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CONFERENCE

Saturday
November 8, 2008
8:30 AM – 4:00 PM
MountainRidge,
Wallingford, CT

Speaker:

To Be Announced

Workshops: Topics for a day-long series of workshops for conservation and inland wetlands commissioners and staff are being finalized. The workshops are organized into four tracks: Open Space / Resource Conservation, Wetlands & Watercourse Protection, Science & Technology, and Commission Leadership & Administration. Opportunities to network, view many informational displays on conservation issues and presentation of the CACIWC Annual Achievement Awards will complete the scheduled activities.

MAKING CONSERVATION COMMISSION RECOMMENDATIONS COUNT: WHAT'S FREE ADVICE WORTH? WHAT YOU MAKE IT WORTH!

by Mark K. Branse, Esq., Branse & Willis, LLC

Many towns have separate conservation commissions, i.e., not combined with an Inland Wetlands and Watercourses agency having regulatory powers for wetlands permits. A combined commission wears two "hats" (see *The Habitat* Vol. XII, No. 4, January, 1999), and has the advantage that applicants *must*, in most cases, at least appear before the commission and get a permit. The separate conservation commission has no such leverage and is purely advisory to other land use agencies. How do you make that advice count?

Know Your Own Role

Conn. Gen. Stats. §7-131a authorizes municipalities to create conservation commissions. The relevant provisions are as follows:

- (a) Any town, city or borough, by vote of its legislative body, may establish a conservation commission **for the development, conservation, supervision and regulation of natural resources**, including water resources, within its territorial limits. * * *
- (b) A conservation commission shall conduct research into the utilization and possible utilization of land areas of the municipality and may coordinate the activities of unofficial bodies organized for similar purposes, and may advertise, prepare and distribute books, maps, charts, plans and pamphlets as necessary for its purposes. It may propose a greenways plan for inclusion in the plan of conservation and development of the municipality prepared pursuant to Section 8-23. It may inventory natural resources and formulate watershed management and drought management plans. Such plans shall be consistent with water supply management plans prepared pursuant to Section 25-32d. It shall keep an index of all open areas, publicly or privately owned, including open marshlands, swamps and other wetlands, for the purpose of obtaining information on the proper use of such areas, **and may from time to time recommend to the planning commission or, if none, to the chief executive officer or the legislative body plans and programs for the development and use of such areas. It may make recommendations to zoning commissions, planning commissions, inland wetlands agencies and other municipal agencies on proposed land use changes.** * * *. (Emphasis added).

So you have authority, by Statute, to *advise* your sister land use agencies, as well as other municipal agencies concerning a wide variety of land use topics.

Recommendations, continued on page 3

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Congratulations!

The efforts of a 12-year, locally led effort to protect the Eightmile River in East Haddam, Lyme and Salem came to fruition May 8, 2008 when President Bush signed a bill into law that designates the Eightmile as a Wild & Scenic River. This designation is the final step in an exhaustive Wild & Scenic process that focused on identification and study of the river's outstanding resource values and community protection efforts.

Prior to the approvals in Washington, a Watershed Management Plan was completed that, along with the Wild & Scenic designation plan, was overwhelmingly endorsed by the three communities and their land use commissions and elected officials.

"The real success of this designation is the many people from the towns who have supported, worked on and made this designation a reality." said Anthony Irving, chair of the Eightmile Wild & Scenic Coordinating Committee. "With so many believers the future protection of this river system is in good and capable hands."

The Watershed Management Plan and an interactive map of the watershed are available at www.eightmileriver.org. 

RESOURCES

INLAND WETLANDS TRAINING DVD FOR NEW COMMISSION MEMBERS

In December 2005 the Department of Environmental Protection introduced a training DVD targeted towards new municipal inland wetlands agency members. The DVD focused on the Connecticut Inland Wetlands and Watercourses Act and examined critical topics such as: the definitions of inland wetlands and watercourses; the commission meeting; and timelines for applications and amendments. The DVD was revised and redistributed to all municipal inland wetlands agencies in February 2008. Please note that the original DVD (volume 1) is still a very valid and useful training tool. The original DVD (volume 1) and the revised DVD (volume 1a) differ only in that the revised DVD contains information on site walks. The Department of Environmental Protection has mailed a copy of each DVD volume to every municipal inland wetlands agency. If you are a new commission member and would like to view the DVD please contact your chairperson or town wetlands staff. 

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Can the Other Agency Heed Your Advice?

