amt. 5.7 in.
Drainage Area(DA) 25 Ac. Ave. Watershed Slope 9 %

Hydrologic Soil Group	Land Use	Treatment or Practice	Hydrologic Cond.	Runoff Curve No. (RCN)	Area Ac. or %	RCN Times Ac. or %
CHARLTON "B" 32	MEADOW			58	10.83	628.14
HOLLIS "C" 17C	MEADOW			71	5.34	379.14
LEICESTER RIDGEBURY "C" 43M	FOREST			77	7.03	541.31
FILL "C" M-2	FOREST			77	1.87	143.99
				Totals	25.07	1692.58

Weighted RCN = $\frac{1692.58}{25}$ = 67.7 Use 68

Runoff 2.40 in. Peak discharge per runoff inch 29 cfs/in

Adjustment Factors

Shape Watershed length 1350 ft. Equiv. DA (EDA) 22.5 Ac.
Equivalent peak per runoff inch (EDP) 27 x $\frac{25}{22.5}$ = 30.0

Slope Factor = 0.90

Ratio DA/Ponding and swampy area $\frac{25}{11}$ = 2.1 Factor = 0.50

Percent of impervious area ________ % Factor = ________

Hydraulic length; (channel) modification ____ Factor = ________

Adjusted peak Discharge (Q)

2.40 x 30.0 x 0.90 x 0.50 x ____ x ____ = 32.4 cfs

Note: Determine only those adjusted factors that are applicable. Final adjusted discharge is the peak flow to the design point, reservoir or reach.

TABLE F Drainage Worksheet 1: For Heavenly Lane in Natural, Undeveloped Condition

WORK SHEET
Trial Form

U.S. DEPARTMENT OF AGRICULTURE
Soil Conservation Service

PEAK RATES OF DISCHARGE FROM SMALL WATERSHEDS

Landowner or Cooperator ________ Sheet 2 of ____
Location HEAVENLY LA. Computed by ________ Date ____
SCD ________ Checked by ________ Date ____

LAND USE PRACTICE DEVELOPED (TWO ACRE LOTS)

Rainfall Freq. 25 Yr. 24-hour Rainfall Amt. 5.7 in.
Drainage Area(DA) 25 Ac. Ave. Watershed Slope 9 %

Hydro-logic Soil Group	Land Use	Treatment or Practice	Hydro-logic Cond.	Runoff Curve No. (RCN)	Area Ac. or %	RCN Times Ac. or %
CHARLTON "B" 32	MEADOW			58	7.29	422.8
HOLLIS "C" 17C	MEADOW			71	4.00	284.0
LEICESTER RIDGEBURY "C" 43M	FOREST			77	6.63	510.5
FILL "C" M-2	FOREST			77	1.37	105.5
- - - -	- - - -	PAVED ACCESS ROAD	- - - -	98	1.37	134.3
- - - -	- - - -	11 LOTS, 20% IMPERM.	- - - -	98	4.40	431.2
				Totals		1888.3

Weighted RCN = $\frac{1888.3}{25}$ = 75.5 Use 75

Runoff 3.51 in. Peak discharge per runoff inch 22.5 cfs/in

Adjustment Factors

Shape Watershed length 1350 ft. Equiv. DA (EDA) 22.5 Ac.
Equivalent peak per runoff inch (EDP) 29.5 x $\frac{25}{22.5}$ = 32.8

Slope Factor = 0.9

Ratio DA/Ponding and swampy area $\frac{25}{11}$ = 2.1 Factor = 0.5

Percent of impervious area ____ % Factor = ____

Hydraulic length; (channel) modification ____ Factor = ____

Adjusted peak Discharge (Q)

3.51 x 32.8 x 0.9 x 0.5 x ____ x ____ = 51.8 cfs

Note: Determine only those adjusted factors that are applicable. Final adjusted discharge is the peak flow to the design point, reservoir or reach.

change = +60%

TABLE H Drainage Worksheet 3: For Heavenly Lane with an Alternate, Clustered Subdivision

WORK SHEET
Trial Form

U.S. DEPARTMENT OF AGRICULTURE
Soil Conservation Service

PEAK RATES OF DISCHARGE FROM SMALL WATERSHEDS

Landowner or Cooperator ______ Sheet 3 of ______
Location HEAVENLY LA Computed by ______ Date ______
SCD ______ Checked by ______ Date ______

LAND USE PRACTICE ALTERNATE PLAN (1-ACRE, CLUSTERED)

Rainfall Freq. 25 Yr. 24-hour Rainfall Amt. 5.7 in.
Drainage Area(DA) 25 Ac. Ave. Watershed Slope 9 %

Hydrologic Soil Group	Land Use	Treatment or Practice	Hydrologic Cond.	Runoff Curve No. (RCN)	Area Ac. or %	RCN Times Ac. or %
CHARLTON "B" 32	MEADOW			58	8.51	493.6
HOLLIS "C" 17C	MEADOW			71	4.42	313.8
LEICESTER RIDGEBURY "C" 43M	FOREST			77	7.03	541.3
FILL "C" M-2	FOREST			77	1.74	134.0
- - -	- - -	PAVED ACCESS ROAD	- - -	98	1.17	114.7
		11 LOTS, 20% IMPERM.		98	2.20	215.6
			Totals		25.07	1813.0

Weighted RCN = $\frac{1813.0}{25}$ = 72.5 Use 73

Runoff 2.84 in. Peak discharge per runoff inch 32 cfs/in

Adjustment Factors

Shape Watershed length 1350 ft. Equiv. DA (EDA) 22.5 Ac.
Equivalent peak per runoff inch (EDP) 29 x $\frac{25.0}{22.5}$ = 32.2

Slope Factor = 0.9

Ratio DA/Ponding and swampy area $\frac{25}{11}$ = 2.1 Factor = 0.5

Percent of impervious area ______ % Factor = ______

Hydraulic length; (channel) modification ___ Factor = ______

Adjusted peak Discharge (Q)

2.84 x 32.2 x 0.9 x 0.5 x ____ x ____ = 41.2 cfs

Note: Determine only those adjusted factors that are applicable. Final adjusted discharge is the peak flow to the design point, reservoir or reach.

change = + 27%

TABLE G Drainage Worksheet 2: For Heavenly Lane with a Conventional, Two-Acre Subdivision