Appenedix A

Fee Schedule

Zoning

• Copy of Regulations	$ 20.00
• Copy of Lyme Plan of Conservation and Development	10.00
• Zoning Permit (valid for 1 year)	25.00
• Zoning Permit Renewal	10.00
• Sign Permit	25.00
• Home Occupation Permit	50.00
• Certificate of Zoning Compliance	25.00
• Site Plan Review	50.00
• Coastal Site Plan Review	50.00
• Erosion and Sedimentation Plan	50.00
• Flood Hazard Review	50.00
• Commercial Cutting Plan	40.00
• Commercial Development Plan	50.00
• Special Permit	300.00
• Special Permit Amendment	150.00
• Earth Material Operation (valid for 2 years)	500.00
• Earth Material Operation Renewal (valid for 2 years)	250.00
• Application for Regulation Change	300.00
• Application for Zone Change	300.00

Subdivision

• Basic Fee 1-4 Lots	200.00
• Over 4 Lots (add per lot)	50.00
• If Subdivision Includes Public Improvements i.e. roads, drainage, easements, etc. (per lot)	100.00
• Subdivision Coastal Site Plan Review (per lot)	50.00
• Flood Hazard Review (per lot)	50.00
• Subdivision Plan Amendment	50.00
• Inspection for Improvements per Section 3.15.1	1,000.00

Resubdivision

• Basic Fee 1-4 Lots	400.00
• Over 4 Lots (add per lot)	100.00
• If Resubdivision Includes Public Improvements i.e. roads, drainage, easements, etc. (per lot)	100.00
• Resubdivision Coastal Site Plan Review (per lot)	50.00
• Flood Hazard Review (per lot)	50.00
• Resubdivision Plan Amendment	50.00

Zoning Board of Appeals

• Variance	200.00
• Appeal of Order	150.00

The fee shall be paid at the time of application and is non-refundable. As provided for by Public Act 04-144, effective May 21, 2004, an additional $30.00 State fee will be collected for all Zoning, Zoning Board of Appeals and Subdivision / Resubdivision applications.

The applicant shall pay a fee equal to the Town's expenditures in hiring outside consultants to review any land-use applications. The fees will be determined by the Town through obtaining an estimate from its consultants based on the nature of the application and application submittal and multiply that fee by 1.5. The applicant shall make a payment to the town prior to the Land Use Commission holding a public hearing for said application within five (5) business days of receiving notice of the amount due. If the Town expenditure exceeds the estimate, the applicant shall submit additional funds within five (5) business days of receiving notice from the Town. Any fees remaining after the completion of the application review will be returned to the applicant.

The applicant shall pay an inspection fee of eight (8%) percent for the cost of the improvements made to the property relating to the site work including drainage, erosion and sediment controls, pavement, landscaping, and any other required inspection to ensure construction is in compliance with Town Standards. The applicant shall make a payment to the Town prior to the Land Use Commission holding a public hearing for said application within five (5) business days of receiving notice of the amount due. If the Town expenditure exceeds the estimate, the applicant shall submit additional funds within five (5) business days of receiving notice from the Town.

Fee Waivers

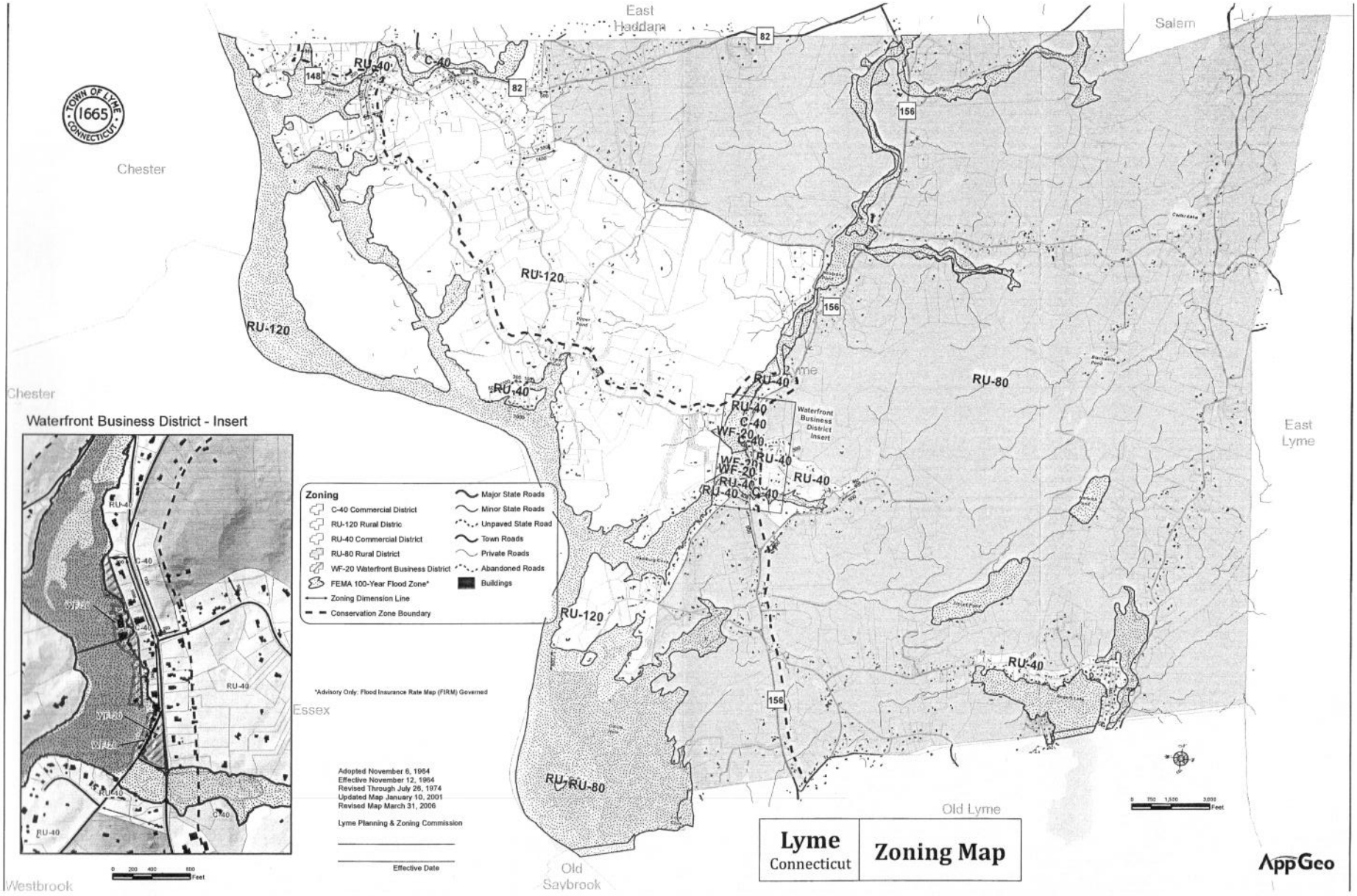
- All fees shall be waived when the Town of Lyme is the applicant or petitioner.
- All or part of the fee may be waived when the applicant or petitioner is a non-profit or charitable organization operating within the Town of Lyme for the benefit of the residents of the town.

Fee Credits

- The board or commission receiving the application or petition may, in its sole discretion, credit prior fees paid to it if the prior fee was paid for an application or petition previously filed by the applicant or petitioner, which was withdrawn prior to board or commission action.
- The amount of the fee to be credited shall be limited to the amount previously paid less any expenses incurred by the board or commission in connection with a prior application or petition.

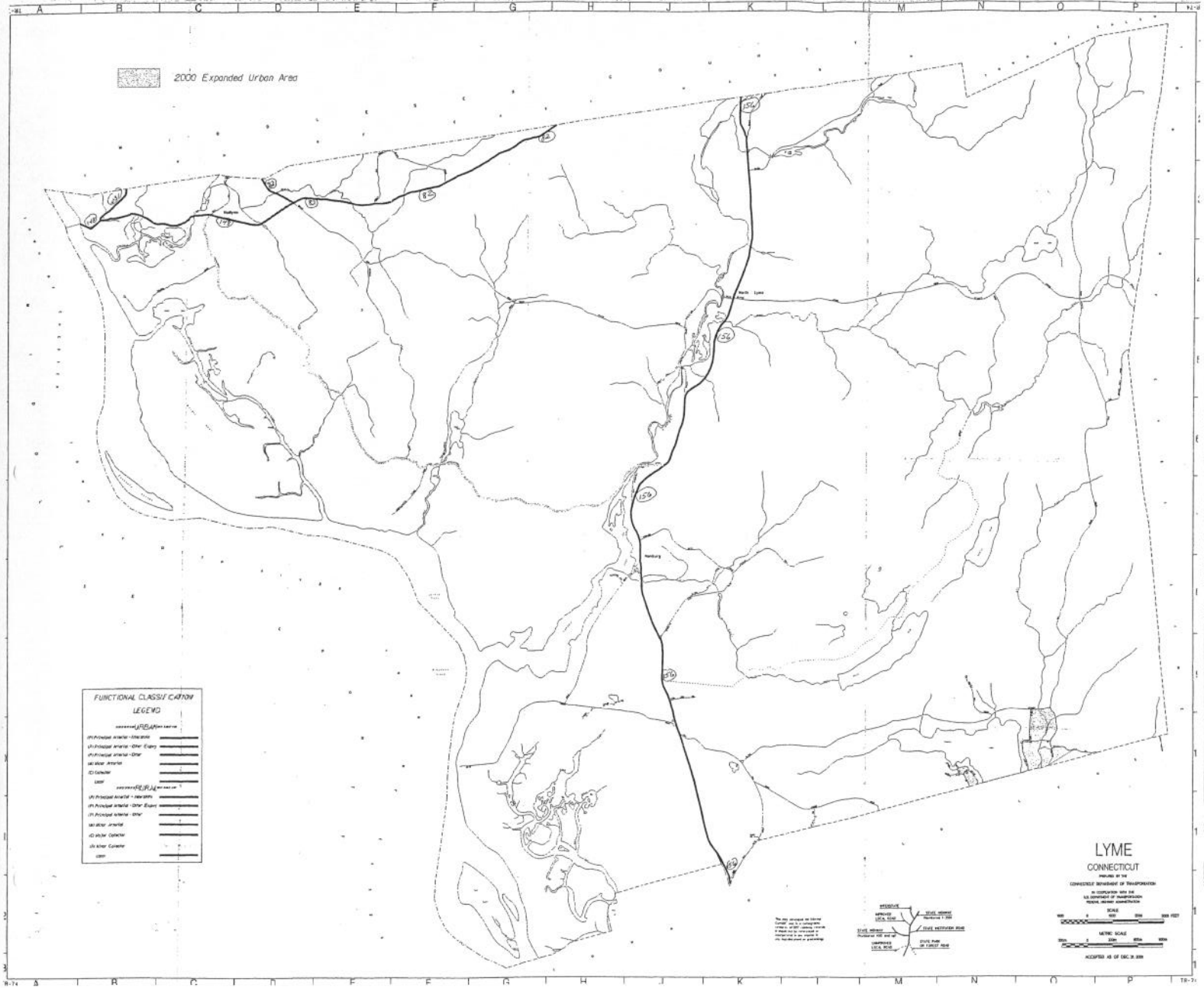
Appendix B

Zoning Map


TOWN OF LYME
1665
CONNECTICUT
Chester
East Haddam
Salem
East Lyme
Old Lyme
Old Saybrook
Westbrook
Essex
Lyme
RU-120
RU-40
C-40
RU-80
WF-20
Waterfront Business District - Insert
Waterfront Business District Insert
Zoning
C-40 Commercial District
RU-120 Rural Distric
RU-40 Commercial District
RU-80 Rural District
WF-20 Waterfront Business District
FEMA 100-Year Flood Zone*
Zoning Dimension Line
Conservation Zone Boundary
Major State Roads
Minor State Roads
Unpaved State Road
Town Roads
Private Roads
Abandoned Roads
Buildings
*Advisory Only: Flood Insurance Rate Map (FIRM) Governed
Adopted November 6, 1964
Effective November 12, 1964
Revised Through July 26, 1974
Updated Map January 10, 2001
Revised Map March 31, 2006
Lyme Planning & Zoning Commission
Effective Date
Feet
Lyme
Connecticut
Zoning Map
AppGeo

Appendix C

Lyme Road Map


2000 Expanded Urban Area
FUNCTIONAL CLASSIFICATION
LEGEND
URBAN
RURAL
LYME
CONNECTICUT
PREPARED BY THE
CONNECTICUT DEPARTMENT OF TRANSPORTATION
IN COOPERATION WITH THE
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION
SCALE
METRIC SCALE
ACCEPTED AS OF DEC. 31, 2000

Appendix D

Application Material

APPLICATION FOR ZONING PERMIT
PLANNING & ZONING COMMISSION
TOWN OF LYME, CONNECTICUT

PERMIT #:_____

NOTE: PROPERTY TAXES MUST BE PAID IN FULL BEFORE A PERMIT IS ISSUED.

Assessor's Map#: _____ Lot#: _____ Zoning District:_____

APPLICANT:_____ DATE:_____

PROPERTY ADDRESS: _____ TEL #:_____

OWNER: _____ CELL#:_____

MAILING ADDRESS: _____

The undersigned hereby makes application for a ZONING PERMIT under the Zoning Regulations of the Town of Lyme, Connecticut.
Application is made for the following:

- ☐ Proposed new building or structure and use thereof
- ☐ Change of use of existing building or structure
- ☐ Modification of existing building or structure and use thereof
- ☐ Home Occupation
- ☐ Other _____
- ☐ Accessory Apartment
- ☐ Timber Harvest
- ☐ Sign Permit
- ☐ Bed and Breakfast

List All Existing Easements: _____

_____

_____

Description of Proposal: _____

_____

PROPERTY LOCATED WITHIN:

	YES	NO		YES	NO
Conservation Zone:	☐	☐	Coastal Zone:	☐	☐
Flood Plain District:	☐	☐	Inland Wetland Zone	☐	☐

Comments: _____

_____

Date:_____ Signed:_____

Application Fee: $_____ Paid by Cash ☐ Paid by Check ☐ Check #_____

O APPROVED O DENIED _____

_____

_____

_____

_____

Date: _____ *Zoning Enforcement Officer*

INSTRUCTIONS AND PROCEDURES FOR APPLICATION TO LYME ZONING BOARD OF APPEALS

The Lyme Zoning Board of Appeals hears appeals for the following reasons:

(1) The Zoning Enforcement Officer or the building official cannot issue a permit because of a violation of the Lyme Zoning Regulations.
(2) A special permit is required by the Lyme Zoning Regulations.
(3) The issuance of a permit by the Zoning Enforcement Officer or the building official is appealed.