There is no case law concerning the weight to be given to a conservation commission recommendation, but the courts have held that it is not an abuse of discretion for a land use agency to act upon the advice of an agency that is statutorily authorized to render such advice. In *Arway v. Bloom*, 29 Conn. App. 469 (1992), affirmed 227 Conn. 799 (1993), the Redding Inland Wetlands and Watercourses Commission granted a permit and transmitted its decision to the Zoning Commission per its duty under Conn. Gen. Stats. §8-3(g) and 8-3c(b) to file a report with that Commission, which in turn, was required to give “due consideration to the report” of the Wetlands Commission. *Id.* The Zoning Commission approved the use subject to a number of conditions, the first of which was drawn verbatim from the Wetlands Commission’s approval. Neighbors appealed the Wetlands and Zoning approvals, and the trial court sustained the Wetlands appeal on procedural grounds. The trial court then sustained the Zoning appeal on the grounds that since the Wetlands decision was void, the Zoning Commission had acted illegally in giving “due consideration” to that permit when approving the site plan. The Appellate Court overturned the trial court decision:

“Wherever possible, specify the changes that you are seeking. The authority of a land use agency to just deny an application is much lower than its authority to modify or condition one.”

Here, the zoning commission acted on the applicants’ site plan and special permit application with a favorable final report from the wetlands commission in hand. The fact that the wetlands decision was later reversed by the trial court on procedural grounds did nothing to disturb the zoning commission’s jurisdiction to render its own decision at the time it considered the wetlands report.

Id., pp. 479-480.

So it would appear that other land use agencies *can* heed the advice you are Statutorily authorized to give them and the courts will support that.

Getting Them to Listen

OK, the other agency *can* heed your advice. But why *should* they?

Know the Ground Rules: In order for your advice to be effective, you have to know the scope of authority and discretion of the receiving agency to accept it. What kind of application is being heard—text or map amendment for wetlands or zoning, subdivision text amendment, special permit, wetlands permit, subdivision, or site plan review? They all have different levels of discretion that the agency can exercise, and they are arranged in the preceding sentence from highest to lowest levels of discretion. If it’s a permit application, what are the criteria of the regulations that the agency is applying? To the extent that you can couch your recommendations by reference to

the words used in the regulatory criteria, you increase the agency’s confidence that it can heed your advice, and you also boost the agency’s chances for being upheld on appeal. The worst thing you can do is recommend that another agency do something that, by its own regulations, it is not authorized to do. You lose credibility and, if they heed your advice, you expose them to a successful court appeal.

Know the Facts: Unlike the combined wetlands commission, you have no way to *force* an applicant to come in and make a presentation to you. Some zoning and/or subdivision regulations include a requirement for referral to the conservation commission, and I would certainly urge you to seek such regulations. Without that, you have two options: invite the applicant before you (with adequate notice) and hope that they will appear; or get the facts from town staff members. But whatever it takes, know what you are talking about.

Know the Schedule: A last-minute recommendation is less likely to be heeded by either the applicant or the receiving agency. I represent applicants, and they always try to accommodate every possible concern *if they hear it early enough*. Once the final drainage calculations are completed, it is a lot more expensive and time-consuming to make what would otherwise be a small tweak in the stormwater management plan. So try to get into the process at the earliest possible moment.

Be Honest: Let’s face it, a lot of the opponents who appear at a public hearing and waive the flag of “environmental protection” never gave a damn until there



JOURNEY TO THE LEGAL HORIZON

by Janet P. Brooks

Question:

An environmental intervenor has submitted a petition requesting notice of any meeting on a specific application. The intervenor believes that contact with staff on the application, whether by telephone, e-mail or an in-person meeting, is subject to notice. Is an environmental intervenor legally entitled to notice of any “meeting” that the wetlands agency staff has with the applicant or its representatives?

Answer:

This question presents the first opportunity in this column to look at the effect that the Connecticut Environmental Protection Act¹ (“CEPA”) has upon the Inland Wetlands and Watercourses Act. We’ll start with a general overview of CEPA and end with the opening question.

Wetlands agencies have to carry out their duties under the Inland Wetlands and Watercourses Act. Wetlands agencies are “creatures of statute” and cannot act outside their enabling statute. However, other laws apply to wetlands agencies as well, most notably, the Freedom of Information Act (“FOIA”), which establishes the right to open meetings and access to public documents. CEPA is another law that can apply to wetlands agencies. It is an unusual law, in that CEPA applies only when it is invoked. In contrast, FOIA applies to wetlands agencies without having to be invoked. CEPA was passed in 1971 to provide “all persons with an adequate remedy to protect the air, water and other natural resources from unreasonable pollution, impairment or destruction.” The law creates two remedies: (1) bringing a court action to stop the unreasonable conduct (no money damages); (2) intervention by anyone, broadly defined, in administrative agency proceedings to raise environmental issues.

Any person, and more specifically “the Attorney General, any political subdivision of the state, any instrumentality or agency of the state or of a political subdivision thereof,” can become an intervenor by filing a “verified pleading.” The Connecticut Supreme Court has

¹ The Connecticut Environmental *Protection* Act should not be confused with the Connecticut Environmental *Policy* Act, also referred to as CEPA, a law which requires *state agencies* to make a written evaluation of environmental impacts before proceeding with actions which may potentially adversely affect the environment.