Regular meetings of the ZBA are held on the third Thursday of each month at 7:30 p.m. at the Town Hall or such other time or place as the Chairman or Acting Chairman of the Board may from time to time determine.

Applications shall be filed at the Lyme Town Hall with the Town Clerk or Zoning Enforcement Officer between 9:00 a.m. and 4:00 p.m. weekdays and shall be signed by the applicant or his agent. The applicant is also responsible for notification to all property owners within 150 feet by certified return receipt mail. All pertinent questions on the application must be answered and all information required by the form to be given shall be concisely stated. Additional statements may be added on separate sheets, if required.

The original plus five copies of the application shall be accompanied with six copies of a plot plan. Plot plans must be legible, in detail, but need not be done by a licensed engineer or surveyor. Six sets of building plans if a new or existing building, addition or alteration to a building are involved, and with the filing fee of $_____. Checks should be made out to the Town of Lyme. Four sets of plans will be returned to the applicant at his request, after the Board's decision.

Plot plans shall be drawn to scale, accurately showing lot dimensions, area yard dimensions, location and size of all existing and proposed buildings on the property, the existing and intended uses of each building or part of a building, the number of families or housekeeping units the buildings are designed to accommodate, and such other information as may be necessary to clearly define the questions involved. All dimensions and areas shown on plot plans relating to the location of buildings and structures on the lot and the location and size of the lot shall be based if possible on an actual survey by a duly licensed civil engineer or surveyor. Also, please indicate location of water supply and septic system. If topographical conditions are claimed as hardship, applications shall be accompanied with photos or topo survey showing same.

- The final date for filing applications shall be <u>no later</u> than the third Thursday of the preceding month.
- The appeal will then be heard at the next scheduled meeting. Applicant or his agent must be present at the meeting.
- On an application for a re-hearing, the applicant must allege new facts and prove same at the hearing.
- The Board, in its discretion, may dismiss an appeal (without prejudice) for failure to comply with any of the foregoing rules.
- Any waiver of the above requirements must be approved by the Board's Chairman or his authorized representative prior to the application.
- If assistance is needed in filing, please contact the Chairman, Lyme Zoning Board of Appeals.

APPEAL
THE ZONING BOARD OF APPEALS
LYME, CONNECTICUT

1. I (we) hereby appeal to the Lyme Zoning Board of Appeals from the decision of the Zoning Enforcement Officer or the Building Official for a variance ( ) or exception ( ) or other _____ to:

☐ use ☐ land only For use as ☐ ____ family residence

☐ erect ☐ structure or building ☐ accessory building

☐ alter ☐ commercial

☐ add to

☐ occupy

2. LOCATION of affected premises: Map No. ____ Lot No.____ Page No. _____Vol. No. _____

Title of Subdivision Map (if any) _____ Located on the

_____side of _____ street _____feet distance from the

intersection of _____ with _____.

Zone: RU 40 ☐ RU 80 ☐ RU 120 ☐ C 40 ☐ WF 20 ☐

OWNER:_____ MAILING ADDRESS_____

APPLICANT: _____ MAILING ADDRESS_____

3. THIS APPEAL relates to ☐ use ☐ area ☐ yard dimensions ☐ height

☐ number of family units ☐ street frontage ☐ Other

Describe briefly _____

_____

_____

_____

4. VARIANCE of the following sections of the Lyme Zoning Regulations is requested

(Please specify in detail)_____

_____

_____

(a) Strict application of the regulations would produce UNDUE HADSHIP because:

_____

_____

_____

(b) The hardship created is UNIQUE and not shared by all properties alike in the neighborhood because:

_____

_____

_____

(c) The variance would not change the CHARACTER of the neighborhood because:

_____

_____

_____

5. The denial of Issuance of Permit No._____ for the above named premises by the Zoning Officer is APPEALED because:

_____

_____

6. Certified mail notification is required(return receipt requested) of ALL OWNERS whose property is within 150 feet of any portion of subject property and is to be provided on an attached list to include: Name, Mailing address, Tax Map Number, Lot Number.

The applicant may add other related material.

I (we) certify to the best of my (our) knowledge the above information is correct and complete.

Date Filed: _____ Signed: _____

_____

APPLICATION: ☐ **APPROVED** ☐ **DENIED** **DATE:** _____

GUIDELINES FOR APPLICANTS

Applicants should check one or more blocks as applicable. If the applicant is acting for another party or parties the applicant's name should appear after "Application is hereby made by" and the name or names of the party or parties represented should appear after "for"

For applications for Subdivision approval, all subdivisions are deemed to be regular unless paragraph 3.7 of the Lyme Subdivision regulations applies.

For applications for Resubdivision, see paragraph 2.1.14 of the Lyme Subdivision regulations and/or Title 1, Chapter 126, Section 8-18 of The Connecticut General Statutes for the definition of Resubdivision.

For applications for a special exception Section 17. of the Lyme Zoning Regulations, list the special exception being sought on the application.

For applications for municipal improvements, This applies only to Town of Lyme activities. In this case Title 1, chapter 126, section 8-24 of The Connecticut General Statutes applies

For applications for regulations changes the Commission will require that a clear, concise, written description of the change accompany the application.

For applications for Coastal Site Plan Review, A CAM Model Application for Review of Coastal Site Plans must accompany the application.

Application may be made by mailing the application to the Chairman, Agent or Secretary of the Commission or may be made in person at any meeting of the Commission. Regular meetings are held the second Monday of each month in the Town Hall conference room starting at **7:30 pm** except when that Monday falls on a legal holiday in which case the meeting will be held on the Tuesday following the holiday.

TOWN OF LYME

PLANNING AND ZONING

COMMISSION

APPLICATIONS

FOR:

1._____ Subdivision Approval (a) _____ Regular (b) _____ Exception

2._____ Resubdivision Approval

(a)_____Subdivision Amendment

3._____ Special Exception. Brief Description of Special Exception

_____

_____

4._____ Municipal Improvement. Brief Description of Municipal Improvement:

_____

_____

5._____ Regulations revision

(a) _____ Plan of Development
(b) _____ Zoning Regulations
(c) _____ Subdivision Regulations

6._____ Coastal Site Plan Review

7._____ Other _____

Application is hereby made by _____

for _____

on this ____ day of _____, _____.
(month) (year)

Received by Planning and Zoning Commission on this _____ day of

_____, _____ by _____, _____.
(month) (year)

SUBDIVISION APPROVAL PROCESS

Phase 1 Detail--Testing and Preliminary Plans

1. Preliminary Discussion with:

   Zoning Enforcement Office, P & C Chairman, Sanitarian, Inland-Wetlands Commission agent, and the Building Inspector

2. Wetlands Delineation (Applicant pays cost:engineer or soil scientis

3. Test Data for Subsurface Sewage Disposal

   (State Department of Health Services, on-site sewage disposal system with Design Flows of 5,000 gal. per day or less and non-discharging toilet systems--Section 19-13-B103a through 19-13-B103f)

   a. Obtain engineer to delineate preliminary lot layout
   b. Obtain engineer to formulate detailed cost estimates
   c. Obtain engineer to conduct deep hole and perc tests (Applicant hires back hoe operator)
   d. coordinate testing with Town Sanitarian
   e. Sanitarian issues Report
      Engineered systems may be required
      State Department of Health may be required

4. Engineer produces plan which complies with town Subdivision Regulations and Inland-Wetland Regulations

Phase 2 Detail--Formulation of Preliminary Subdivision Plans

1. Presentation of Plans to affected town agencies e.g. Inland-Wetlands, P & Z
2. Formal application to affected town agencies/public hearings held

Phase 3 Detail--Final Subdivision Plans

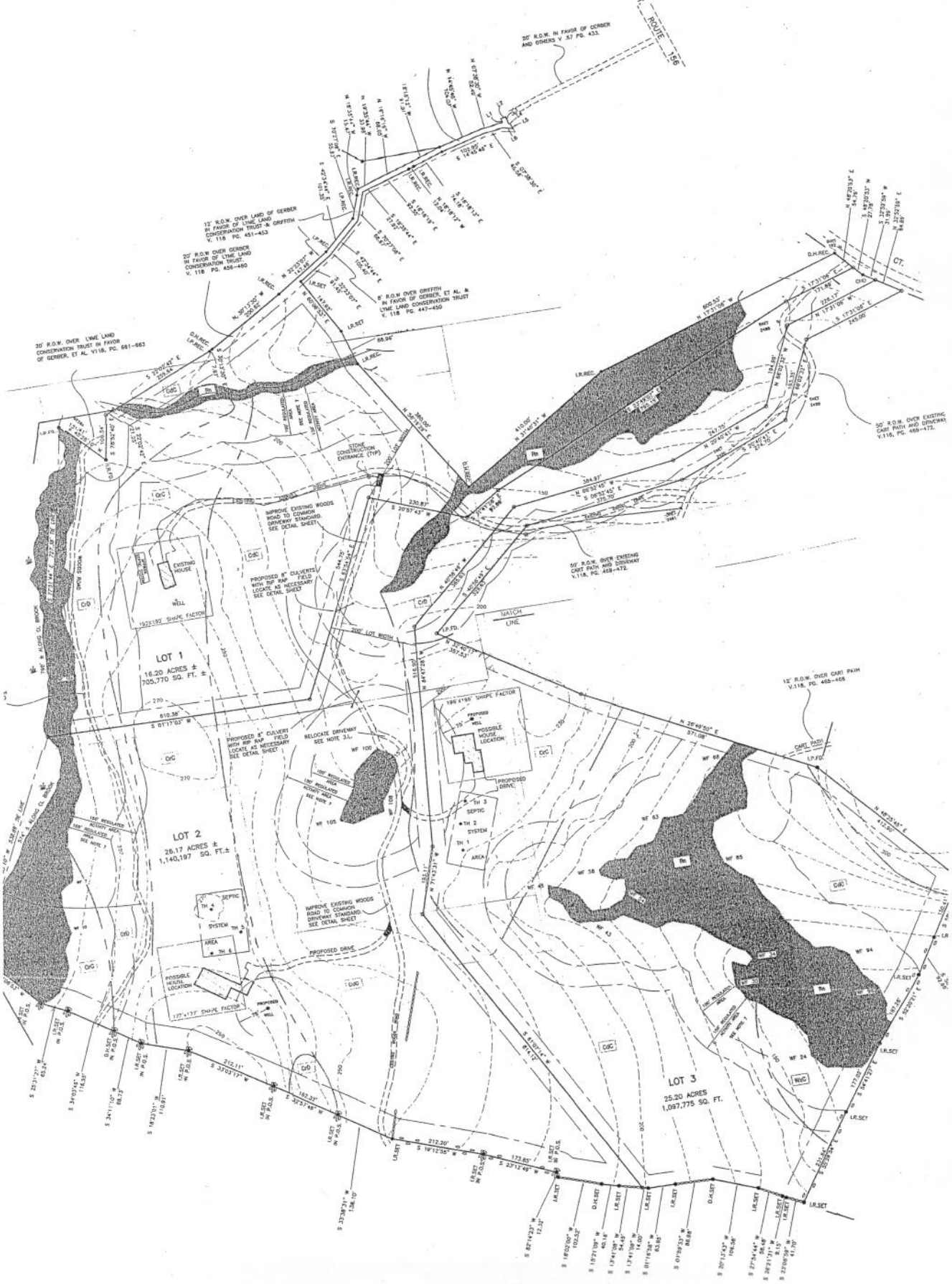
Formulate final plans to comply with P & Z and Inland-Wetlands reviews.

Presentation of legal documents and/or bond if required

Appendix E

Determination of Net Buildable Lot Area

Example


ROUTE 156
CT.
20' R.O.W. IN FAVOR OF GERBER AND OTHERS V. 57 PG. 433.
12' R.O.W. OVER LAND OF GERBER IN FAVOR OF LYME LAND CONSERVATION TRUST & GRIFFITH V. 118 PG. 451-453
20' R.O.W OVER GERBER IN FAVOR OF LYME LAND CONSERVATION TRUST. V. 118 PG. 456-460
8' R.O.W OVER GRIFFITH IN FAVOR OF GERBER, ET AL. & LYME LAND CONSERVATION TRUST V. 118 PG. 447-450
20' R.O.W. OVER LYME LAND CONSERVATION TRUST IN FAVOR OF GERBER, ET AL. V118, PG. 661-663
50' R.O.W. OVER EXISTING CART PATH AND DRIVEWAY V.118, PG. 469-472.
15' R.O.W. OVER CART PATH V.118, PG. 465-468
STONE CONSTRUCTION ENTRANCE (TYP)
IMPROVE EXISTING WOODS ROAD TO COMMON DRIVEWAY STANDARD. SEE DETAIL SHEET.
PROPOSED 8" CULVERTS WITH RIP RAP FIELD LOCATE AS NECESSARY SEE DETAIL SHEET
EXISTING HOUSE
WELL
192'x192' SHAPE FACTOR
MATCH LINE
200' LOT WIDTH
LOT 1
16.20 ACRES ±
705,770 SQ. FT. ±
PROPOSED 8" CULVERT WITH RIP RAP FIELD LOCATE AS NECESSARY SEE DETAIL SHEET
RELOCATE DRIVEWAY SEE NOTE 3.L.
196'x196' SHAPE FACTOR
PROPOSED WELL
POSSIBLE HOUSE LOCATION
PROPOSED DRIVE
SEPTIC SYSTEM AREA
TH 1
TH 2
TH 3
LOT 2
26.17 ACRES ±
1,140,197 SQ. FT.±
SEPTIC SYSTEM AREA
TH 4
TH 5
TH 6
IMPROVE EXISTING WOODS ROAD TO COMMON DRIVEWAY STANDARD. SEE DETAIL SHEET
PROPOSED DRIVE
POSSIBLE HOUSE LOCATION
177'x177' SHAPE FACTOR
LOT 3
25.20 ACRES
1,097,775 SQ. FT.

APPENDIX E
DETERMINATION OF NET BUILDABLE LOT AREA
EXAMPLES

Soil determination is made from Soil Potential Ratings Septic Tank Absorption Fields for Single Family Residences New London County, Connecticut.

LOT #1

Shape Factor/Net Buildable Lot Area
Note: Due to large lot size and past experience in computing shape factor/net buildable lot area, scaling of soil areas is acceptable in determining shape factor otherwise actual surveyed measurements shall be used.

1. **Soils**	**Resource Characteristic** *(per section 20)*	**Area**
CdC	100%	196,500 sq. ft.
CrC	75%	130,000 sq. ft.
CrD	50%	
WzC	50%	
Rn & wetland setback	0%	260,000 sq. ft.
Net Buildable Area Provided		586,500 sq. ft.