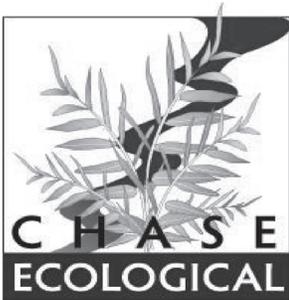
interpreted the list of potential intervenors quite broadly. The intervention of a town council was upheld in zoning and wetlands agency proceedings. A “verified pleading” is simply a written statement in which the intervenor asserts that the proceeding “involves conduct which has, or which is reasonably likely to have, the effect of unreasonably polluting, impairing or destroying the public trust in the air, water or other natural resources of the state.” “Verified” means the intervenor has sworn to truth of the allegations, in the presence of a notary public or attorney, whose signature is also included. The intervenor does not have to prove the truth of the allegations in the petition in order to intervene. Through court cases, the law has been interpreted to protect only those natural resources over which the agency has jurisdiction. So, while inland wetlands and watercourses may be the subject of a CEPA intervention before a wetlands agency, air quality may not.

The intervenor becomes a party to the proceedings. As a party the intervenor may put on evidence to prove the allegations of unreasonable conduct to rebut the applicant’s presentation, and may cross-examine the applicant or their representatives. If an intervenor is successful at proving the harmful effect of the proposed conduct, the agency is not authorized to approve the application as “long as there is a feasible and prudent alternative.” The intervention process starts with a sworn statement alleging unreasonable conduct to a natural resource. It ends with the agency determining whether there is proof of the unreasonable conduct, and if so, whether there is a feasible and prudent alternative to the proposal.

CEPA intervention provides a potent tool to present an agency with testimony and argument why an application should be denied. A third party does not have to rely on the strength of an agency and its ability to evaluate an applicant’s proposal. The CEPA intervenor can provide it through its experts. The intervenor is on equal footing with the applicant. The applicant needs to show its entitlement to a permit; the CEPA intervenor, proof of the unreasonable pollution, impairment or destruction of a natural resource.

The CEPA intervenor has more rights than a member of the public speaking at a public hearing. The intervenor

Legal, continued opposite



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Legal, continued

may rebut evidence and cross-examine witnesses. The right of the public to participate is not expanded by the presence of a CEPA intervenor in a proceeding.

But does the authority to intervene in an administrative proceeding extend to involvement in the staff's day-to-day administering of the wetlands program in the town hall? Probably not. There haven't been any legal cases addressing this question, but it is hard to identify the legal theory to support intervention into the town employee's administering of his/her duties. Agency proceedings take place in public places upon duly noticed meetings. The actions of an agency at such a meeting constitute the agency proceedings, not the staff's discussions on the telephone or in person at the counter in the land use office, reply to an e-mail. After all, case law has clearly stated that an agency does not have to endorse an opinion held by the staff. The staff has no voting power.

The amount of time town staff can devote to an applicant, member of the public or CEPA intervenor will vary from town to town. CEPA does not prescribe a course of conduct between town staff and intervenors. A town is free to allocate its staff resources as it chooses in administering the wetlands act. In some towns staff may give the intervenor notice of communication between the staff and the applicant. CEPA does not require town staff to give notice of such communications. The law establishes a mechanism to permit third-party intervention into an agency proceeding and to require the agency to determine whether the proposed activity is reasonably likely to unreasonably pollute, impair or destroy a natural resource.

Janet P. Brooks is an attorney with D'Aquila & Brooks, LLC in Middletown. She has written a book for lawyers on CEPA, along with David F. Sherwood, Connecticut Environmental Protection Act, Volume 15 of the Connecticut Practice Series.



Recommendations, continued from page 3

was an application in their own back yard. Don't get sucked into that. Treat all applicants and applications equally. Adopting a set of guidelines (such as criteria for open space) will help you to be consistent and demonstrate to both the agency and the applicant that you are playing fair.

Be Specific: A recommendation that is vague is less likely to be heeded. State *as precisely as you can* what should change about the proposal and why. Recommendations like, "the development is too dense" or "the open space is located in the wrong place" are sure to be ignored—and they *should be*.

Be Constructive: Wherever possible, specify the changes that you are seeking. The authority of a land use agency to just deny an application is much lower than its authority to modify or condition one. Seek ways that the proposal can reasonably be modified to achieve both your goals and the applicant's. Remember: An applicant would like to go to the regulatory agency with a positive recommendation from you, so if they can make changes to their plan to achieve that, they will.

Be There: Letters and e-mails are great for setting forth a position of your commission, but the applicants will be at the agency hearing in person, with their entourage of experts. If you really want your advice to be taken, you need to be prepared to send one or more live bodies to attend the hearing and present your letter, amplify on it if need be, and respond to questions or comments.

Be Respectful: The problem with being "just" an advisor is that there will be times when your advice is ignored. Don't get mad! Always give the agency a face-saving way out if you can: "We felt that open space in the northwest corner made sense for the reasons articulated in our letter, but we understand the agency giving a higher priority to an active recreation field in the southwest corner." Throwing a tantrum will not increase your credibility with the agency and will almost surely decrease it.