2. Weighted Resource Characteristic

$$\frac{196{,}500 \times 1.0}{586{,}500} + \frac{130{,}000 \times 0.75}{586{,}000} + 0 =$$

$$(0.34) + (0.17) = 0.51$$

3. Net Buildable Area = 28,000 divided by 0.51 = 54,902 sq. ft. (exceeds minimum required)

4. Shape Factor = $\frac{0.67 \times 28{,}000}{0.51}$ = 36,785 sq, ft.

(192' x 192')
(136' x 278')

LOT 2

Shape Factor/Net Buildable Lot Area

Note: Due to large lot size and past experience in computing shape factor/net buildable lot area, scaling of soil areas is acceptable in determining shape factor.

1.. Soils	Resource Characteristic	Area	
CdC	100%	385,000 sq. ft.	
CrC	75%	176,000 sq. ft.	(SEE MAP 2)
CrD	50%	48,000 sq. ft.	
WzC	50%		
Rn &w/in 100'	0%	255,000 sq. ft.	
Net Buildable Area Provided		864,000 sq. ft.	

2. Weighted Resource Characteristic

$$\frac{385{,}000}{864{,}000} \times 1.0 + \frac{176{,}000}{864{,}000} \times 0.75 + \frac{48{,}000}{864{,}000} \times 0.5 + 0 =$$

$$(0.45) + (0.15) + (0.03) = 0.63$$

3. Net Buildable Area = 28,000 divided by 0.63 = 44,444 sq. ft. (exceeds minimum required)

4. Shape Factor = $\frac{0.67 \times 28{,}000}{0.63}$ = 29,777 sq, ft.

(172.5' x 172.5')
(122' x 244')

LOT 3

Shape Factor/Net Buildable Lot Area

Note: Due to large lot size and past experience in computing shape factor/net buildable lot area, scaling of soil areas is acceptable in determining shape factor.

1.. Soils	Resource Characteristic	Area	
CdC	100%	325,250 sq. ft.	
CrC	75%	210,000 sq. ft.	(SEE MAP 3)
CrD	50%	37,000 sq. ft.	
WzC	50%		
Rn &w/in 100'	0%	400,000 sq. ft.	
Net Buildable Area Provided		972,250 sq. ft.	

2. Weighted Resource Characteristic

$$\frac{325{,}250 \times 1.0}{972{,}259} + \frac{210{,}000 \times 0.75}{972{,}259} + \frac{37{,}000 \times 0.5}{972{,}259} + 0 =$$

$$(0.33) + (0.16) + (0.02) = 0.51$$

3. Net Buildable Area = 28,000 divided by 0.51 = 54,902 sq. ft. (exceeds minimum requirement)

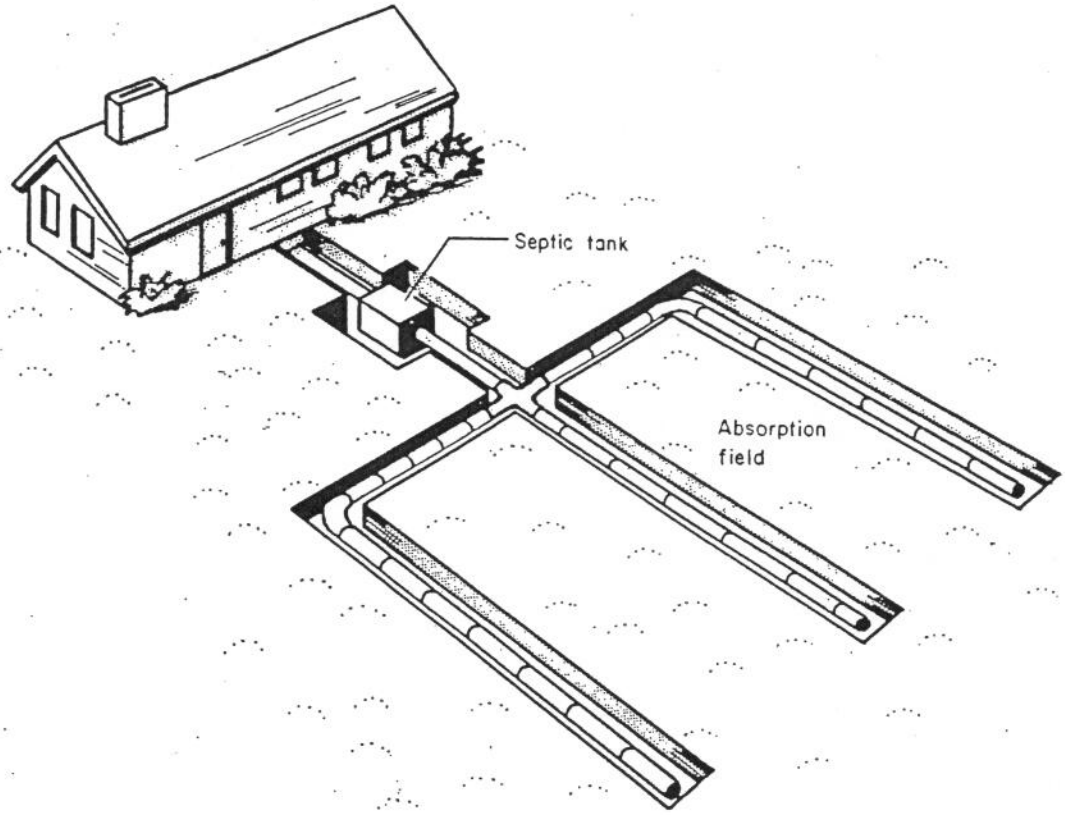
4. Shape Factor = $\frac{0.67 \times 28{,}000}{0.51}$ = 36,784 sq, ft.

(191.5' x 191.5')
(135.5' x 271')

SOIL POTENTIAL RATINGS

SEPTIC TANK ABSORPTION FIELDS FOR SINGLE FAMILY RESIDENCES

NEW LONDON COUNTY, CONNECTICUT



New London County Soil and Water Conservation District

1986

NEW LONDON

North Lyme
Beaver
EIGHMILE
Nickerson Hill
GERBER
1" = 1000
Rn - VERY LOW (0%)
WzC - LOW (10%)
CrD - VERY LOW TO HIGH
CrC - MEDIUM (15%)
CdC - VERY HIGH (100%)

TABLE 1
(continued)

SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS BY MAP UNIT
NEW LONDON COUNTY, CONNECTICUT

MAP SYMBOL	MAP UNIT NAME	POTENTIAL RATING	CONCERNS	CORRECTIVE MEASURES	ADDITIONAL CONSIDERATIONS	STATE REGULATIONS
Ts	- Tisbury silt loam	LOW	Fast perc rate, depth to water table.	Fill. Double separating distance between wells and leach fields.		1
Ub	- Udorthents-Pits complex, gravelly	NOT RATED				
Ud	- Udorthents-Urban land complex					
Ur	- Urban land					
W	- Water					
Wd	- Walpole sandy loam	VERY LOW**	Fast perc rate, depth to water table.	Curtain drain and fill. Double separating distance between wells and absorption field.	Access to drainage outlet.	2,3,4
We	- Westbrook mucky peat	EXTREMELY LOW	Organic soils, depth to water table, flooding (tidal).		Tidal flooding. No drainage outlet.	2,3,4
Wh	- Westbrook mucky peat, low salt					
WvA	- Windsor loamy sand, 0-3% slopes	HIGH	Fast perc rate.	Double separating distance between wells and absorption field.		1
WvB	- Windsor loamy sand, 3-8% slopes					
WxA	- Woodbridge fine sandy loam, 0-3% slopes	LOW	Slow perc rate, depth to water table.	Fill, curtain drain and drainage swale. Design absorption field to distribute effluent over a larger area.	Access to drainage outlet.	1; possibly 2 depending on perc rate measured on-site.
WxB	- Woodbridge fine sandy loam, 3-8% slopes					
WxC	- Woodbridge fine sandy loam, 8-15% slopes					
WyB	- Woodbridge very stony fine sandy loam, 0-8% slopes					
WyC	- Woodbridge very stony fine sandy loam, 8-15% slopes					
WzA	- Woodbridge and Rainbow extremely stony soils 0-3% slopes					
WzC	- Woodbridge and Rainbow extremely stony soils, 3-15% slopes					

**The rating assumes that the water table is the naturally occurring soil can be drained to a depth of 18 inches or more.

1 Identified as an area of special concern by state regulations - engineer's design required.
2 Identified as unsuitable in its natural condition by state regulations - an engineer's evaluation is needed to determine whether an absorption field can be built.
3 Identified as inland wetlands or tidal wetlands by state regulations. Local, state, and/or federal wetland permits may be required.
4 A permit to install an absorption field cannot be issued if the site cannot be drained. A permit cannot be issued if the groundwater level is less than 18 inches below the soil surface for one month or longer.

TABLE 1
(continued)

SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS BY MAP UNIT
NEW LONDON COUNTY, CONNECTICUT

MAP SYMBOL	MAP UNIT NAME	POTENTIAL RATING	CONCERNS	CORRECTIVE MEASURES	ADDITIONAL CONSIDERATIONS	STATE REGULATIONS
RaA	- Rainbow silt loam, 0-3% slopes	LOW	Slow perc rate, depth to water table.	Fill, curtain drain and drainage swale. Design absorption field to distribute effluent over a larger area.	Access to drainage outlet.	1; possibly 2 depending on perc rate measured on-site.
RaB	- Rainbow silt loam, 3-8% slopes					
RbB	- Rainbow very stony silt loam, 0-8% slopes					
Rc	- Raypol silt loam	VERY LOW**	Fast perc rate, depth to water table.	Curtain drain and fill. Double separating distance between wells and absorption field.	Access to drainage outlet.	2,3,4
Rd	- Ridgebury fine sandy loam	VERY LOW**	Depth to water table.	Curtain drain and fill.	Access to drainage outlet.	2,3,4
Rn	- Ridgebury, Leicester, and extremely stony fine sandy loams	EXTREMELY LOW	Fast perc rate, depth to water table, flooding.		Drainage needed. Access to drainage outlet unlikely.	2,3,4
Ro	- Rippowam fine sandy loam	EXTREMELY LOW	Depth to bedrock, slope.			5
Rp	- Rock outcrop-Hollis complex	EXTREMELY LOW	Fast perc rate, depth to water table.		Drainage needed. Access to drainage outlet unlikely.	2,3,4
Sf	- Scarboro mucky fine sandy loam	LOW	Fast perc rate, depth to water table.	Fill. Double separating distance between wells and leach fields.		1
Sg	- Sudbury sandy loam	LOW	Depth to water table.	Fill, curtain drain and drainage swale.	Access to drainage outlet.	1
SvA	- Sutton fine sandy loam, 0-3% slopes					
SvB	- Sutton fine sandy loam, 3-8% slopes					
SwB	- Sutton very stony fine loam, 0-8% slopes					
SxB	- Sutton extremely stony fine sandy loam, 0-8% slopes					

**The rating assumes that the water table in the naturally occuring soil can be drained to a depth of 18 inches or more.

1 Identified as an area of special concern by state regulations - engineer's design required.
2 Identified as unsuitable in its natural condition by state regulations - an engineer's evaluation is needed to determine whether an absorption field can be built.
3 Identified as inland wetlands or tidal wetlands by state regulations. Local, state, and/or federal wetland permits may be required.
4 A permit to install an absorption field cannot be issued if the site cannot be drained. A permit cannot be issued if the groundwater level is less than 18 inches below the soil surface for one month or longer.
5 A permit to install an absorption field cannot be issued if the depth to bedrock, of the naturally occurring soil, is less than 24 inches.

TABLE 1
(continued)

SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS BY MAP UNIT
NEW LONDON COUNTY, CONNECTICUT

MAP SYMBOL	MAP UNIT NAME	POTENTIAL RATING	CONCERNS	CORRECTIVE MEASURES	ADDITIONAL CONSIDERATIONS	STATE REGULATIONS
Nn	- Ninigret fine sandy loam	LOW	Fast perc rate, depth to water table.	Fill. Double separating distance between wells and absorption field.		1
Pa	- Pawcatuck mucky peat	EXTREMELY LOW	Organic soils, depth water table, flooding (tidal).		Tidal flooding. No drainage outlet.	2,3,4
PbB PbC	- Paxton and Montauk fine sandy loams, 3-8% slopes - Paxton and Montauk fine sandy loams, 8-15% slopes	MEDIUM	Slow perc rate, depth to water table. +	Fill and/or curtain drain and drainage swale. Design absorption field to distribute effluent over a larger area.	Access to drainage outlet.	1; possibly 2 depending on perc rate measured on site.
PbD	- Paxton and Montauk fine sandy loams, 15-25% slopes	MEDIUM	Slow perc rate, slope, depth to water table. +	Fill/and or curtain drain and drainage swale. Design absorption field to distribute effluent over a larger area. Installation to accomodate for slope.	Access to drainage outlet.	1; possibly 2 depending on perc rate measured on-site.
PdB PdC PeC	- Paxton and Montauk very stony fine sandy loams, 3-8% slopes - Paxton and Montauk very stony fine sandy loams, 8-15% slopes - Paxton and Montauk extremely stony fine sandy loams, 3-15% slopes	MEDIUM	Slow perc rate, depth to water table. +	Fill and/or curtain drain and drainage swale. Design absorption field to distribute effluent over a larger area.	Access to drainage outlet.	1; possibly 2 depending on perc rate measured on-site.
PeD	- Paxton and Montauk extremely stony fine loams, 15-35% slopes	MEDIUM#	Slow perc rate, slope, depth to water table. +	Fill and/or curtain drain and drainage swale. Design absorption field to distribute effluent over a larger area. Installation to accomodate for slope.	Access to drainage outlet.	1; possibly 2 depending on perc rate measured on-site.
Ps	- Pootatuck Variant fine sandy loam	VERY LOW	Fast perc rate, depth to water table, flooding.	Fill. Solution to flooding problem is site specific.		1,3

This rating applies to slopes up to 25%. On slopes greater than 25%, the potential rating may be significantly lower.
+ The water table in these soils is present only for a very brief period of time.

1 Identified as an area of special concern by state regulations - engineer's design required.
2 Identified as unsuitable in its natural condition by state regulations - an engineer's evaluation is needed to determine whether an absorption field can be built.
3 Identified as inland wetlands or tidal wetlands by state regulations. Local, state, and/or federal wetland permits may be required.
4 A permit to install an absorption field cannot be issued if the depth to bedrock, of the naturally occurring soil, is less than 24 inches.

TABLE 1
(continued)

SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS BY MAP UNIT
NEW LONDON COUNTY, CONNECTICUT

MAP SYMBOL	MAP UNIT NAME	POTENTIAL RATING	CONCERNS	CORRECTIVE MEASURES	ADDITIONAL CONSIDERATIONS	STATE REGULATIONS
HrD	- Hollis-Charlton-Rock outcrop complex, 15-45% slopes	VERY LOW			Feasibility study. Increase area of investigation to utilize the deepest soils and flattest slopes. Verify depth to bedrock.	
	Hollis and Rock outcrop parts	extremely low	Depth to bedrock, slope.			
	Charlton parts	high#	Slope.	Design and installation to accommodate for slope.		5
Ip	- Ipswich mucky peat	EXTREMELY LOW	Organic soils, depth to water table, flooding (tidal).		Tidal flooding. No drainage outlet.	1 for slopes >25%
Ln	- Limerick Variant silt loam	EXTREMELY LOW	Depth to water table, flooding.		Drainage needed. Access to drainage outlet unlikely.	2,3,4
MyA	- Merrimac sandy loam, 0-3% slopes		Fast perc rate.	Double separating distance between wells and absorption field.		2,3,4
MyB	- Merrimac sandy loam, 3-8% slopes	HIGH				1
MyC	- Merrimac sandy loam, 8-15% slopes					
NaB	- Narragansett silt loam, 3-8% slopes		None.			
NgB	- Narragansett very stony silt loam, 3-15% slopes	VERY HIGH				
NhC	- Narragansett extremely stony silt loam, 3-15% slopes					
NhD	- Narragansett extremely stony silt loam, 15-25% slopes	HIGH	Slope.	Design and installation to accommodate for slope.		
NtC	- Narragansett-Hollis complex, very rocky, 3-15% slopes	MEDIUM				
	Narragansett part	very high	None.		Feasibility study. Increase area of investigation to utilize the deepest soils. Verify depth to bedrock.	
	Hollis part	extremely low	Depth to bedrock.			5

This rating applies to slopes up to 25%. On slopes greater than 25%, the potential rating may be significantly lower.

1 Identified as an area of special concern by state regulations - engineer's design required.
2 Identified as unsuitable in its natural condition by state regulations - an engineer's evaluation is needed to determine whether an absorption field can be built.
3 Identified as inland wetlands or tidal wetlands by state regulations. Local, state, and/or federal wetland permits may be required.
4 A permit to install an absorption field cannot be issued if the site cannot be drained. A permit cannot be issued if the groundwater level is less than 18 inches below the soil surface for one month or longer.
5 A permit to install an absorption field cannot be issued if the depth to bedrock, of the naturally occurring soil, is less than 24 inches.

TABLE 1
(continued)

SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS BY MAP UNIT
NEW LONDON COUNTY, CONNECTICUT

MAP SYMBOL	MAP UNIT NAME	POTENTIAL RATING	CONCERNS	CORRECTIVE MEASURES	ADDITIONAL CONSIDERATIONS	STATE REGULATIONS
CrC	- Charlton-Hollis fine sandy loams, very rocky, 3-15% slopes	MEDIUM				
	Charlton part	very high	None.		Feasibility study. Increase area of investigation to utilize the deepest soils. Verify depth to bedrock.	
	Hollis part	extremely low	Depth to bedrock.			5
CrD	- Charlton-Hollis fine sandy loams, very rocky, 15-45% slopes	VERY LOW				
	Charlton part	high#	Slope.	Design and installation to accommodate for slope.	Feasibility study. Increase area of investigation to utilize the deepest soils and flattest slopes. Verify depth to bedrock.	1 for slopes >25%
	Hollis part	extremely low	Slope, depth to bedrock.			5
Du	- Dumps	NOT RATED				
HcA	- Haven silt loam, 0-3% slopes		Fast perc rate.	Double separating distance between wells and absorption field.		1
HcB	- Haven silt loam, 3-8% slopes					
HkA	- Hinckley gravelly sandy loam, 0-3% slopes	HIGH				
HkC	- Hinckley gravelly sandy loam, 3-15% slopes					
HkD	- Hinckley gravelly sandy loam, 15-35% slopes	MEDIUM#	Fast perc rate, slope.	Double separating distance between wells and absorption field. Design and installation to accommodate for slope.	Increase area of investigation to utilize the flattest slopes.	1
HrC	- Hollis-Charlton-Rock outcrop complex, 3-15% slopes	LOW				
	Hollis and Rock outcrop parts	extremely low	Depth to bedrock.		Feasibility study. Increase area of investigation to utilize the deepest soils. Verify depth to bedrock.	5
	Charlton part	very high	None.			

This rating applies to slopes of up to 25%. On slopes greater than 25%, the potential rating may be significantly lower.

1 Identified as an area of special concern by state regulations - engineer's design required.
5 A permit to install an absorption field cannot be issued if the depth to bedrock, of the naturally occurring soil, is less than 24 inches.

TABLE 1

SOIL POTENTIAL RATINGS FOR SEPTIC TANK ABSORPTION FIELDS BY MAP UNIT
NEW LONDON COUNTY, CONNECTICUT

MAP SYMBOL	MAP UNIT NAME	POTENTIAL RATING	CONCERNS	CORRECTIVE MEASURES	ADDITIONAL CONSIDERATIONS	STATE REGULATIONS
Aa	- Adrian muck	EXTREMELY LOW	Organic soils, depth to water table.		Drainage needed. Access to drainage outlet unlikely.	2,3,4
AfA AfB	- Agawam fine sandy loam, 0-3% slopes - Agawam fine sandy loam, 3-8% slopes	HIGH	Fast perc rate.	Double separating distance between wells and absorption field.		1
Ba	- Beaches	NOT RATED				
BrB	- Broadbrook silt loam, 3-8% slopes	MEDIUM	Slow perc rate, depth to water table. +	Fill and/or curtain drain and drainage swale. Design absorption field to distribute effluent over a larger area.	Access to drainage outlet.	1; possibly 2 depending on perc rate measured on-site.
CbB CbC	- Canton and Charlton fine sandy loams, 3-8% slopes - Canton and Charlton fine sandy loams, 8-15% slopes	VERY HIGH	None.			
CbD	- Canton and Charlton fine sandy loams, 15-25% slopes	VERY HIGH	None.			
CcB CcC CdC	- Canton and Charlton very stony fine sandy loams, 3-8% slopes - Canton and Charlton very stony fine sandy loams, 8-15% slopes - Canton and Charlton extremely stony fine sandy loams, 3-15% slopes	VERY HIGH	None.			
CdD	- Canton and Charlton extremely stony fine sandy loams, 15-35% slopes	HIGH#	Slope.	Design and installation to accommodate for slope.	Increase area of investigation to utilize the flattest slopes.	1 for slopes >25%
Ce	- Carlisle muck	EXTREMELY LOW	Organic soils, depth to water table.		Drainage needed. Access to drainage outlet unlikely.	2,3,4

This rating applies to slopes up to 25%. On slopes greater than 25%, the potential rating may be significantly lower.
+ The water table in these soils is present only for a very brief period of time.

1 Identified as an area of special concern by state regulations - engineer's design required.
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4 A permit to install an absorption field cannot be issued if the site cannot be drained. A permit cannot be issued if the groundwater level is less than 18 inches below the soil surface for one month or longer.

APPENDIX F
GUIDELINES FOR TIDAL AREAS IN LYME
May 5, 1980

The tidal areas of Lyme shall be designated Zones A and B respectively, and structures in each zone will normally be expected to meet the criteria that follow:

Zone A includes the Waterfront District in Hamburg; the entire outer portion of Hamburg Cove from a line between the end of the Camp Claire bulkhead and the rocky point opposite on Jewett land, thence downstream along both shores of the outer cove to the Connecticut River; then north and south along the shoreline of the Connecticut River to the boundaries of East Haddam and Old Lyme, excepting the channel inside Notts Island.

Zone B includes the more confined areas of inner Hamburg Cove upstream of the aforementioned line (between Camp Claire and Jewett land) to the Joshuatown Bridge, and except for the Waterfront District; all of Lord's Cove within the Town of Lyme; Joshua Creek; Selden Creek and Pond; Whalebone Creek; and the channel behind Notts Island.

Regulated structures include all walkways, ramps, floats, and docks, and any other structure extending into the tidal area.

In Zone A:
a) The combined deck area of all structures shall not be greater than 400 square feet;
b) The extreme end of structures may not extend more than 25% of the distance to the opposite shore, measured from ordinary low water, or more than 50 feet beyond ordinary low water, whichever is the lesser distance; A channel required for passage shall not be obstructed;
c) Structures may not intrude into the area within 10 feet of the side property lines extended, except by written agreement of the adjoining property owners; If the structure is to be shared by the two adjacent owners, the rights of both for structures shall be fully utilized in the single structure, and any access rights required by either owner shall be provided in a recorded easement. If the structure is for the use of only one landowner, its exceptional location must be justified by topographic features.
d) For each waterfront lot in a Floodplain Plain, Rural or Commercial District, there may be only one extension beyond high water of a dock, float, or dock and float in combination. (As indicated in Lyme's present zoning regulations, Section 4.3.11, this structure must be "for use of the owners, and/or occupants of the premises and their guests in residence.")
e) Structures over wetlands must be open pile and timber construction, or similar type construction, and shall not be wider than 6 feet.

In Zone B:

a) The combined deck area of structures shall not be greater than 80 square feet;

b) The extreme end of structures shall not extend more than 25% of the distance to the opposite shore, measured from ordinary low water, or more than 20 feet beyond ordinary low water, whichever is the lesser distance. A channel required for passage shall not be obstructed.

c) Same as "c" in zone A

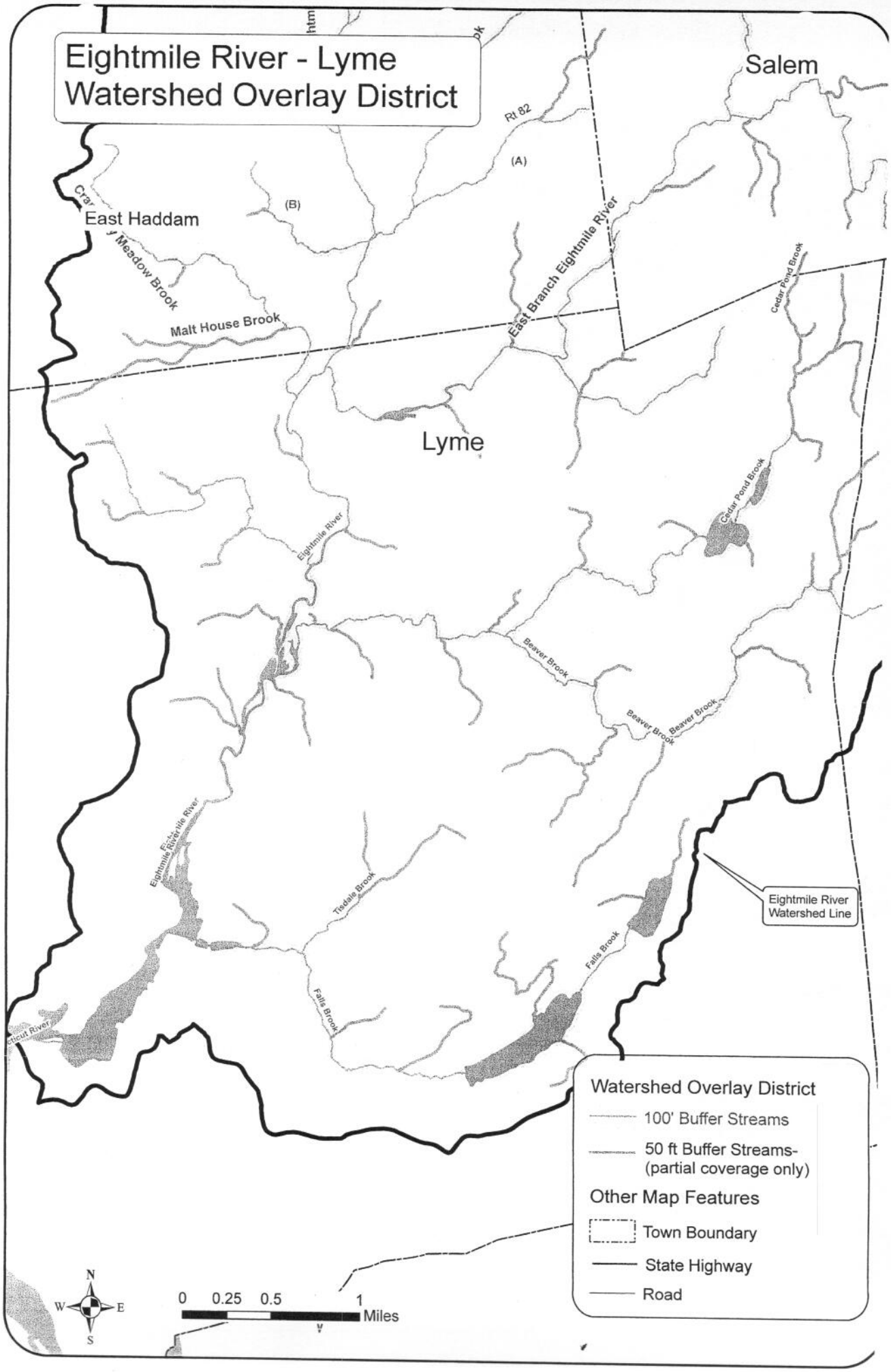
d) Same as "d" in Zone A

e) Structures over wetlands must be open pile and timber construction, or similar type construction, and shall not be wider than 4 feet.

f) No dock or float shall be placed opposite an existing dock in such a position that the extremity of the first is within 50 feet of the nearest extremity of the opposite facility.

Appendix G

Eightmile Watershed Overlay District Map


Eightmile River - Lyme
Watershed Overlay District
Salem
Rt 82
(A)
(B)
East Haddam
Meadow Brook
Malt House Brook
East Branch Eightmile River
Cedar Pond Brook
Lyme
Eightmile River
Beaver Brook
Tiedale Brook
Falls Brook
Eightmile River Watershed Line
Watershed Overlay District
100' Buffer Streams
50 ft Buffer Streams-
(partial coverage only)
Other Map Features
Town Boundary
State Highway
Road
N
W
E
S
0 0.25 0.5 1
Miles

Appendix H

Backyard Stream Buffers

Backyard Stream Buffers

Backyard without streamside buffer. | Backyard with streamside buffer.