Be Watchful: There is a fine line between "I told you so" and "please note what happened on that other project when you didn't heed our advice. Gosh, it would be good not to have *that* happen again!" In Glastonbury, we were able to persuade the Council to hire the Town's first environmental planner because of a costly and destructive error that would have been easily avoidable by proper

review. Use past mistakes to make your point, but don't humiliate the ones who *made* those mistakes—they're probably the people whose support you are seeking.

Infiltrate: Many land use agencies have trouble getting volunteers to serve, and with the long hours, lack of public gratitude, and low "wages," it's no wonder. *You* are prime candidates. Volunteer!

You *can* make a difference in the process! Know the rules, be constructive, be alert!

*** *Denotes partial paragraph*

Editor's Note: CACIWC's goal is to have separate conservation commissions in all 169 towns--there are now 99. Twenty-five of the 99 separate conservation commissions have been established since 2001 with many of them previously combined with Inland Wetlands Commissions (see "A Conservation Commission Renaissance", The Habitat, Vol. XVIII No. 4, Fall 2006, pg. 3). As separate commissions there is time to carry out conservation commission responsibilities, including conducting land use research and advising other land use commissions. Atty. Branse' article provides excellent guidelines for making your advice effective.



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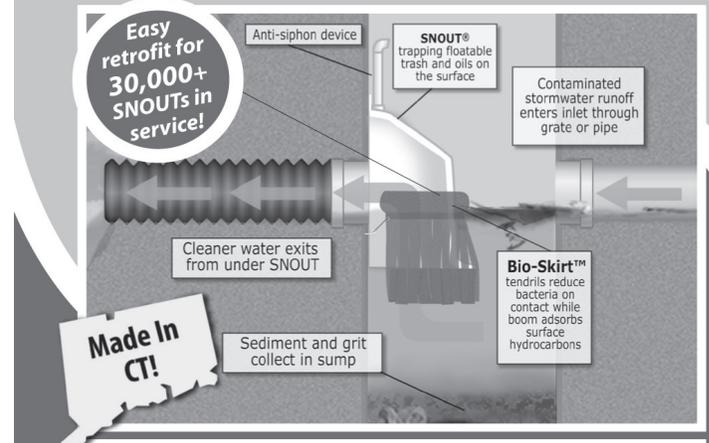
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Rain Gardens and Bioretention Models for Stormwater Management, Pollutant Control and Low Impact Development

by Kim Kelley, Uconn Cooperative Extension Program

Managing storm water and surface run off, which both contain point and non-point source pollutants, are major concerns for both residential and commercial land use applications. Non-point source pollution occurs when water runs over land or through ground, picks up pollutants and deposits them in surface waters or introduces them to groundwater (<http://www.epa.gov/owow/nps/facts/point5.html>). Successful models to address these problems have been developed and implemented that utilize, and in some cases enhance, biological, chemical and physical processes that occur naturally in our environment. These models are based on bioretention and onsite retention and management of storm water. Having both commercial and residential applications, designs can be made to accommodate the specific needs of the site. Rain gardens based on the fundamentals of bioretention are designed for residential applications, whereas areas for larger commercial/municipal applications would require an engineered bioretention design in the site plan.

Rain gardens are easy to design and install, and are an effective tool for Low Impact Development (LID). It is important to understand that rain gardens are NOT water gardens. They are designed to infiltrate water quickly therefore removing any hazard of standing water. Rain gardens are made to accept run off from roofs, driveways and other impervious surfaces. By intercepting the run-off and utilizing the natural properties of existing plant and soil relationships, pollutants and particulates are, in essence, 'filtered out'. A properly designed rain garden captures the dirty 'first flush' and can accommodate as much as one inch of run off from above ground sources. The gardens can be sized to accommodate the volume and the nature of the input source. Some basic guidelines for designing and planning a rain garden come from replicating naturally occurring physical, chemical and biological processes.

To grasp the mechanics behind these designs there is a need to look more closely at these fundamental aspects of rain garden designs. They address the physical movement of water through interception, infiltration, settling, and filtration. This is done by capturing the run off or storm water into shallow well drained depressions. There may be instances where physical structures need

to be used to guide the water into the desired area. In larger bioretention areas curb cuts and pretreatment areas may be needed before the water reaches the infiltration stage. Once in the 'treatment' or settling area the design is based on soil, plant, and mulch relationships to pull the pollutants out of the water. Once directed toward the depression the design slows the water down allowing it to infiltrate into the surrounding soils. This leads to settling and filtering of particulates and suspended solids as the water moves through the soil and mulch. It is very important to know the composition of the soil as high levels of clay can lead to slow drainage, possible clogging, and eventual failure of the system. Our native Connecticut soils can be sufficient, but infiltration rates will need to be determined to prove the drainage is sufficient. Special soil mixes are available, and under drains may be installed to decrease any 'ponding'.

The biological and chemical properties of plant/soil/mulch relationships are responsible for the 'cleaning' of the water. Plants, through a process called transpiration, move water and dissolved substances from the roots, and up throughout the plant, eventually releasing water vapor from the leaves. Over 90% of the water taken up by the roots is released into the air via the leaves. This important plant function is a large factor of how nutrients are taken up from the soil, such as phosphate and nitrogen. Some plants are particularly good at taking up certain types of pollutants from the soil. This process, called phytoremediation, is the use of plants for the on-site remediation of contaminated soils and water. This concept is one of the basic principles in the design of bioretention areas.

Soils contain very active populations of microorganisms, such as fungi and bacteria, which play a vital role in decomposition, degradation, the development of humus. An 'active' soil is essential for the roots to successfully uptake dissolved substances. This is because there are chemical reactions and ion exchanges that help to move these nutrients into the plant. Humus, which can come from something as simple as leaf mulch, adsorbs or 'adheres' metals and nitrates, removing them from the water. Soils also play an important role in reducing thermal pollution. A study showed that bioretention was responsible for reducing the temperature from input runoff from 33 C to 22 C (Minami & Davis, 1999).

Gardens, continued next page

Gardens, continued

Plant selection is very important to the successful function of both rain gardens and bioretention areas. Wetlands plants are not to be used in these designs, as the water is supposed to drain quickly in these systems, leaving no standing water. A site plan that includes wetlands species for plant selection is not a rain garden design. Using a diverse selection of plants will discourage insect and disease problems and enhance the plant community. Recommended planting lists are available at the resource sites and links provided below. Proper plant choice will not only ensure a well functioning rain garden but also provide an aesthetically pleasing one.

How effective are these models in LID site plans? Rain gardens and bioretention areas are self sustaining systems when properly designed and installed, retaining and enhancing their effectiveness over time with minimal maintenance. As these natural processes do their 'work,' beneficial soil characteristics are enhanced, which in turn increase the plant/soil/mulch communities' ability to 'clean' the soil. This results in a low-maintenance and virtually self-contained functioning system.

Where can these systems be used, and why should we use them? They are a very cost effective and efficient way to deal with the biggest contributors to wetlands and water course pollution; thermal, point and non-point. Ease of installation makes this a viable option for existing sites whether commercial, municipal, or residential. New construction and site plans can incorporate these concepts into their design plans. Municipalities usually have large expanses of paved areas and open spaces with storm drains and other costly structures.

How are they cost effective? Several case studies have been performed comparing conventional Best Management Practices (BMP) designs to bioretention layouts. The results indicate that integrating bioretention across a site can achieve a net reduction of between 15 and 50% of site development costs when compared to conventional BMP's. Some of the key economic advantages are:

- Storm Water Management (SWM) costs and complexity reduced significantly
- Grading and sediment controls costs reduced by preserving dispersed drainage flow patterns
- Installation costs reduced by the use of non-structural design
- Reduction or elimination of storm drainage infrastructure

- Reduction/elimination of large scale SWM end-of-pipe treatment areas
(Prince George's County Bioretention Manual, 2002)

This BMP approach to storm water management is constantly being updated and refined as more municipalities become aware of its effectiveness. The following sites provide a much more intensive look at bioremediation and Rain gardens for LID, including useful charts and guidelines.

This article was adapted from information found in the following sources:

- Local examples of bioretention - visit the CT NEMO site. This site contains a searchable database for LID practices, engineering firms familiar with LID, and construction companies who have installed LID practices. <http://clear.uconn.edu/tools/lid/pdf/CT0012.pdf>
- UCONN Cooperative Extension System Rain Garden Manual
http://nemo.uconn.edu/tools/publications/rain_garden_broch.pdf
- EPA fact sheet Reducing Storm Water Costs Through Low Impact Development Strategies and Practices
<http://www.epa.gov/owow/nps/lid/costs07/factsheet.html>
<http://www.epa.gov/owow/nps/lid/>
- Comprehensive Bioretention Manual
<http://www.goprincegeorgescounty.com/Government/AgencyIndex/DER/ESD/Bioretention/bioretention.asp>
- Other rain garden sites
<http://www.dof.virginia.gov/rfb/rain-gardens.shtml>
<http://www.bae.ncsu.edu/topic/raingarden/>



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Connecticut Department of Environmental Protection

• Stream Crossing Guidelines •

Connecticut citizens may readily recognize the negative effects of existing dams on fish passage; however, many may not be aware that stream crossings, particularly culverts, can permanently block or seasonally impede upstream fish passage. Consequently, fish populations can become “fragmented” and thus unable to reach critical spawning, nursery, feeding, or seasonal refuge habitats. Fragmentation can contribute to reduced population density and species diversity within the affected waters.

Municipal inland wetlands commissions have permitting authority over many activities, including stream crossing projects that fall outside the regulatory purview of State and Federal agencies. Because of this, local land use officials have the opportunity to assist the DEP in the restoration of stream habitat fragmentation and to help prevent further fragmentation that might otherwise be caused by new projects.

DEP Inland Fisheries Division (IFD), Habitat Conservation and Enhancement staff have been assessing fish passage and instream habitat needs at stream crossings since the late 1980’s having adopted technical guidance and best management practices to ensure fish passage and habitat protection. Most recently, IFD staff have summarized this guidance into a publication designed to assist municipal officials and private landowners make informed decisions concerning the design, construction, and permitting of “fish friendly” stream crossings.