Guidelines for Maintaining, Improving, and Restoring Streamside Vegetation

U.S. Department of Agriculture
Natural Resources Conservation Service

United States
Environmental Protection Agency

Norwalk River
Watershed Initiative

Fairfield County
Conservation District

Connecticut Department of
Environmental Protection

October 1998

The intent of this booklet is to present streamside property owners with information about the importance of streamside vegetation, and to provide guidelines on maintaining, improving, and restoring streamside vegetative buffers.

The information presented in this booklet is not intended for regulatory purposes. For guidelines on regulatory setback distances from watercourses and wetlands, see Connecticut DEP's *Guidelines for Upland Review Area Regulations Under Connecticut's Inland Wetlands and Watercourses Act.*

This brochure was produced by the Fairfield County Soil and Water Conservation District to assist the Norwalk River Watershed Initiative and was funded in part by the Connecticut Department of Environmental Protection (DEP), through a U.S. Environmental Protection Agency Nonpoint Source Grant under Section 319 of the Clean Water Act, and in part by USDA, Natural Resources Conservation Service.

This brochure was prepared and published by the USDA, Natural Resources Conservation Service in Connecticut.

To obtain additional information, contact a local USDA Natural Resources Conservation Service or Soil and Water Conservation District office.

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RIPARIAN STREAM BUFFERS

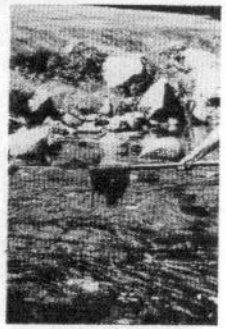
Riparian zone refers to the areas adjacent to streams, rivers, and other fresh water bodies. Riparian vegetation refers to the plants that occur naturally in riparian zones. Riparian or streamside vegetation performs many functions important to streams. Streamside vegetation provides streams with erosion control, water quality protection, fish and wildlife habitat, and scenic beauty. Human land uses within riparian zones often cause a reduction or loss of streamside vegetation, which usually results in the degradation of the stream.

Maintaining, improving, or restoring areas of trees and/or shrubs adjacent to streams helps maintain or improve stream quality. These vegetated areas or "stream buffers" protect the stream from the adverse impacts of developed landscapes. Property owners can help preserve or improve streams by maintaining or restoring adequate stream buffers.

OUR IMPACTS ON STREAMS

When we live or work close to water courses, we often clear streamside vegetation to obtain a better view of or gain accessibility to the stream. When we clear streamside vegetation, we eliminate many of the beneficial functions performed by riparian vegetation.

Changes in the landscape caused by development can negatively impact our water resources. Urban and suburban areas can be major sources of nonpoint source pollution. Nonpoint source pollution occurs when water becomes contaminated as it falls through contaminated air as rain, or as it flows over the land surface. Water flowing over parking lots, industrial sites, roads, lawns, and landscaped areas picks up sediments, nutrients, hydrocarbons, heavy metals, and other pollutants that often end up reaching streams and other surface waters.



Land use changes associated with urban and suburban development often increase the amount of impervious or compacted areas such as roofs, roads, sidewalks, lawns, and parking lots. Rain water cannot infiltrate the ground through these impervious surfaces and becomes runoff; consequently, more water reaches the stream faster than under natural conditions. These developed conditions can increase erosion and flooding hazards along streams.

FUNCTIONS OF STREAMSIDE VEGETATION

Erosion Control - The roots and stems of streamside vegetation stabilize streambanks by binding soil and by reducing the velocity of flowing water.

Fish and Wildlife Habitat - Leaves, branches, and fruits are major sources of food and shelter for aquatic organisms in streams. Streamside vegetation also plays a major role in moderating water temperatures in streams, which helps to maintain suitable habitat for fish and aquatic invertebrates. Streamside vegetation also provides habitat and travelways for birds, mammals, amphibians, and reptiles.

Water Quality Protection - During the summer lack of streamside vegetation can increase stream temperatures because of increased water exposure to solar radiation. As water temperatures increase, oxygen levels in the water decrease.

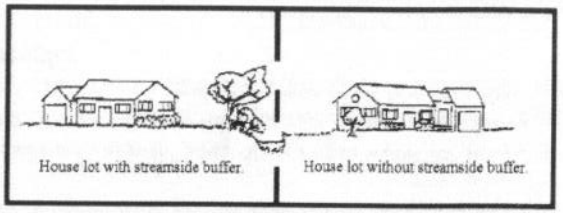
In nutrient rich waters, excessive algae growth can be detrimental to the quality of the stream. Streamside vegetation can filter nutrients, sediments, and other contaminants that may be reaching streams in surface runoff and shallow subsurface flows.

Open grassed areas adjacent to streams and ponds are inviting to Canada geese and ducks. Large numbers of these birds can negatively impact water quality by contributing nutrients, bacteria, and organic matter to surface waters. Streamside vegetation discourages these birds from using areas adjacent to streams and ponds.

WHAT IS THE APPROPRIATE WIDTH FOR A STREAM BUFFER?

The adequate width of a buffer will vary depending on the function(s) desired by the landowner and the land available.

The width of the buffer should be measured starting at the upper edge of the stream channel extending perpendicular from the stream.



Most stream buffers can be divided into two zones, a "streamside zone" and an "upper zone."

The primary functions of the streamside zone are to provide streambank erosion control, provide shade, provide some filtering of pollutants, and maintain suitable habitat for aquatic organisms. The width of the streamside zone should range between 15 and 25 feet.

The primary functions of the upper zone are to improve or protect water quality by filtering pollutants from runoff and to provide wildlife habitat. The width of the upper zone should range from 20 to 135 feet.

The total width of a completely functional buffer will range between 35 and 150 feet (this range of widths may not be adequate habitat for many wildlife species).

Keeping it simple: In many cases a streamside buffer zone may be sufficient to maintain stream quality. The

need for an upper zone buffer for the treatment of polluted runoff will depend on the presence of sources of pollution and on the absence of concentrated flows (channels or stormwater pipes).

Concentrated flows in channels and stormwater discharge pipes can bypass buffers, making them inefficient for filtering pollutants. By addressing pollution at the source, the need for an upper zone buffer is reduced.

When deciding how wide a buffer should be, consider: Are there landscaped areas or gardens where fertilizers and pesticides are frequently used? Are there parking lots and roads discharging runoff into the stream? If not, water quality may not be an issue and an upper zone may not be needed.

REDUCING POLLUTION FROM RESIDENTIAL AREAS

Green lawns are popular in residential neighborhoods and in landscaped commercial areas. In an effort to maintain green lawns, yards are frequently fertilized and watered. Often when it rains or when yards are over-watered, fertilizers and other chemicals used for maintaining green lawns reach streams. This can be harmful to the water quality of the stream.

Household chemicals and auto fluids may also find their way into streams. Improperly disposed of household chemicals, or spilled auto fluids may be polluting a nearby stream. Here are some ways of reducing pollution from backyards:

- ❑ Test the soil to determine the need for fertilizer and lime. Apply only as much fertilizer as the lawn needs. (Soil samples can be sent to the University of Connecticut soil testing laboratory in Storrs.)
- ❑ Water lawns only when needed. Lawns only need about 1 inch of water per week. Use a garden rain gauge to determine if the lawn needs to be watered.
- ❑ Plant shrubs and ground covers (myrtle, pachysandra, and forsythia) to add some diversity to the yard. These plants require less maintenance than grass lawns.

- ❑ Never dump into stormdrains, streams, or wetlands. Contact the municipality for information about proper disposal of hazardous materials such as pesticides, auto fluids, and household cleaners.
- ❑ Take cars to the car wash. That soapy dirty water flowing away from a driveway may eventually reach a watercourse.
- ❑ Do not wait on car leaks. Always check the driveway for oil spots or signs of other car fluid leaks. Have them repaired as soon as possible.

WHAT TO PLANT IN A BUFFER

Once it has been decided how wide a riparian buffer should be, decide what to plant. **In some sites, natural regenerations of streamside vegetation can be achieved by not mowing close to the stream.**

Consider the Plants

Always favor plants that are native and have multiple values such as erosion control, wildlife habitat, and aesthetics. Look at nearby streamside vegetation to identify plants that will grow successfully in the local area. Avoid invasive plants such as: multiflora rose, euonymus, and autumn olive. Tables 1 and 2 (see pages 5 and 6) contain lists of commonly used streamside buffer plants.

Consider the Stream

Consider the width of the stream. To provide adequate shade, the height of the streamside vegetation should equal or exceed the width of the stream.

Consider the Soils

Determining the types of soils present on the property, can help choose plants that are well suited for the site.

Riparian soils occur along flood plains, in depressions, or in areas adjacent to springs and seeps. They generally are either saturated with water for some period during the year, or are subject to periodic overflow from ponding or flooding.

Soils are better defined by their texture. Coarse soils include sandy and gravely soils. Fine soils include silts and clays. Soils that have a good mixture of coarse and fine materials are called loams.

Sandy and gravely soils do not hold water for long periods of time. During the summer, when water flows are low, these well drained areas may become dry and droughty.

Fine soils take and give up water slowly. Fine soils tend to remain wet for long periods of time and may pond.

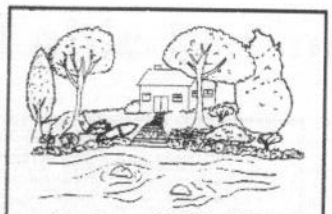
Other important soil properties for plants to be grown in buffer areas are: flooding frequency and duration, pH, presence or absence of root restricting layers (bedrock), aspect (direction the slope faces), and organic matter content.

Consider Landscaping and Aesthetics:

Plant characteristics to consider for aesthetics include seasonal foliage color, flowers, fruits, and form of branching.

The more natural the buffer the better it will perform its functions. This is especially important in the streamside

zone. The dominant vegetation in the buffer should consist of trees and shrubs selected for their suitability to the site and intended purpose. Herbaceous vegetation can be used on buffers for small streams and ponds.



Landscaped buffer with view and access to stream.

Protecting streams does not require that all backyards resemble a natural forest. Maintaining easy accessibility and a year round view to the stream may be an important consideration for many property owners. Buffers can be landscaped to protect stream quality and at the same time provide accessibility and views to the stream by following these two principles:

1. Keep the stream shaded with a tree canopy.
2. Protect the streambanks with a dense root system and soft woody vegetation. *(See Figure 1 for streamside buffer landscaping ideas.)*

Views and accessibility to the stream may be maintained by pruning low tree branches, reducing use of evergreen trees and shrubs, and strategically spacing plantings. However, these practices will reduce the wildlife habitat value of the buffer by reducing important wildlife cover.

An alternative to thinned or open buffers would be to keep an open access path 10 to 15 feet wide leading to the stream. Where pedestrian access to the waters is desired, a hard surface or trail with steps or a ramp may be appropriate.

Planting Guidelines for Woody Vegetation:

- ❑ Shrubs less than 10 feet in height at maturity - plant 3 to 5 feet apart
- ❑ Shrubs and trees from 10 to 25 feet in height at maturity - plant 5 to 10 feet apart
- ❑ Trees greater than 25 feet in height at maturity - plant 10 to 30 feet apart.

For open areas, double the plant to plant spacing.

TREES THAT GROW WELL TOGETHER

The following mixtures of trees are often found adjacent to streams in natural landscapes:

- ❑ River Birch, Silver Maple, and Black Willow
- ❑ Green Ash, Red Maple, and Pin Oak
- ❑ Sycamore, Cottonwood, and Red Maple
- ❑ Black Ash, White Cedar, White Spruce

OTHER CONSIDERATIONS

Eroding and Unstable Banks or Shores - Streams are dynamic systems that are in constant motion and change, which can cause erosion problems. In ponded areas, fluctuating water levels can also result in shoreline erosion problems. In many cases, establishing streamside vegetation may help stabilize the streambank or shoreline, but in sites undergoing severe erosion an erosion control specialist should be consulted.

Wildlife Damage - Browsing deer or beaver activity might ruin efforts to establish a stream buffer.

Beaver forage on the bark and twigs of trees such as Ash, Aspen, Willow, Birch, Maple, Apple, Alder, Cherry, Pine, and Poplar. Most damage caused by beavers results from dam building, bank borrowing, tree cutting, or flooding.

Deer feed on a variety of vegetation. During the summer deer feed on grasses, the buds of Maple, Sumac and Oak Trees, and on farm crops. During the winter deer feed on Cedar, White Pine, Oak, Maple, and other trees.

To prevent or reduce damage to stream buffers from deer or beaver, consider using one or more of the following measures:

- ❑ *Use plants that are considered less palatable to beaver or deer.* Using plants that may not be attractive to these animals might help reduce browsing damage. However, starving beaver and deer will feed on anything they can reach.

  Some plants considered less palatable to beaver are: Spruce, White Cedar, Hemlock, Tamarack (Larch), Beech, Red Maple, and White Birch. Avoid plants that are preferred by beaver such as Poplars (tulip tree), Yellow Birch, and Ash.

  Some plants considered of low value to deer are: Alder, Spruce, Hemlock, Tamarack (Larch), Beech, Hornbeam (Iron wood), Hawthorn, and Sycamore.

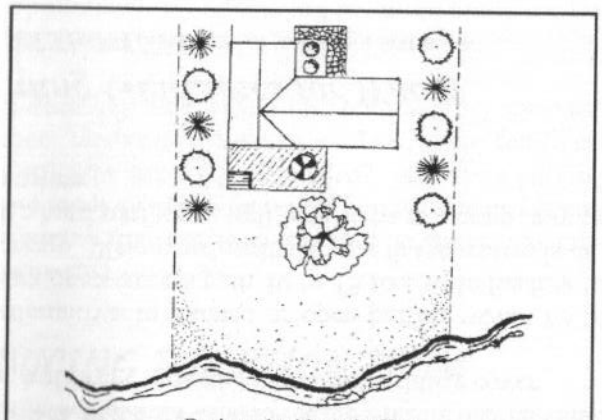
  Some plants that are preferred deer or beaver foods, but will endure heavy browsing are: Dogwoods, Willows, Ash, and Yellow Birch.

- ❑ *Protect young seedlings.* Wire mesh fences may be erected around individual plants you might wish to protect from browsing. Planting tubes are also commercially available to protect young seedlings from browsing.