This article will only touch upon the highlights of this publication. The full document can be downloaded from the DEP website at: <http://www.ct.gov/dep/lib/dep/fishing/restoration/streamcrossingguidelines.pdf>.

Common Stream Crossing Problems

• Perched Culverts

The most common stream crossing problems in Connecticut are perched culverts that are situated above the elevation of the stream bottom at the culvert outlet (downstream end) that present obvious physical barriers to upstream fish passage (Figure 1). Perched culvert conditions are the result of improper installation or are created over time by years of excessive scour and erosion of the streambed at the culvert outlet.

• Shallow Water Depth

Another common problem are culverts that create shallow water or sheetflow conditions, especially during seasonal low flow periods. Thus, fish cannot swim through these structures due to insufficient water depths.

• Excessive Water Velocity

Excessive water velocities can occur within the main body of a culvert at the inlet/outlet sections. Velocity problems are typically observed within smooth bottom concrete box culverts that do not contain natural streambed substrates and lack channel roughness. Excessive velocities or hydraulic jumps can sometimes occur in culverts placed at improper slopes. Many fish species may not be able to pass through culverts with excessive velocities due to exhaustion.



Figure 1. Example of culverts perched above streambed blocking fish passage.

• Debris accumulation

Debris accumulation is another condition that can block fish passage. Accumulation of debris most often occurs at undersized culvert or multiple culvert situations, usually at the culvert inlet.

Stream Crossing Guidelines

Many of the standards in our guidelines have been adopted from and are consistent with U.S. Army Corps of Engineers Connecticut Programmatic General Permit guidance. Refer to <http://www.nae.usace.army.mil/reg/ctpgp/pdf> for more details relative to general permit requirements and also contact the DEP Inland Water

Crossing, continued

Resources Division for permit guidance. Guidelines focus primarily on fish and fish passage, but incorporating the suggested practices will also benefit other wildlife.

For new or replacement stream crossing projects, the IFD typically recommends the installation of **clear span bridges** or **bottomless arch culverts** for the crossing of perennial watercourses. These structures are “fish passage friendly” since they do not create barriers or impediments to fish migration and they best preserve physical instream habitats. Intermittent watercourses are evaluated for fish passage needs based upon the potential for seasonal utilization of the watercourses by fish.

In certain situations, the IFD has accepted the installation of culverts for stream crossings. However, several modifications to culvert design may be required to ensure fish passage and maintenance of aquatic resource integrity. The modifications recommended are as follows:

- **Single Culvert**

The invert of a box culvert should be set no less than 1 foot below the existing streambed elevation. This installation technique is referred to as a sunken or embedded culvert. The invert of a round culvert less than 10 feet in diameter should be set 1 to 2 feet below the existing streambed elevation. For round pipe greater than 10 feet in diameter, the culvert invert should be set a minimum of 20% of the pipe diameter below the streambed elevation.

- **Multiple Culverts**

Multiple culverts are discouraged where design criteria can be met with a single culvert. For multiple culvert situations, one or more of the culverts should be installed as per the guidelines for single culverts. Recessed culvert(s) should be installed in the thalweg or deepest section of the channel and be in alignment with the low flow channel.

- **Gradient**

The culvert gradient should be no steeper than the streambed gradient upstream or downstream of the culvert matching the overall stream gradient as closely as possible. Gradient for sunken culverts should not exceed 3%. Bottomless arch culverts or clear span bridges should be utilized in all cases where gradient exceeds 3%.

- **Alignment**

Culvert alignment should be similar to that of the stream and not placed at a skew. This will ensure proper water conveyance and will protect against excessive channel erosion or scour.

- **Length**

Culvert length should be as short as possible. Vertical headwalls rather than fill slopes are recommended at the culvert inlet and outlet to reduce the total culvert length. Narrowing and lowering the roadway along with steepening embankments can also help reduce culvert length.

- **Width**

The culvert should have a width that spans an area 1.2 times the bankfull width of the stream. In Connecticut streams, bankfull width equates to the channel width wetted at the 1.5 to 2 year storm frequency flow. This standard also applies to arch (bottomless) culverts.

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• **Corrugated Culverts**

Corrugated culverts are preferred over smooth culverts since the corrugations create a roughness that aids in the retention of streambed material. Metal culverts are least preferred due to longevity concerns with rusting.

• **Preservation of Streambed Substrates**

Native streambed material excavated for culvert placement should be stockpiled and replaced within the culvert following its installation. Streambed material should be replaced in a manner replicating the original stream cross section with a well-defined low flow channel contiguous with that existing in the stream.

• **Openness Ratio**

The culvert should have an Openness Ratio of ≥ 0.25 . The Openness Ratio (OR) is calculated by dividing a culvert's cross sectional area (height x width) by its length. All measurements are in meters.

Embedded Culverts: $OR = \frac{[(\text{Cross-sectional culvert area pre-embedded}) - \text{Embedded area}]}{\text{Culvert Length}}$

Arch Culverts (bottomless): $OR = \frac{\text{Height} \times \text{Width}}{\text{Length}}$

Other Stream Crossing Considerations

Certain construction activities can prevent or delay the migratory movements of resident riverine and anadromous fishes through a project site. Consequently, seasonal construction windows, defined as "time periods during which construction should occur" are often recommended during times of the year when it is easier to control soil erosion and sedimentation and fewer fish are undergoing migrations. Appropriate construction windows are typically determined on a case-by-case basis, but the following two windows are most often recommended.

1. Inland Resident Fish Construction Window

In inland waters, unconfined instream construction activities associated with either bridge/culvert installation and rehabilitation projects should only be allowed from the period June 1 through September 30, inclusive. Conversely this means a prohibition of unconfined instream construction activities from October 1 through May 31.

2. Anadromous Fish Construction Window

Collectively, spawning migrations of river herring, American shad and Atlantic salmon occur between March 1 and June 30. Therefore to protect all of these migratory species, unconfined instream construction activities associated with either bridge/culvert installation and rehabilitation projects should only be allowed from July 1 to February 28th, inclusive. Conversely this means a prohibition of unconfined instream construction activities from March 1 through June 30.

Summary

The DEP stream crossing publication is not meant to be a technical design manual. Please refer to the several design manuals that have been cited for more technical/engineering information, many of which are available on the Internet. IFD staff are available to provide technical guidance relative to fish passage requirements for stream crossings. Please refer to the appropriate contact information listed for further assistance.

CONTACT INFORMATION

Technical Guidance

Bureau of Natural Resources, Inland Fisheries Division
Habitat Conservation and Enhancement Program
Hartford Office: 860-424-3474
Eastern Connecticut: 860-295-9523
Western Connecticut: 860-567-8998
Coastal Connecticut: 860-434-6043

Regulatory Guidance

Bureau of Water Protection and Land Reuse, Inland Water Resources Division
Environmental Analysis Section: 860-424-3019

This article was adapted for The Habitat by Brian D. Murphy, Senior Fisheries Habitat Biologist, CT DEP Inland Fisheries Division.



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Technologies Utilized for Enforcement Along Water Resources

by Larry Marsicano, Kristen Ponak, Melinda Tarsi, Howie Berger and Linda Berger

Development pressures in much of Connecticut can make protection of riparian areas along water resources difficult. A common event along lake shorelines is the conversion of small seasonal cabins into larger full-time homes. While properties undergo improvement, riparian buffers between the structures and the water resources may be removed and replaced with lawns, stone patios, docking systems, or other structures, and many times without the appropriate permits and oversight. And unless you can regularly observe projects from the water, you may never know the shoreline is being altered until it is too late. That scenario played out along the shoreline of Candlewood Lake many times over many years, despite the best efforts of municipal land use enforcement personnel from the five municipalities bordering the lake.

To aid in the control of undesirable alterations to the shoreline, a technology was developed that integrated a geographic information system (GIS) with a secure web content management system. This effort was coordinated by the Candlewood Lake Authority (CLA) with technical support from the Northwest Conservation District in

Torrington, CT and Visual Access Technology, Inc. in New Milford, CT. The CLA is a municipal entity charged with providing public safety and natural resource protection on Candlewood Lake, the largest lake in the State at approximately 5,500 surface acres and with 60+ miles of shoreline. Most of the shoreline is owned by FirstLight Power Resources (FLPR) who is required by the Federal Energy Regulatory Commission to protect natural resources associated with their hydroelectric resources. Over 60% of the shoreline abuts residential use, with much of that comprised of one-quarter acre lots or smaller.

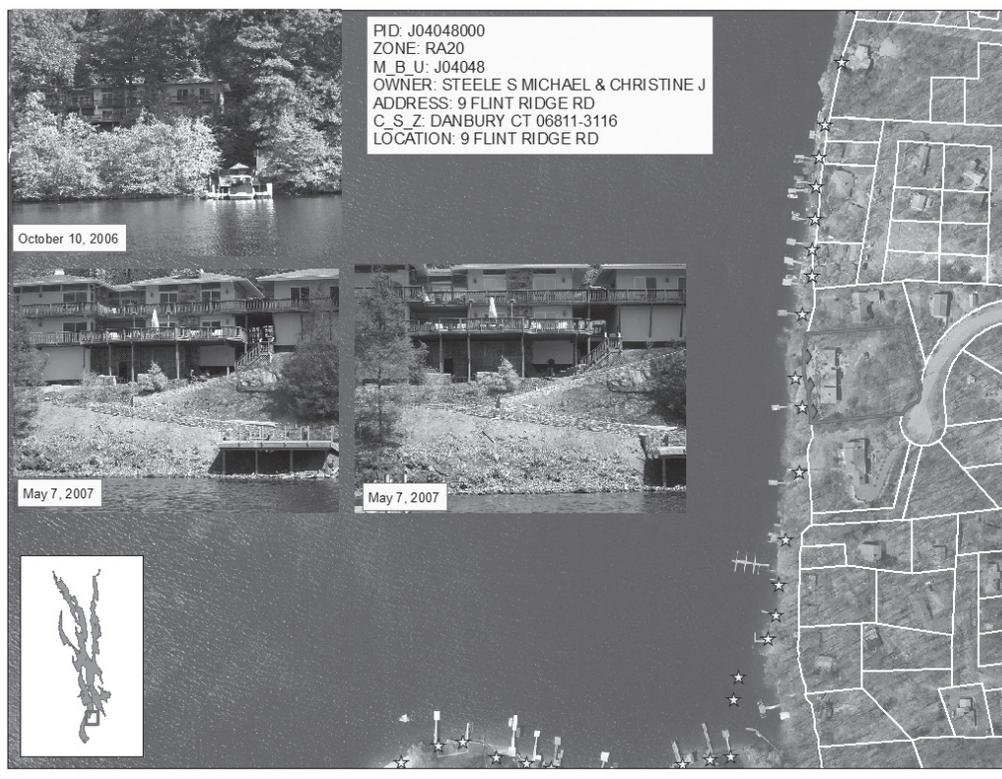


Figure 1. Active lakefront site

The GIS operates as the back end of the system integrating the 2004 CT DOT aerial flyover data, Candlewood watershed parcel data, the Assessors' databases from each of five municipalities (Danbury, Brookfield, New Fairfield, New Milford, and Sherman), and a 2006 geo-referenced photographic inventory of the lake's shoreline. The CLA designed the GIS with the assistance of staff at the NCD, maintains the system, and regularly updates the inventory with photographs of new activity.

The front-end, web content management system (Fig. 1), was developed by Visual Access Technology, and is where shoreline activities are cataloged and the data for an active lakefront site is made available. Content management systems are designed for interactive use by a large number of contributors to the content of the website. Our secure website provides a portal for those with access to most of the data incorporated in the Candlewood Lake GIS and other relevant information for a site (meeting minutes, site plan approval conditions, notices of violation, photographs, etc.). Access to the site is provided to land use personnel of the municipalities and FLPR. Data for a

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particular site is chronologically listed and users can update with additional information as an activity goes from violation or application to completion. Updates to the database include adding new records of activity on the shoreline observed or reported and adding documents or photos to the record for sites already cataloged.

The website also provides an internal notification feature where the CLA can notify enforcement officers or FLPR of new active sites along the shoreline with an email containing a link to that record in the database. Notifications and responses can be sent to the CLA as well. Those notifications and responses are archived as part of the record for a site.

The GIS / Web Content Management system promises to improve protection of the shoreline in a number of ways. First, it makes identification of activity along the shoreline easier. Since street addresses are rarely visible from the water, CLA personnel had to rely on general location to report activities to appropriate authorities. With the photographic inventory, property identifications can be made quickly and accurately. The system has also created a mechanism for sharing data between various parties, in this case the CLA,

municipal land use offices, and FLPR. There are no technical requirements on users, other than the CLA, to have expertise in GIS technology, since active sites and relevant data are stored on an easy-to-use website.

The system has been introduced to municipal land use staff and the Mayors and First Selectmen of the bordering towns, who have been supportive. Many have started utilizing it. FLPR committed to collaborating on the development of the system at the conference of the New England Chapter of the North America Lake Management Society held at UCONN in Storrs, CT in June of 2007.

Larry Marsicano is the Executive Director of the CLA.

Kristen Ponak is a GIS Specialist working with the CT DEP, working on a Masters at Central Connecticut State University, a Research Associate for the CLA, and formerly was employed by the Northwest Conservation District.

Melinda Tarsi is a PhD student at the Social Science School at the University of Massachusetts, Amherst and a Research Associate for the CLA.

Howie Berger and Linda Berger are Principals at Visual Access Technology, Inc. Mr. Berger also serves as a Delegate of the Candlewood Lake Authority, while Mrs. Berger is an IWWC member, both for the Town of Sherman, CT. Mrs. Berger is also a member of the Board of Directors for CACIWC.



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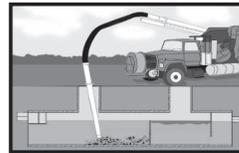
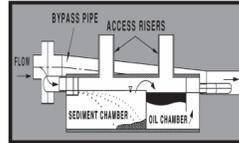
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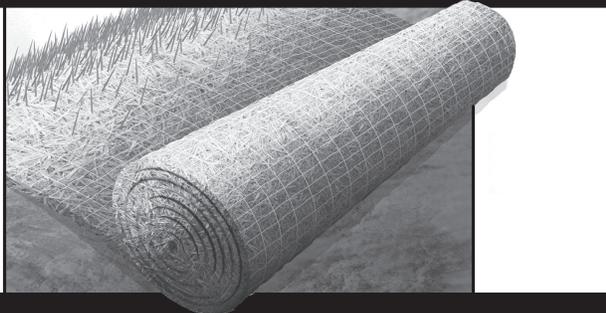
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