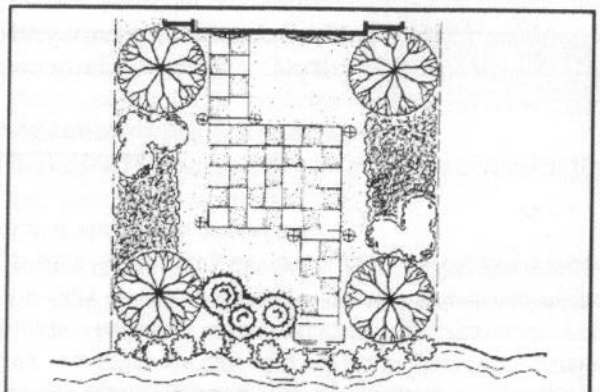
- ❑ *Deer Repellents:* Homemade repellents such as bone meal, human hair, and soap have been used with limited success. Commercial taste and odor repellents are also available. Repellent performance will vary depending on the density of the deer population and the availability of other sources of food.

For more information on beaver and deer control in residential areas contact the Connecticut DEP Wildlife Division.

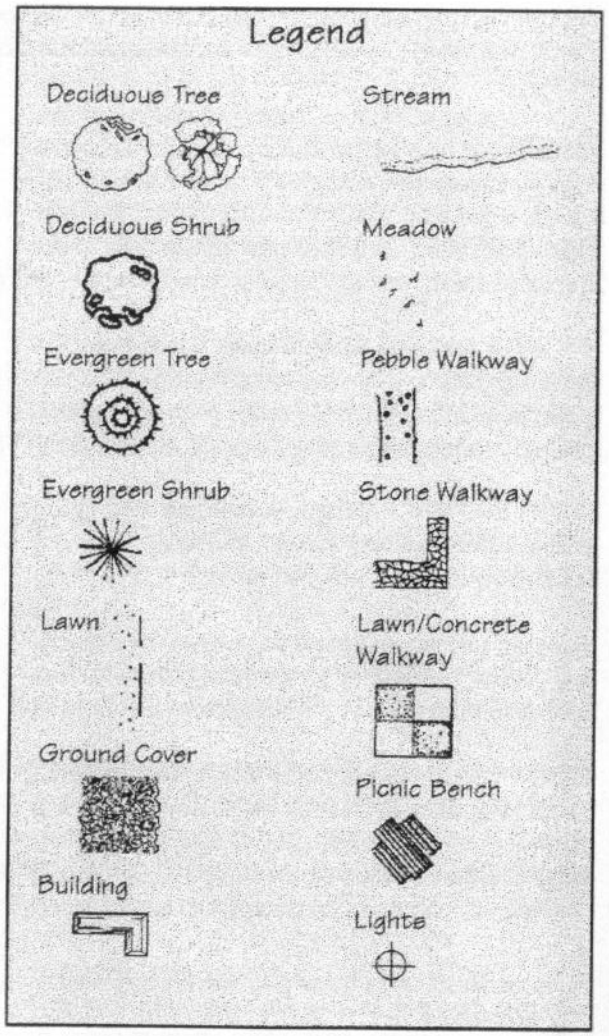
Figure 1. Examples of Landscape Plans for Backyard Stream Buffers

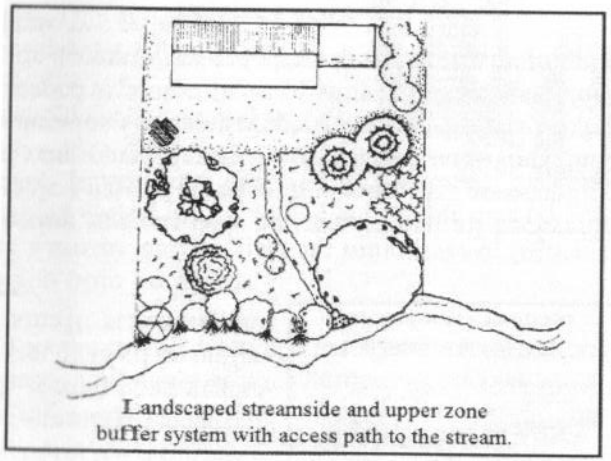


Backyard without buffer.

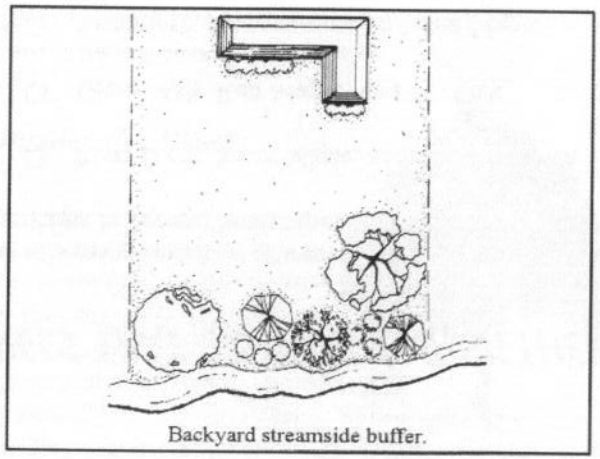


Landscaped backyard with streamside buffer and access path to stream.





Landscaped streamside and upper zone buffer system with access path to the stream.



Backyard streamside buffer.

Table 1. Common Streamside Trees and Shrubs

Common Name	Scientific Name	Mature Height (ft.)	Tolerance to Wet Soils	Tolerance to Shade	Tolerance to Dry Soils	Tolerance to Flooding	Aesthetics	Wildlife Habitat	Remarks
			L = Low , M = Medium, H = High						
Hardwood Trees									
Red Maple	*Acer rubrum*	50 to 70	H	M	H	H	H	M	Red flower in early spring, Bright red foliage, Fast growing
Silver Maple	*Acer saccharinum*	60 to 80	H	L	L	M	M	M	Reddish-brown flower, Yellow foliage, Weak wood
Speckled Alder	*Alnus rugosa*	30 to 40	H	H	M	H	M	M	Often grows in shrubby form, Forms dense thickets
River Birch	*Betula nigra*	49 to 82	H	M	M	H	H	L	Yellow foliage, Exfoliating bark
White Ash	*Fraxinus americana*	75 to 100	H	L	M	H	H	H	Fast growing, most common native ash
Green Ash	*Fraxinus pennsylvanica*	30-50	H	L	H	H	L	H	Strong wood, Yellow foliage
American Sycamore	*Platanus occidentalis*	110 to 120	H	L	H	H	M	L	Fast growing, Bark forms scaled pattern, Ball like fruit
Cottonwood	*Populus deltoides*	80 to 100	H	L	M	H	H	M	Fast growing, Weak wood
Swamp White Oak	*Quercus bicolor*	60 to 70	H	M	L	H	L	H	Fast growing, Strong wood, Large acorn production
Pin Oak	*Quercus palustris*	40 to 80	M	M	H	H	M	H	Fast growing, Strong wood, Large acorn production, Scarlet foliage
Black Willow	*Salix nigra*	30-60	H	L	L	M	H	L	Short lived, fast growing
Bass Wood	*Tilia americana*	65 to 82	M	H	L	M	M	M	
Coniferous Trees									
Eastern Red Cedar	*Juniperus virginiana*	20 to 50	H	H	H	H	M	H	Slow growing, Grayish-blue fruit
Tamarack	*Larix laricina*	49 to 82	M	L	L	M	H	L	Deciduous, looses needles in the Fall
White Spruce	*Picea glauca*	60 to 70	M	M	H	M	M	H	Often used for Christmas trees
White Pine	*Pinus strobus*	60 to 100	M	H	M	L	H	M	Largest conifer of the eastern forest
Northern White Cedar	*Thuja occidentalis*	50 to 65	M	M	M	M	H	M	Weak wood easily damaged by snow, wind, or ice
Shrubs									
Shadbush	*Amelanchier candensis*	20 to 30	H	M	H	H	H	H	White flowers, Yellow to red foliage, Purplish-blue fruit
Silky Dogwood	*Cornus amomum*	7 to 10	H	L	M	H	M	H	White or yellow flower, Good for streambank stabilization
Hawthorn	*Crataegus L.*	5 to 25	H	L	H	H	M	H	Thorns on branches. Small berry-like fruit.
Winterberry	*Ilex verticillata*	10	H	M	M	H	H	H	Greenish-white flower, Red berry stays on shrub through winter
Bankers Dwarf Willow	*Salix cotteti*	6	H	M	M	H	L	L	Good for streambank stabilization
Pussy Willow	*Salix bicolor*	26	H	M	M	H	H	L	
Elderberry	*Sambucus canadensis*	12	H	L	M	M	M	H	White or Yellowish-white flower, Black-blue fruit
Highbush Blueberry	*Vaccinium corymbosum*	6 to 12	H	M	M	H	H	H	Blooms May to June. Berries July to August
Nannyberry	*Virburnum lentago*	33	M	M	M	M	H	H	

Table 2. Recommended Grass Seeding Mixtures for Herbaceous Riparian Buffers

Recommended Use	Common Name	Variety	Seeding Rate (lb. - pure live seed/acre)
Wildlife habitat, Dry Soils	Switchgrass	Shelter	2.0
	Big bluestem	Niagara	3.0
	Eastern gamagrass	Pete	1.0
	Indiangrass	Rumsey or NE-54	1.0
	Little bluestem	Aldous or Camper	2.0
	Sideoats grama	El Reno or Trailway	1.0
		Total	10.0
Wildlife habitat, Wet Soils	Switchgrass	Shelter	8.0
	Deertongue	Tioga	2.0
	White clover or	Common	
	Birdsfoot treefoil	Empire	1.0
		Total	11.0
Erosion Control	Birdsfoot treefoil or	Empire	3.0
	White clover	Common	
	Orchardgrass	Pennlate	6.0
	Timothy	Climax	5.0
	Perennial ryegrass	Turf type	1.0
		Total	15.0

Appendix I

Design Elements for Stormwater Management
And
Low Impact Development

Office of Long Island Sound Programs
Fact Sheet
for
STORMWATER MANAGEMENT

What is Stormwater Management?

Stormwater management is a comprehensive process to minimize potential adverse impacts to natural resources and water quality from stormwater runoff. The traditional approach to handling stormwater runoff has been to collect it from the developed area and shunt it as quickly as possible to the nearest water body to prevent flooding in upland areas. In the past, little attention had been paid to the impacts of the associated increases in both the volumes and rates discharged and the pollutants carried in the runoff. The result has been severe erosion of streams, the loss and degradation of habitat, increased flooding and associated damage, increased siltation resulting in more frequent dredging to maintain navigation, and tremendous capital expenditures to address these problems.

Proper state-of-the-art stormwater management involves many techniques including pollution prevention, minimization of impervious surfaces, on-site retention of a portion of the runoff, where appropriate, and treatment of non-retained runoff to remove contaminants such as oils, greases, suspended solids and floatable debris. One general goal is to design development in such a manner that the changes in runoff rates and volumes are minimized. This is initially accomplished through the proper siting and design of proposed structures and infrastructure.

Why is stormwater management important?

Pollution of our surface and ground waters has been a recognized problem for many years. While great strides have been made in controlling point sources of pollution, primarily through the National Pollution Discharge Elimination System (NPDES) permitting program and corresponding state regulatory programs, there is a new awareness of the importance of controlling nonpoint sources of pollution (pollution generated by many diffuse sources). Stormwater runoff is a major contributor of nonpoint source pollution.

The amount of stormwater runoff from a given site is dictated by site-specific conditions, such as the soil=s infiltration capacity, the type and extent of site cover (e.g., vegetation or pavement), the slope, and the duration and intensity of each rainfall event. Stormwater that penetrates the soil is slowed, filtered, cooled, and renovated. Renovation is a process by which bacteria and minerals in the soil treat and bind contaminants, removing them from the stormwater.

Impervious surfaces, such as pavement and buildings, reduce the area of soil into which rainfall can infiltrate, thus increasing the volume of runoff that flows over the land. As this runoff flows over impervious and pervious surfaces, it can pick up and transport floating, suspended, and

dissolved constituents such as pathogens, toxic materials (heavy metals, oils, antifreeze, pesticides, etc.), high levels of nutrients (fertilizers and organic matter), eroded sediments (topsoil and road sand), and trash. This runoff flows down gradient over the land to the nearest water body or depression where it not only deposits the contaminants it carries, but it alters the temperature, pH, and/or salinity of receiving waters. It should be noted that even clean, potable freshwater can be a pollutant when introduced to a brackish or saline environment in the coastal area. Freshwater dilutes the salt concentrations in the receiving area, adversely impacting the flora and fauna that are uniquely suited to such salty environs. Over the long-term, sediment settles out of the water column and can degrade habitat in stream bottoms, tidal wetlands, and shellfish beds.

Poorly planned new development and redevelopment can result in increased stormwater discharges, and ultimately more polluted runoff reaching watercourses and wetlands. Unlike conditions in the soil, there are few natural processes available in the receiving waters to treat, reduce, or control many of the harmful constituents in the runoff; they can only be diluted by the volume of water that they reach. With constant inputs after each rainfall, concentrations of many harmful constituents have been increasing in the sediments and the water column. Additionally, increasing stormwater discharges can lead to increased risks of flooding and flood damage and to increased siltation in coastal waters which often results in habitat degradation and an increased need to dredge to maintain navigation.

Design issues relate to the topography, soil conditions, existing drainage, and natural resources on and adjacent to the site. The implementation of structural and/or non-structural best management practices (BMPs) can also be used to provide both effective erosion and sedimentation control and minimization of other pollutants including oils, greases, toxics, pathogens and floatable debris. Please refer to the manual titled *Coastal Water Protection: A Guide for Local Officials*, (DEP, 1996) for additional detailed information. A copy of the guide has been provided to the planning and zoning department in each coastal municipality.

What are the statutory policies that apply?

The Connecticut Coastal Management Act (CCMA) contains several policies that highlight the need to incorporate stormwater management into individual project reviews and long-range planning. These include the following:

> To manage estuarine embayments so as to insure that coastal uses proceed in a manner that assures sustained biological productivity, the maintenance of healthy marine populations and the maintenance of essential patterns of circulation, drainage and basin configuration; to protect, enhance and allow natural restoration of eelgrass flats except in special limited cases, notably shellfish management, where the benefits accrued through alteration of the flat may outweigh the long-term benefits to marine biota, waterfowl, and commercial and recreational finfisheries [Connecticut General Statutes (CGS) section 22a-92(c)(2)(A)].
>
> It is found and declared that the pollution of the waters of the state is inimical to the public health, safety and welfare of the inhabitants of the state, is a public nuisance and is

harmful to wildlife, fish and aquatic life and impairs domestic, agricultural, industrial, recreational and other legitimate beneficial uses of water and that the use of public funds and the granting of tax exemptions for the purpose of controlling and eliminating such pollution is a public use and purpose for which moneys may be expended and tax exemptions granted, and the necessity and public interest for the enactment of this chapter and the elimination of pollution is hereby declared as a matter of legislative determination [CGS section 22a-422, as referenced by CGS section 22a-92(a)(2)].

The CCMA defines adverse impacts which must be avoided or, if avoidance is not possible, must be minimized in order for a project to be lawfully approvable. The following potential adverse impacts must be considered during the coastal site plan review process and when evaluating proposed zoning regulation and map amendments.

Degrading water quality through the significant introduction into either coastal waters or ground water supplies of suspended solids, nutrients, toxics, heavy metals, or pathogens, or through the significant alteration of temperature, pH, dissolved oxygen, or salinity [CGS section 22a-93(15)(A)];

Degrading existing circulation patterns of coastal waters through the significant patterns of tidal exchange or flushing rates, freshwater input, or existing basin characteristics and channel contours [CGS section 22a-93(15)(B)];

Degrading natural or existing drainage patterns through the significant alteration of groundwater flow and recharge and volume of runoff [CGS section 22a-93(15)(D)];

Degrading or destroying essential wildlife, finfish or shellfish habitat through significant alteration of the composition, migration patterns, distribution, breeding or other population characteristics of the natural species or significant alteration of the natural components of the habitat [CGS section 22a-93(15)(G)]; and

Degrading tidal wetlands, beaches and dunes, rocky shorefronts, and bluffs and escarpments through significant alteration of their natural characteristics and functions [CGS section 22a-93(15)(H)].

In addition, the state statutes pertaining to planning and zoning contain specific requirements for zoning regulations and plans of development that relate to the restoration and protection of coastal resources. These are:

In any municipality that is contiguous to Long Island Sound the regulations adopted under this section shall be made with reasonable consideration for restoration and protection of the ecosystem and habitat of Long Island Sound and shall be designed to reduce hypoxia, pathogens, toxic contaminants and floatable debris in Long Island Sound. Such regulations shall provide that the commission consider the environmental impact on Long Island Sound of any proposal for development [CGS section 8-2(b)].

The plan adopted under this section for any municipality that is contiguous to Long Island Sound shall be made with reasonable consideration for restoration and protection of the

ecosystem and habitat of Long Island Sound and shall be designed to reduce hypoxia, pathogens, toxic contaminants and floatable debris in Long Island Sound [excerpt from CGS section 8-23].

Proper management of stormwater will address these statutory requirements.

Are stormwater discharges regulated by the Department of Environmental Protection?

Yes. Technically, most discharges to the waters of the State Of Connecticut are regulated by the Department of Environmental Protection through either a general permit or individual permit requirement. There are several types of stormwater discharges that are covered by the issuance of a general permit. If the stormwater discharge does not qualify for coverage by the general permit because adverse impacts to the waters of the state would result, an individual permit may be required prior to discharge.

Registration is required to be submitted in order for stormwater discharges to be authorized by the following general permits issued by the Connecticut Department of Environmental Protection:

Stormwater and Dewatering Wastewaters from Construction Activities: This general permit applies to all discharges of stormwater and dewatering wastewaters from construction activities which include, but are not limited to, clearing, grading, and excavation and which result in the disturbance of *five or more acres* of total land area on a site.

Stormwater Associated with Commercial Activities: This general permit applies to all discharges from any conveyance which is used for collecting and conveying stormwater and which is directly related to retail, commercial, and/or office services whose facilities occupy *five acres or more* of contiguous impervious surface.

Stormwater Associated with Industrial Activities: This general permit applies to all discharges from any conveyance which is used for collecting and conveying stormwater and which is directly related to manufacturing, processing or material storage areas at an industrial activity site.

What can a municipality do to minimize impacts from stormwater runoff?

- Maintain, enhance or restore the quality of coastal waters and submerged lands through the adoption and implementation of a stormwater management ordinance, either as an amendment to the municipal zoning regulations or as a "stand-alone" ordinance. In either case, it should require 1) that new development projects be designed to minimize clearing, cutting and filling in undisturbed areas to ensure that new development is consistent with the capabilities of the land to support such development; 2) soil erosion and sediment control plans for all development projects near sensitive coastal resources, even those projects with less than one-half acre land disturbance proposed, and strictly enforce appropriate

sedimentation and erosion control measures during construction; and 3) that site plan and special permit/exception applications include appropriate best management practices to retain and treat on-site the runoff generated by the first inch of rainfall, remove 80% of the total suspended solids on an annual basis, and, where site conditions allow, prohibit post-development increases in the pre-development rates and volumes of stormwater discharge.

- Review zoning regulations to determine the maximum impervious cover allowed in each district and carefully consider reducing these maximums wherever possible, particularly in areas abutting coastal waters and other sensitive coastal resources, but also for areas serviced by municipal stormwater systems that discharge to coastal waters. Include buildings, paved areas, sidewalks, terraces, patios and other non-porous surfaces when calculating impervious cover.

- Update subdivision regulations to encourage cluster developments that incorporate features such as curbless roads, narrow roads, grass swales, retention ponds, and other features that reduce impervious cover, disperse and treat stormwater, and minimize the collection and transport of stormwater to surface waters.

- Update the municipality=s Plan of Conservation and Development and Municipal Coastal Program, if applicable, to encourage best management practices for stormwater for all new or substantially improved development, including improvements to municipal roads, bridges and other facilities, and for currently developed areas. Consider including the following:

  An inventory of existing storm drain outfalls to identify opportunities to retrofit roads and other municipal facilities for stormwater retention and pollutant reduction;

  Identification of illicit connections to municipal storm sewer system (anything that is not stormwater that is being discharged to the stormwater system without a permit) and recommendations to correct or mitigate adverse impacts associated with these connections;

  Adoption of a municipal ordinance that prohibits illicit connections to municipal stormwater systems;

  Consideration of (and preparation for) the use of alternatives to winter sanding and salting on roadways and parking areas;

  Planning for and implementation of appropriate snow disposal practices;

  Initiation of a storm drain stenciling program to help identify direct links to coastal waters and other waterbodies;

  Adoption of an ordinance that limits the application of fertilizers and broad-based pesticides, particularly in months with historically high or low average precipitation such as April and August; and

Recommendations for regularly scheduled street sweeping and catch basin clean-outs to minimize the amount of sediment, contaminants, and floatable debris entering coastal waters and other waterbodies through the municipal stormwater management system, and recommendations to amend the zoning regulations to require similar maintenance of private parking lots and streets.

- Develop a watershed management plan with neighboring municipalities that share your watershed boundaries, and implement a coordinated stormwater management plan.

- Develop an educational handout that: addresses the importance of stormwater management; identifies actions that individuals can take to minimize potential stormwater impacts (including, for example, the proper use of fertilizer, disposal of used motor oil and composting of lawn clippings, etc.); and includes the municipality's standards for development. Include it in every application package for land use and/or building permits and authorization.

- Develop an open space/greenways plan to create recreational opportunities and buffer sensitive and important resources, particularly streams, tributaries, and coastal resources from stormwater impacts.

- During the review process for new or redeveloping marinas, require coastal site plan conditions that incorporate the practices identified in *Best Management Practices for Coastal Marinas* (DEP-OLISP, August 1992).

- Coordinate with the Department of Environmental Protection's Stormwater Management Unit to make sure that all eligible stormwater discharges from industrial, commercial, or construction activities are covered by the appropriate general permit and to ensure compliance with Stormwater Pollution Prevention Plans.

- Refer coastal site plan review applications for waterfront sites or significant development proposals within the coastal boundary to the DEP's Office of Long Island Sound Programs for comment and technical assistance.

Connecticut Department of Environmental Protection
Inland Water Resources Division Fact Sheet
Considering Low Impact Development Principles in Site Design

In order to reduce the impact of development and address stormwater quality issues, the Department strongly encourages the use of Low Impact Development (LID) measures. LID is a site design strategy intended to maintain or replicate predevelopment hydrology through the use of small-scale controls, integrated throughout the site, to manage stormwater runoff as close to its source as possible. Infiltration of stormwater through LID helps to remove sediments, nutrients, heavy metals, and other types of pollutants from runoff.

Key Strategies for LID

Key strategies for effective LID include: infiltrating, filtering, and storing as much stormwater as feasible, managing stormwater close to where the rain/snow falls, managing stormwater at multiple locations throughout the landscape, conserving and restoring natural vegetation and soils, preserving open space and minimizing land disturbance, designing the site to minimize impervious surfaces, and providing for maintenance and education. Water quality and quantity benefits are maximized when multiple techniques are grouped together. In areas of compacted and/or possibly contaminated soils, soil suitability should be further investigated prior to selecting optimum treatment and/or remediation measures. Where soil conditions permit, the DEP encourages the utilization of one, or a combination of, the following measures:

- the use of pervious pavement or grid pavers (which are very compatible for parking lot and fire lane applications), or impervious pavement without curbs or with notched curbs to direct runoff to properly designed and installed infiltration areas;
- the use of vegetated swales, tree box filters, and/or infiltration islands to infiltrate and treat stormwater runoff (from building roofs, roads, and parking lots);
- the minimization of access road widths and parking lot areas to the maximum extent possible to reduce the area of impervious surface;
- the use of dry wells to manage runoff from building roofs;
- incorporation of proper physical barriers or operational procedures for special activity areas where pollutants could potentially be released (e.g. loading docks, maintenance and service areas, dumpsters, etc.);

- the installation of rainwater harvesting systems to capture stormwater from building roofs for the purpose of reuse for irrigation (i.e. - rain barrels for residential use and cisterns for larger developments);
- the use of residential rain gardens to manage runoff from roofs and driveways;
- the use of vegetated roofs (green roofs) to detain, absorb, and reduce the volume of roof runoff; and
- providing for pollution prevention measures to reduce the introduction of pollutants to the environment.

LID in Urban Areas

If the proposed site is located in a highly urbanized area, it is likely underlain by urban land complex soils. The Natural Resources Conservation Service (NRCS) Soil Web Survey (http://websoilsurvey.nrcs.usda.gov/app/HomePage.htm) provides information on soil textures, parent materials, slopes, height of seasonal high water table, depth to restrictive layer, and permeability. In highly developed areas, infiltration may be limited due to the high percentage of impervious cover. However, infiltration practices may be suitable at urban sites depending on:

• Potential contamination of soils in historically industrialized areas. The siting of areas for infiltration must consider any existing soil or groundwater contamination.

• Site specific soil conditions. NRCS mapping consists of a minimum 3 acres map unit and soils may vary substantially within each mapping unit. Test pits should be dug in areas planned for infiltration practices to verify soil suitability and/or limitations.

• Investigation of areas of compacted soils and the utilization of proper construction staging. Planning should insure that areas to be used for infiltration are not compacted during the construction process by vehicles or machinery.

Even if infiltration is limited at a site, it is still possible to implement LID practices. Specifically, potential exists for the installation of green roofs on buildings and/or the use of cisterns to capture and reuse rainwater.

LID in Areas with a High Seasonal Water Table or Hardpan Layer

- The impact of stormwater runoff to any streams and/or wetlands near the site should be considered. Water quality treatment is influenced by hydraulic conductivity and time of travel. If stormwater infiltration is limited by an impermeable layer close to the surface, the water may run laterally through the ground and discharge to the stream or wetlands, providing limited water quality treatment. However, a longer time of travel may provide sufficient treatment. Proper soil testing for infiltration potential will increase the likelihood of successful BMP design.

- In areas with a high seasonal water table, bioretention areas/rain gardens should be planted with water tolerant/wetland plants. The presence of a high seasonal water table suggests that water may drain slowly or not at all during certain parts of the year. Planting native wetland vegetation will help to ensure plant survival and increase the effectiveness of bioretention practices. Information on native plantings that are both drought tolerant and tolerant of wet conditions can be found in The UConn Cooperative Extension System's guide to building a rain garden at http://nemo.uconn.edu/publications/rain_garden_broch.pdf. Native plant lists for Connecticut can also be found at http://www.fhwa.dot.gov/environment/rdsduse/ct.htm.

LID Guidance for Federal Projects

- LID techniques have been utilized by Department of Defense (DoD) agencies during the last several years. The effectiveness of these projects in managing runoff as well as reducing construction and maintenance costs has created significant interest in LID. The DoD has created a Unified Facilities Criteria document, Low Impact Development, that provides guidelines for integrating LID planning and design into a facility's regulatory and resource protection programs. It is available on-line at: http://www.wbdg.org/ccb/DOD/UFC/ufc_3_210_10.pdf.

- Section 438 of the Energy Independence and Security Act (EISA) of 2007 requires federal agencies to reduce stormwater runoff from federal development projects to protect water resources. In December 2009, the EPA developed a technical guidance document on implementing the stormwater runoff requirements for federal projects under Section 438 of EISA. The document contains guidance on how compliance with Section 438 can be achieved, measured and evaluated and can be found at: http://www.epa.gov/owow/NPS/lid/section438/pdf/final_sec438_eisa.pdf.

For more information contact the CT DEP Watershed Management/Low Impact Development Program:

Name	Area	Telephone
MaryAnn Nusom Haverstock	Program Oversight	(860) 424-3347
Chris Malik	Watershed Manager	(860) 424-3959
Susan Peterson	Watershed Manager	(860) 424-3854
Eric Thomas	Watershed Manager	(860) 424-3548
Jessica Morgan	Low Impact Development Coordinator	(860) 418-5994

What's Happening to the Water Cycle?

As we develop our land and increase the amount of paved surfaces and buildings, known as impervious cover, the water cycle is changed. Less rainfall and snowmelt sinks into the ground and more water flows rapidly over the land into our lakes, rivers and estuaries. Stormwater runoff can lead to increased flooding, erosion, pollution and decreased groundwater recharge during dry periods.

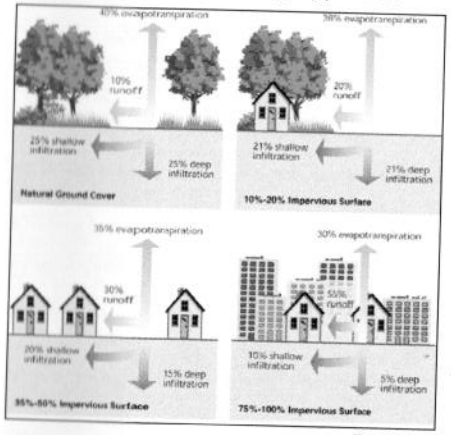


Photo: FISRWG

As impervious surfaces increase, the problems associated with stormwater also increase. Stormwater can contain pollutants such as sediment, nutrients, bacteria and chemicals that can threaten aquatic health, and contribute to the loss of water dependent recreational activities. Stormwater is recognized nationally as the leading cause of water pollution today.

Conventional methods of land development collect and convey stormwater quickly into a series of drains and pipes that flow directly into the closest waterbody with little or no water quality treatment.

How can we fix it? LID!

Low Impact Development (LID) techniques manage stormwater runoff by imitating the natural movement of water in the environment. LID decreases the volume of runoff and improves water quality by infiltrating, filtering, storing and evaporating stormwater. LID transforms stormwater from a nuisance that must be disposed of quickly into an asset that nourishes ground water resources. Ground water is an important source of drinking water supply, and also helps to maintain stream flow during critical dry weather periods when fish and aquatic life are most vulnerable.

The primary goals of LID are to:

- Manage and treat stormwater starting at its source and at multiple locations throughout the landscape
- Protect natural systems and processes (water movement, vegetation, native soils, sensitive/important features)
- Incorporate natural features (wetlands, stream corridors, mature forests) as design features into development plans
- Re-evaluate the cost and use of traditional building techniques and infrastructure (lots, streets, curbs, sidewalks, storm drains)
- Preserve open space and minimize land disturbance

LID techniques can be utilized both within your community and around your home. Practices can be applied singly or in a sequence. When multiple techniques are grouped together, water quality and quantity benefits are maximized.

Low Impact Development Practices

Rain Barrels – Low cost collection devices connected to your downspout that store roof runoff for later use. Using rain water for watering plants or washing your car can lower your water bill and decrease demand during times of drought.

Rain Gardens – Also called bio-retention areas, are depressed perennial or shrub gardens with both water and drought-tolerant plants. Rain gardens manage runoff by collecting rain water from rooftops and lawns into the garden, where it can infiltrate into the ground. Rain gardens are designed to hold water for only a few hours after a storm, so there is limited opportunity for mosquitoes to breed.

Swales – Broad, shallow channels planted with dense vegetation along roads, driveways and parking lots. Properly designed and maintained swales can trap pollutants, increase groundwater recharge and slow the flow of runoff, reducing erosion.

Photo: US FHWA

Buffers – Natural or landscaped areas used to separate a body of water from an area of intensive land use, preventing sediment and other pollutants from reaching the water.

Permeable Pavements – Surfacing materials such as gravels, concrete pavers, and porous asphalt/concrete which allow rainwater and runoff to infiltrate into the ground, instead of running into the storm drain.

Photo: UCONN NEMO

GreenRoofs – Engineered systems of soil and plants that detain, absorb and filter rain, and reduce the volume of roof runoff. Green roofs may be applied to many existing flat roofs and new construction. Some green roof companies will work with a homeowner to supply a "do-it-yourself" kit that is appropriate for a residence.

Photo: City of Seattle, WA

Narrowed Roads – Reduce runoff by decreasing the amount of paved area. This will increase infiltration into the ground and decrease the volume of water sent into the storm sewer system. These roads also calm traffic and can add to neighborhood aesthetics.

Low Impact Development and You

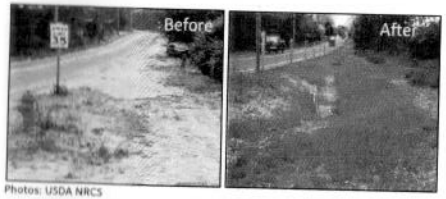
Every resident can promote the use of LID in their community. Ways that you can be proactive include:

- Incorporate one or more LID practices in your own yard
- Educate others in your neighborhood about the benefits of LID
- Encourage your municipal officials to implement LID demonstration projects in public areas
- Promote discussion of community-wide LID goals
- Participate with your local government to amend existing zoning and/or subdivision regulations to allow the use of LID

All LID features require some maintenance to work properly over their lifespan, but are often less work than traditional landscaping practices.

Low Impact Development Working for You

A number of Connecticut communities are starting to use LID practices. Shown below is a drainage swale created along a busy road in Wallingford designed to capture and filter runoff before it enters a local lake.



Photos: USDA NRCS

The Benefits of Low Impact Development

For Your Town:

- Can preserve features that are important to a town's character
- Helps balance the need for growth with environmental protection
- Reduces the costs of infrastructure maintenance (streets, curbs, sidewalks, storm drains)
- Slows/calms traffic and provides an attractive and pleasing environment for residents through narrower streets and street side plantings
- Can be applied to residential, commercial and even industrial properties
- Is consistent with environmental responsibility while increasing marketability.

For Your Environment:

- Helps maintain the natural hydrology of the site and the health of our surface and ground water supplies
- Preserves the ecological and biological balance of the natural system
- Protects water quality by reducing sediments, nutrients, and other pollutants
- Preserves trees and other natural vegetation
- Provides habitat for wildlife

Want to Know More? Click to Explore!

UCONN's Nonpoint Education for Municipal Officials (NEMO) website provides tools, resources, publications and more:
www.nemo.uconn.edu

For NEMO's LID elements, site design and more:
http://nemo.uconn.edu/tools/stormwater/index.htm

For NEMO's guide to building a rain garden:
http://www.nemo.uconn.edu/tools/publications.htm

The USDA Natural Resource Conservation Service has information about rain gardens at:
http://www.ct.nrcs.usda.gov/eln-educational_materials.html

Jordan Cove Urban Watershed Project discusses the creation of a LID neighborhood in CT:
http://jordancove.uconn.edu/

The CT DEP Stormwater Quality Manual provides guidance on including LID in development:
www.ct.gov/dep/stormwater

Boston Metropolitan Area Planning Council, LID Toolkit provides information and resources:
http://www.mapc.org/LID.html

U.S. EPA LID website offers information:
http://www.epa.gov/owow/nps/lid/

First Brochure of the LID Series

For more information contact CT DEP's Watershed Management Program:
Jessica Morgan - LID Coordinator
jessica.morgan@ct.gov
860-418-5994
http://www.ct.gov/dep/watershed

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Updated 04/09 This document was printed on recycled paper.

Rainfall as a Resource

A Resident's Guide to Low Impact Development In Connecticut

This neighborhood in Waterford, CT was constructed using multiple Low Impact Development techniques. Photo: Jordan Cove Urban Watershed Project, UCONN.

Connecticut Department of Environmental Protection
Bureau of Water Protection and Land Reuse
Planning and Standards Division
79 Elm Street, Hartford, Connecticut 06106

Date:_____

Project:_____

Reviewer:_____

STORMWATER/LID REVIEW CHECKLIST

Part 1: General Information

Definitions for terms used throughout this document can be Found in the *2004 CT Stormwater Quality Manual

1. Development Details

☐ Redevelopment of existing developed footprint. (no increase in impervious surface)
☐ Redevelopment of existing developed site with expansion of developed footprint
☐ New proposed developed site

2. Development Type

☐ Residential ☐ Commercial ☐ Industrial ☐ Mixed Use ☐ Other_____

3. Proposed Site Development:

Acreage of site: _____ac.

Acreage of existing impervious surfaces: _____ac. _____% of site

Acreage of site proposed to be disturbed: _____ac. _____% of site

Acreage of total impervious surfaces: _____ac. _____% of site

4. Waterbody and Watershed Information:

Named waterbodies on or adjacent to the site:_____

Regional and subregional watersheds site is located in:_____

Are any waterbodies included on the CT Impaired Waters List?_____

If yes, name the impairment_____

and possible identified cause(s) and source (s):_____

Part II: Site Planning and Design

1. Stormwater Objectives for Surface Flows *(check all that apply)*

☐ Water Quality Treatment
☐ Peak flow control
☐ Run-off volume reduction
☐ Stream channel protection

2. Stormwater Objectives for Groundwater Recharge *(check all that apply)*

☐ Run-off volume reduction
☐ Peak flow control
☐ Stream channel protection
☐ Maintain groundwater resources

Storm event(s) used for #1 and #2: _____

2. Proposed site planning and Low Impact Design concepts used to minimize stormwater impacts: *(check all that are addressed)*

Development Designed to Minimizes Impacts to Natural Features

- ☐ Preservation of large areas of land in a natural vegetated state
- ☐ Vegetated buffers have been provided and enhanced.
- ☐ Designed to fit the terrain. Natural drainage patterns maintained
- ☐ Stormwater treatment designed to reduce the impact on natural wetlands and vernal pools.
- ☐ Stormwater management conducted at multiple locations
- ☐ Designed to limit land disturbance/impervious surfaces.
  - ☐ reduced parking
  - ☐ reduced or zero lot line setbacks
  - ☐ shared driveways
  - ☐ cluster/open space subdivision
- ☐ Conservation and/or restoration of native soils. Compacted soils addressed.
- ☐ Creation of steep slopes has been minimized.
- ☐ Landscaping practices promote native/drought resistant/non-invasive plantings
- ☐ Lawn areas are minimized and use of organic lawn care practices promoted.

Development Reduces and Addresses Stormwater Impacts

- ☐ Impervious areas have been reduced and infiltration increased
  - ☐ Reduced street widths and lengths
  - ☐ Alternative cul-de-sac design and parking lot islands
  - ☐ Reduced parking lot size
  - ☐ Elimination or reduction of sidewalk widths or placement on only one side
  - ☐ Driveway alternatives incorporated; (shared, two track, permeable)
  - ☐ Removal or breaks in curbing where feasible
  - ☐ Use of permeable materials on roads, parking lots, sidewalks, driveways and patios
  - ☐ Use of vegetated green roofs
  - ☐ Infiltration of run-off through use of dry wells, infiltrators and permeable surfaces
- ☐ Impervious surfaces disconnected where possible; roof drains, pipe flow, curb openings
- ☐ Development has been designed to diffuse flow concentration by sheet flow, curbless design, perimeter swale/level spreader, etc.
- ☐ The Water Quality Volume (WQV) has been identified and appropriately treated.
  - ☐ Treatment of "first flush", 1" of rainfall
  - ☐ Incorporation of rain gardens
  - ☐ Soil amendments/filters
  - ☐ Use of Bioretention
    - ☐ Manmade wetland systems
    - ☐ Grassed swales
    - ☐ Tree box filters
    - ☐ Shallow vegetated depressions
  - ☐ Other initiatives/emerging technology_____
- ☐ Source controls and pollution prevention measures have been incorporated to minimize pollutant levels. Oil, grease and debris traps/separators have been used where needed.
- ☐ Methods for the control of increases in the peak flows, volume and flood control addressed.
- ☐ Use of cisterns and/or rain barrels for rainwater harvesting

Short and Long Term Best Management Practices Addressed

- ☐ Site maintenance for stormwater treatment controls during and post construction included.
- ☐ Maintenance access for all stormwater treatment practices included.
- ☐ Responsible party for implementation, maintenance and correction of stormwater treatment practices has been designated and appropriate contact documentation submitted.
- ☐ Treatment practices designed to minimize the potential for nuisance insects and vectors.
- ☐ Incorporation of additional barriers, collection and treatment systems for regulated substances or other uses of concern; (dumpsters, loading docks, service areas)
- ☐ Water quality monitoring of stormwater treatment practices addressed

3. Critical Resources and Details Included: Existing and proposed resources and details, on or adjacent to the site, affecting stormwater treatment and design which are included on the plan and/or in support documentation as appropriate *(check all which are addressed)*

Existing and proposed modifications to Natural Features

- ☐ Wetlands, streams, ponds, vernal pools, shorelines and coastal resources
- ☐ Flood hazard, flood zones and flood ways
- ☐ Surface and groundwater quality classification of on-site and adjacent water bodies
- ☐ Site vegetative patterns, existing and proposed (including native tree cover)
- ☐ Site topography
- ☐ Soils as defined by USDA/NRCS web soil surveys, including names and descriptions

Existing and Proposed Development, Infrastructure and Utilities

- ☐ Existing development and neighboring land uses
- ☐ Sub-grade walls, retaining walls, underground utilities and filled or excavated areas
- ☐ Wells, aquifers and public drinking water supplies
- ☐ Septic tanks and leach fields

Sebacks and Overlay Zones

- ☐ Regulated setbacks overlay zones, critical areas and greenways established by authorities

Stormwater

- ☐ A summary narrative explaining; overall stormwater management plan, changes to pre-and post-development peak runoff rates, volume and water quality for the site is provided.
- ☐ Drainage patterns and flow paths
- ☐ Watershed divides (pre and post) on map with associated acreages
- ☐ Impervious area and run-off coefficient
- ☐ Time of concentration flow paths and impervious coverage in each watershed are included.
- ☐ Deep test holes, soil borings, infiltration percolation and/or permeability tests used for the design of bioretention/infiltration practices have been conducted and data/findings included.
- ☐ Potential pollutant sources (including erosive soils, landscaped area, commercial operations)
- ☐ Type of anticipated stormwater pollutants and removal percentages
- ☐ Other stormwater management infrastructure

Waivers

- ☐ Waivers from local commissions for any stormwater and Low Impact Development (LID) practices have been identified. Include details:_____

Municipal Comments:

Additional LID practices that should be considered:

Additional stormwater design information required:

Additional site plan information that should be submitted:

Additional information necessary:

Part III: Stormwater Treatment Practices

1. Provide a diagram of the treatment train showing the practices used, their location, and how they are connected. Attach and label a separate sheet to checklist.

A. Practices Used *(check all that apply)*	
Primary Treatment	**Secondary Treatment**
☐ Stormwater Pond	**Conventional**
☐ Micropool extended detention pond	☐ Dry detention basin
☐ Wet pond	☐ Underground detention facilities
☐ Wet extended detention pond	☐ Deep sump catch basins
☐ Multiple pond system	☐ Oil/particle separators
☐ Pocket wetland	☐ Dry wells
☐ Stormwater Wetlands	☐ Permeable pavement
☐ Shallow wetland	☐ Vegetated filter strips
☐ Extended detention wetland	☐ Grass drainage channels
☐ Pond/wetland system	**Innovative/Emerging Technologies**
☐ Infiltration Practices	☐ Catch basin inserts
☐ Infiltration trench	☐ Hydrodynamic separators
☐ Infiltration basin	☐ Media filters
☐ Filtering practices	☐ Underground infiltration systems
☐ Surface sand filter	☐ Alum injectors
☐ Underground sand filter	
☐ Perimeter sand filter	
☐ Organic filter	
☐ Bioretention	
☐ Water Quality Swales	
☐ Dry swales	
☐ Wet swales	

1. If no primary treatment practice is used, explain why.

2. If treatment is not provided for all stormwater run-off, explain why.

3. Are other innovative emerging technologies proposed that are not listed? If yes, please describe technologies and provide appropriate information.

C. Stormwater Pollutants Generated and Removed *(check and report rates on all that apply)*	
Type of Pollutant Generated	**Percent removal expected per treatment train (attach additional sheets if necessary)**
☐ Sediment	
☐ Phosphorus	
☐ Nitrogen	
☐ Metals	
☐ Hydro-carbons	
☐ Bacteria	
☐ Other; specify	

Source(s) of removal rates: