

# Stream Flow : The Next Two Decades

## Balancing Human Use and Ecological Health



Connecticut Department of Environmental Protection  
Gina McCarthy, Commissioner







STATE OF CONNECTICUT  
DEPARTMENT OF ENVIRONMENTAL PROTECTION

79 ELM STREET HARTFORD, CT 06106-5127

PHONE: 860-424-3001



Gina McCarthy  
Commissioner

January 29, 2009

A message from the Commissioner

I am pleased to release the attached report that outlines a framework for regulating Stream Flow Standards here in Connecticut. The report is written in "plain language" to allow the general public as well as the regulated community to understand how we intend to meet the mandates of PA 05-142 by balancing stream flow needs to support human uses while maintaining the ecological health of our flowing waters.

As the many experts who dedicated countless hours of their time over the past three years to help DEP develop this framework will undoubtedly attest, regulating stream flows is a new and very challenging endeavor. But, as a result of their input and the on-going efforts of DEP staff, we were able to design an approach that takes advantage of the best available science, is consistent with sound public policy, and is feasible to implement. It includes many innovative elements that represent a significant step forward in how Connecticut manages its water resources and it ensures that the desired result can be achieved in the least disruptive and most cost-effective way. For example, it incorporates a phased implementation strategy to encourage effective planning and better management of water supplies as a way to avoid the need for costly infrastructure improvements to balance human use with ecological health.

In short, while the proposed Stream Flow Standards are protective of Connecticut's river and stream systems, the proposal is not simply about providing more water for fish. It's about promoting better, more efficient management of our water supplies so that all needs, both human and ecological, can be met both today and in the future.

I want to thank the members of the Commissioner's Advisory Group as well as the Science & Technical Workgroup and the Policy & Implementation Workgroup for all their hard work, patience and frank discussion. I also want to recognize the dedicated staff here at DEP who worked tirelessly to get us on this pathway forward. Through your efforts we have developed a smart, flexible, science-based, practical approach to stream flow regulations in Connecticut that could very well be a model for other states in this region and across the nation. I look forward to the release of the draft regulations and the public engagement that will follow.

Gina McCarthy  
Commissioner

## **Stream Flow: The Next Two Decades**

### **Background**

The Connecticut Department of Environmental Protection is proposing revisions to the Stream Flow Standards in response to PA 05-142, enacted in 2005. This statute directed DEP to develop regulations that would expand the coverage of the stream flow standards to include all rivers and streams rather than only those stocked with fish as was the case previously. The statute further directed DEP to develop standards that balance the needs of humans to use water for drinking, washing, fire protection, irrigation, manufacturing, and recreation with the needs of fish and wildlife that also depend on the availability of water to sustain healthy, natural communities.

Two workgroups were convened by DEP to assist in the process of developing the revised regulations. A Science and Technical Workgroup was formed consisting of recognized experts in the fields of stream and river ecology, fisheries biology, hydrology, and drinking water supply management to insure that the regulations would be based on the best available science. A Policy and Implementation Workgroup was also convened to evaluate various policy options relating to implementing the revised regulations. This workgroup included members representing the interests of municipalities, water utilities, environmental advocacy organizations, and State agencies such as the Departments of Public Health and Agriculture. Both Workgroups met numerous times over the course of three years and actively participated in the development of the revised regulations. A Commissioner's Advisory Group was also formed to provide DEP with a broad perspective on the potential impact of the revised regulations on water utilities, farmers, industry, consumers, and citizens who recreate in Connecticut waters or simply have a strong interest in preserving Connecticut's natural environment. As directed by the statute, DEP consulted with other State agencies, such as the Department of Public Health, the Department of Agriculture, the Department of Public Utility Control, and the Office of Policy and Management as well as non-governmental stakeholders.

The Stream Flow Standards require two separate but related activities. First, the proposed regulation requires that all rivers and streams be classified into one of four Classes. Each Class represents a different balancing of human use and ecological health priorities. The classification adopted for a stream informs future decisions regarding how that specific resource will be managed. The proposed regulation establishes a public process for classifying streams and identifies the key considerations for determining what Class is appropriate for specific waters. Once a stream has been classified, a series of requirements are imposed on the operators of dams that regulate stream flow and those who remove water directly from streams or pump significant quantities of ground water from aquifers that sustain the flow of streams and rivers during dry periods. These requirements are phased in over time to allow current users to adjust their operations to comply with the new regulations without unduly disrupting the supply of water available for human use. Second, the proposed regulation also provides the option of adopting a Flow Management Plan for a watershed as an alternative to complying with the specific requirements (presumptive standards) relating to dam releases or maximum stream depletion specified in the regulation. Such a plan might impose different

requirements for dam operations and groundwater withdrawals keyed to the unique characteristics of the watershed. However, the balance between human use and ecological health envisioned when streams in the area covered by the plan were classified must be achieved.

This guide should not be considered authoritative with respect to compliance with the proposed regulations. The actual statute and complete text of the regulation, once adopted, will establish the definitive requirements of the law. Changes to DEP's proposed regulation are likely as a result of the public participation process that must be completed prior to adoption of any regulation by a State agency. This document is intended to provide a "plain language" overview or outline of DEP's regulatory proposal to assist interested citizens in understanding the proposed new stream flow requirements so they can most effectively participate in the on-going process of managing Connecticut's stream and river resources.

### **Classification of Stream and River Systems**

A Stream or River System is defined as the water in the river or stream channel upstream of any point on that stream or river, including all tributary streams that drain into the channel, and the subsurface groundwater that contributes flow to sustain flow in the stream. The river or stream system can therefore be thought of as the interconnected surface water and groundwater in any watershed.

Text Box 1

The proposed stream flow standards incorporate the concept of balancing human and ecological needs for water by establishing different flow standards for each of four categories or classes of waters. In Class 1 waters, priority is given to protecting ecological health. In Class 4 waters, support of human activities is weighted most heavily. Class 2 and Class 3 waters have intermediate balance points between ecological (Class 1) and human (Class 4) uses. The flow standards for each Class are based on maintaining to various degrees the natural variation in flow expected in Connecticut given our seasonal climate and rainfall patterns.

#### **Factors for Consideration in Classification**

Size and location of groundwater withdrawals  
Size and location of planned future withdrawals  
Size and location of dams and impoundments  
Size and location of water and wastewater discharges  
Existing and proposed development  
Presence of flow-sensitive aquatic life  
Location of USGS natural reference stream gages  
Designated open space protected areas  
Physical habitat restoration potential

Text Box 2

Class 1 systems are characterized as resources having little current development in the watershed and which have historically not been affected by the removal of water for human uses. DEP will consider the likelihood that development will occur within the watershed by identifying areas of protected open space and reviewing the State Plan of Conservation and Development. DEP will also consider the need to utilize these resources for future water supply based on information provided by water supply utilities. In addition, systems that currently support populations of sensitive aquatic life that are dependent on free-flowing conditions such as native brook trout and systems that include sites where the USGS has maintained a flow gage that provides a long-term record of natural flow conditions are also likely to be designated by DEP as Class 1.

Class 2 systems share many characteristics with Class 1 systems but the flow standards for this Class allow for greater levels of human alteration. In practice, Class 2 systems will be able to accommodate more intense levels of development in the watershed and greater withdrawal of water from the system for human use while continuing to support a healthy aquatic community. Most water use in Class 2 systems will involve extraction of groundwater through wells hydraulically connected to the stream. Class 2 systems may also include some waste receiving streams in which flow is augmented by treated wastewater discharges.

Class 3 systems are sometimes referred to as “working rivers”. In Class 3 systems, human use may have a significant influence on stream flow patterns. Flow in many Class 3 systems will be controlled by releases from storage reservoirs behind dams which will eliminate a substantial portion of the day-to-day variation in flow typical of a naturally flowing stream. Class 3 systems are expected to have adequate water available to support viable aquatic communities. In some Class 3 resources, current water use may result in insufficient water remaining to support ecological health. A change in current use patterns will be necessary to restore consistency with the flow standards in these situations.

Class 4 systems are characterized as systems where past practice has resulted in a deviation from the natural stream flow pattern that is sufficiently large to call into question the system’s ability to support a healthy aquatic community. Examples might include highly urbanized systems with extreme levels of imperviousness, stream segments immediately below dams where water is diverted to a point some distance downstream, or resources where restoring stream flow patterns to a more natural condition would cause an extreme economic hardship.

The DEP will propose a Class assignment for each river and stream based on an evaluation of factors that have relevance with respect to the balancing of human and ecological values and uses (text box 2). Once a preliminary map has been completed depicting the proposed Classification of all streams and rivers in a major basin, the DEP will initiate a public review process. This process is designed to allow citizens and water users to comment on DEP’s proposal and suggest changes in Class assignments. There are five major basins in Connecticut and DEP anticipates that it will take up to five years to complete the process of classifying all river and stream systems in the entire State.

## Major Basins in Connecticut

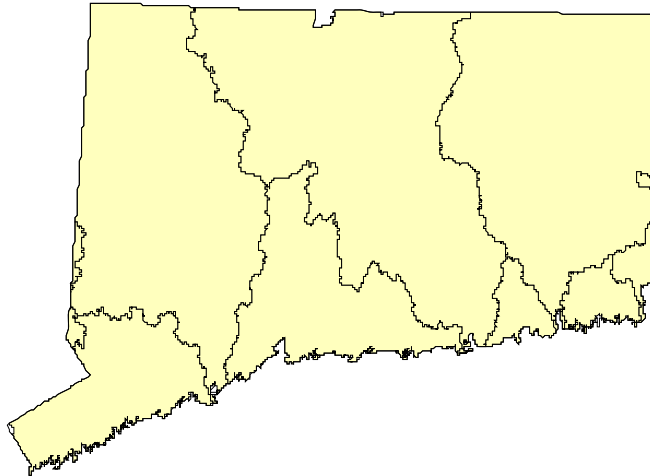


Figure 1

DEP manages the State's water resources under a legal construct known as the Public Trust Doctrine. Providing for meaningful public input into the process of assigning Class designations to specific water resources is a critical component of fulfilling DEP's responsibility relative to managing water resources.

### **The Public Participation and Adoption Process Classification of Rivers and Streams – The First Five years**

1. DEP staff will consider the factors identified in text box 2 and prepare a map depicting proposed Classifications for all stream and river systems within a major basin.
2. DEP will provide Notice that a proposed Classification Map is available for review and will solicit comments on the proposal for a minimum of 90 days. During this period, DEP may hold public informational meetings or conduct other types of outreach activities.
3. DEP will post all comments received on the DEP web site.
4. In the event that comments are received recommending to DEP that a Classification be changed, an additional period of at least 60 days will be provided for rebuttal comments from the public on that proposed change.
5. DEP staff will prepare a responsiveness summary and makes recommendations to the Commissioner regarding changes to the proposed Classification based on comments received.
6. The Commissioner's final decision regarding the Classification of each river and stream system will be published in the Connecticut Law Journal at which time the Classification for that river or stream system will be considered adopted as final.

Text Box 3

The proposed stream flow regulation specifies a process that allows a classification to be changed in the future if conditions warrant. The most straight forward way to implement a change in Classification is through adoption of a Stream Flow Management Plan that establishes an agreement that is binding on all water users within a watershed. Proponents of a Stream Flow Management Plan must demonstrate, to DEP's satisfaction, that adherence to the Plan will result in conditions that are consistent with the narrative stream flow standards and that an appropriate balance has been struck between human and ecological needs. These Flow Management Plans are subject to the same public comment and adoption process as is specified for the original Classification adoption insuring that local citizens and other interested parties have an opportunity to participate in the development of the Plan and management of the resource.

Individual stream or river segments may also be reclassified through a petition process. The person proposing the change must submit a written request to DEP that includes a statement of reasons to support that change. If a change from a "less natural" to a "more natural" Class is proposed (e.g. reclassifying a Class 3 resource to Class 2), the petitioner must demonstrate that the information originally considered by DEP when making the classification has either changed or was mischaracterized at that time. The petitioner must also provide evidence that the stream currently meets the stream flow standard for the proposed Class and that legitimate human needs for water can continue to be satisfied through utilization of other water sources or through conservation and demand management.

Petitions to change a Classification from a "more natural" to a "less natural" Class (e.g. reclassifying a Class 2 resource to Class 3), must include a demonstration that the change is necessary to accommodate legitimate human needs for water that cannot be satisfied without reclassifying the resource in question. Petitioners requesting a change to a less natural class must also demonstrate that protections are in place to minimize the alteration to stream flow patterns to the greatest extent feasible and document that alternative sources of water are not available to meet needs for human use. Requests to change a classification to Class 4 must provide additional support including a demonstration that social needs cannot otherwise be met and that failure to approve the change in Class will result in economic impacts that substantially impair or otherwise negatively affect the community or State's economy.

### **Exemptions and Special Conditions**

Diversions of water from portions of a river or stream system that are tidally influenced are not covered by the proposed stream flow regulations. Additionally, some specific types of activities or water uses are exempt from requirements to operate in accordance with the Stream Flow Standards. Typically, these activities involve intermittent, short-term uses such as providing emergency fire or flood protection or allowing maintenance and repair to a dam or seasonal drawdown of a recreational lake. Small water users such as private homeowner wells and others that pump less than 50,000 gallons per day are also exempt from the regulatory requirements. Water users operating in compliance with a current DEP permit must continue to comply with that permit but are otherwise not required to make any changes to operations in order to comply with the revised stream flow regulation.

Although not explicitly exempt, special release rules apply to a limited number of dams that meet specific conditions. These rules apply to dams impounding streams with an upstream drainage area of three square miles or less, and dams releasing water to a stream that flows for a distance of one mile or less before discharging into a second reservoir impoundment. Where these conditions exist, a minimum release of 0.1 cubic feet per second per square mile is required at all times unless an alternative release has been specifically established by DEP as necessary to protect valuable in stream habitat. Dams that are regulated under federal law by the Federal Energy Regulatory Commissioner (FERC) are not subject to additional release requirements beyond those incorporated into their federal permit.

### Stream Flow and Development Impacts

Development decisions in Connecticut are primarily within the purview of local Town boards and commissions. Local Zoning Boards for example, generally determine the type and extent to which specific parcels of land may be developed and local Wetlands Commissions determine if a proposed development is consistent with rules established to protect those critical habitats. Adoption of Stream Flow Regulations by the DEP does not change Connecticut's long established practice of "home rule" regarding development.

It is important to take note however that one of the most significant factors altering natural stream flow patterns in Connecticut is development and the associated impact of impervious surfaces on groundwater recharge and storm water runoff rates. High density traditional development results in rapid storm water runoff that can result in flooding and erosion of stream habitat downstream. Impervious surfaces also inhibit the natural recharge of groundwater that provides critical base flow for these same streams during dry periods. Storm water runoff also can cause water quality problems by washing pollutants into the stream along with the storm water further stressing aquatic life.

The DEP encourages all Towns and developers to utilize low impact development (LID) techniques that have been developed in recent years to mitigate the impact of storm water runoff. LID can reduce the impact of development by thoughtful site design and use of proven techniques to infiltrate most storm water back into the ground on site while reducing the flashy runoff that can occur with more traditional practices. For additional information on Low Impact Development, please visit DEP's web site.

Text Box 4

### Stream Flow Standards

The DEP's proposed Stream Flow Regulations establish overarching narrative standards that describe the conditions that can be expected when standards are achieved. These standards are based upon the degree to which the condition deviates from its natural state absent human influence. **Class 1** waters are the most natural Class of waters and should exhibit no deviation from natural flow conditions. **Class 2** waters require maintenance of near-natural flow conditions being at most, minimally altered by human activity. **Class 3** waters may exhibit a greater degree of deviation from natural stream flow patterns but must provide ecologically sufficient flow conditions to support a viable aquatic biological community. **Class 4** waters may be substantially altered from the natural condition provided that alteration is necessary to provide for legitimate human needs and requirements.



The Stream Flow Regulation also establishes presumptive numeric criteria that, when complied with, signal that the narrative flow standards are being met. Similar to the narrative standard, the presumptive numeric criterion for each Class of water differs with respect to the degree of deviation from a natural condition. Criteria are presented in two formats, a Minimum Flow Release Rule for waters where in-stream flow is determined by releases of water from a dam control structure, and a Maximum Flow Reduction Rule for streams where flow is influenced primarily by the timing and amount of water withdrawn from the groundwater that feeds the stream.

### **Phased Implementation of Regulatory Requirements**

The Stream Flow Standards are implemented in three phases following the adoption of a stream's classification. The phased implementation approach is designed to encourage and support water planning and conservation efforts. This approach is necessary to achieve the environmental goals established in PA 05-142 without causing undue disruption of the State's existing water supplies and water use practices. Phasing of regulatory requirements provides the opportunity to mitigate the impact of the regulation on water utilities and consumers by providing time to

- 1) implement effective conservation and demand management practices such as programs to conserve water during critical periods, and to incorporate efficient water use requirements and low impact development practices into local land use decisions
- 2) engage in comprehensive water supply planning to balance multiple sources of water within a water supply system, insuring that all existing sources are being used optimally, develop a watershed plan that optimizes yield for human use while continuing to meet the narrative goals established in the stream flow standards, and evaluate the need for system interconnects to allow for movement of water between "water rich" and "water poor" areas.
- 3) design, finance and construct any water supply infrastructure identified through the planning process as necessary to make required releases, transfer water between systems, increase storage capacity, or are necessary to efficiently bring water from the source to consumers,

During the next five years, DEP, DPH, and DPUC must work together to encourage and support water planning and conservation efforts. To assist in the few instances when careful planning and effective conservation may not be sufficient to achieve compliance, agencies must continue to work together to streamline the review and approval of new water storage and water supply system interconnections. Where additional supplies are needed, the phased approach provides a framework within which water utilities can continue to comply with the regulation as these sources are identified, permitted, and developed. Consistent with other efforts underway to explore regionalization of municipal services, special attention may be needed to support the planning and compliance efforts of the State's small municipal water suppliers.

Text Box 5

#### Minimum Flow Release Rule: Reservoirs and Impoundments

Implementation of the Minimum Flow Release Rule with respect to dam operation begins when the DEP completes the process of establishing the Class designation for the stream or river on which the dam is located. During the first 5-year period following that date,

individual dam owners are required to continue to operate in accordance with their current operational rules and maintain existing practice relative to making releases from the reservoir impoundment. This initial 5-year period provides an opportunity for dam owners to plan for and implement any changes to current practices that may be necessary to remain in compliance with the regulations beyond this initial period. Water utilities that are required to prepare Water Supply Plans can be expected to incorporate planning for making necessary releases into their overall planning process. In some cases, dam operators may need to construct or modify the intake structure or release mechanism to allow for the releases that will be required in the future. Installation of monitoring equipment may also be necessary where not currently installed. Many dam operators will take advantage of this initial implementation period to perform modeling of the impact of future compliance on the safe yield of their systems and incorporate this information into their water supply planning process to insure adequate water continues to be available for their customers. Collection of the data necessary for DEP or other water users to assess consistency with the standards such as recording the daily amount of water released from the reservoir will also be initiated at the end of this time period.

## Q

The capital letter “Q” is a shorthand symbol used by hydrologists to denote stream flow rate. A number may follow the Q signifying the percentage of time that a particular flow rate is exceeded. For example, the “Q99” is a statistical estimate of the flow rate that is exceeded on 99 percent of the days at a particular location. Similarly, the “Rearing and Growth bioperiod Q99” denotes the flow rate that is exceeded 99 percent of the days during that bioperiod. Stream flow rates are typically expressed in cubic feet of water per second (cfs) or may be normalized to watershed size and expressed as cubic feet per second per square mile (cfs/m) of drainage.

Text Box 6

Beginning in year 6 of implementation (post adoption of the Classification for a segment), operators of dams releasing to a Class 2 river or stream must provide for 75% of the natural inflow to be passed downstream on an instantaneous basis. The majority of dam operators however, will be releasing water to a Class 3 resource. These operators will be required to comply with the low-level release rule beginning in year 6. The low level release rule establishes 6 minimum release rates, one for each bioperiod during the year as shown in Table 1.

**Table 1 Low Level Release Rule**

Bioperiod	Effective Date	Minimum Required Release
Overwinter	Dec 1 – Feb 28	Bioperiod Q95
Habitat Forming	Mar 1 – Apr 30	Bioperiod Q95
Clupeid Spawning	May 1 – May 30	Bioperiod Q95
Resident Spawning	Jun 1 – Jun 30	Bioperiod Q90
Rearing and Growth	Jul 1 – Oct 31	Bioperiod Q80
Salmonid Spawning	Nov 1 – Nov 30	Bioperiod Q90

## Bioperiods

A bioperiod is a specific time period during the course of the year when certain biological processes that depend on the seasonal variability of stream flow rates occur. For example, in Connecticut, the highest flows of the year typically occur in March and April. These predictably high flows function to maintain natural habitat in the stream channel and maintain connectivity with the adjacent flood plain. This time period is therefore referred to as the “Habitat Forming” bioperiod. The lowest flows frequently occur during the late summer (July through October). These four months are collectively referred to as the Rearing and Growth bioperiod in reference to the dependence of aquatic life on adequate stream flow during this time of the year to sustain and grow juvenile fish into healthy adults. The Stream Flow Standards establish different flow requirements for each of 6 bioperiods, insuring that the seasonal variability in natural stream flow rates necessary to support a healthy ecology is maintained.

Text Box 7

Dam operators are required to begin complying with the Multi-Level Release Rule in year 11 following establishment of the stream classification. This rule established two release rates for each of the 6 bioperiods. Dam operators must evaluate the current flow conditions (based on the median flow for the prior 14 days at a reference stream gage) and adjust their release rate to reflect either a “dry” or “wet” period release as shown in Table 2. When the median flow at the reference gage over the previous 14 days is less than the bioperiod Q25, a dry period release is required. Higher wet period releases are required when the 14-day median flow at the reference gage exceeds the bioperiod Q25. The bioperiod Q25 is often referred to as a “trigger flow” because the type of release required is determined by whether recent flows have been above or below that level. The appropriate release rate must be recalculated and any necessary adjustment to the release rate made at intervals of 14 days or less. This procedure insures that the amount of water released reflects the amount that would be naturally present in the stream at that time as a result of recent precipitation patterns.

**Table 2 Multi-Level Release Rule**

Bioperiod	Effective Date	Minimum Required Release	
		Dry Period Release	Wet Period Release
Overwinter	Dec 1 – Feb 28	Bioperiod Q95	Bioperiod Q75
Habitat Forming	Mar 1 – Apr 30	Bioperiod Q95	Bioperiod Q75
Clupeid Spawning	May 1 – May 30	Bioperiod Q95	Bioperiod Q75
Resident Spawning	Jun 1 – Jun 30	Bioperiod Q90	Bioperiod Q75
Rearing and Growth	Jul 1 – Oct 31	Bioperiod Q80	Bioperiod Q50
Salmonid Spawning	Nov 1 – Nov 30	Bioperiod Q90	Bioperiod Q75

## Drought Triggers

The proposed Stream Flow Regulations allow water utilities to reduce the amount of water they release during periods when there is an increased risk that a drought is imminent and water supplies are in danger of becoming depleted. Drinking water utilities are required by the Department of Public Health (DPH) to prepare a Water Supply Plan. These plans include establishing a series of 4 drought triggers representing increasing levels of concern regarding the adequacy of available water supply. Water utilities consider such things as the available water supply and projected water demand, reservoir storage levels, operational indicators, and climatic factors such as precipitation, groundwater levels, and stream flow in establishing the drought triggers for their water supply system. Plans are updated every five years and subject to DPH review and approval.

The Stream Flow Regulations allow dam operators to eliminate all releases during periods when a water utility is in a drought emergency condition, the most severe of the four drought response triggers as shown in Table 3. Utilities are also required by DPH regulations to take actions specified in their Water Supply Plan to reduce demand for water until conditions return to more normal levels. These actions typically include notification of the public that a drought condition is in effect, voluntary or mandatory conservation measures, and other actions in the utility's contingency plan to insure adequate water for human use.

**Table 3 Drought Triggers**

Water Supply Plan Provisions		Stream Flow Release Requirements	
Drought Trigger	Reduction in Demand	Rearing & Growth	All other Bioperiods
Advisory	10%	100% of Base Flow	75% of Base Flow
Watch	15%	50% of Base Flow	50% of Base Flow
Warning	20%	25% of Base Flow	25% of Base Flow
Emergency	25%	No release required	No release required

Base Flow represents dry level release required for consistency with presumptive standard

### Minimum Flow Reduction Rule: Surface water and Groundwater Withdrawals

Implementation of the Stream Flow Standards with respect to regulation of surface and groundwater withdrawals also begins when the DEP completes the process of establishing Class designations for a stream or river system. During the first 5-year period following that date, water users are required to maintain existing practice relative to utilization of groundwater withdrawals. This 5-year period is designed to provide an opportunity to plan for and implement changes to current practices that may be necessary to remain in compliance with the regulations beyond the initial period. Persons utilizing groundwater wells in many instances will need to conduct investigations that establish the relationship between pumping and depletion of stream flow (see text Box 8). Collection of the data necessary for DEP or individual users to assess consistency with the standards such as the daily amount of water pumped from a supply well under actual use conditions will be compiled during this time period.

Beginning in the 6th year following adoption of the Classification, water users potentially impacting flow in a stream or river system as a result of a groundwater withdrawal are required to comply with the Maximum Flow Reduction Rule on an individual basis without consideration of the impact of other users upstream or downstream. Each individual user must be able to demonstrate that their use of water will not result in violation of the standards under the assumption that flow in the stream is not impacted by any other human activities in the watershed.

In Class 1 waters, the maximum reduction allowed is 5 percent of the Q99, an amount that is not likely to provide sufficient yield to support use as a significant water supply. In Class 2 resources, stream flow may be reduced by up to 25% of the Q99 during the Rearing and Growth bioperiod (July 1 through October 31). This bioperiod coincides with the time of year when stream flows are typically at their lowest in Connecticut and aquatic life is most stressed. In Class 3 rivers and streams, the amount of flow reduction is increased to 50% of the Q99 during the Rearing and Growth bioperiod.

**Table 4 Maximum Flow Reduction Rule**

Bioperiod	Class 1	Class 2	Class 3
Overwinter	0.05 x Q99	0.25 x Q99 x F	0.50 x Q99 x F
Habitat Forming	0.05 x Q99	0.25 x Q99 x F	0.50 x Q99 x F
Cluepied Spawning	0.05 x Q99	0.25 x Q99 x F	0.50 x Q99 x F
Resident Spawning	0.05 x Q99	0.25 x Q99 x F	0.50 x Q99 x F
Rearing and Growth	0.05 x Q99	0.25 x Q99	0.50 x Q99
Salmonid Spawning	0.05 x Q99	0.25 x Q99 x F	0.50 x Q99 x F

"F" represents the ratio of bioperiod Q99 to Rearing and growth bioperiod Q99 at site

During other times of the year outside of the Rearing and Growth bioperiod, a preponderance of the scientific evidence suggests that the amount of water removed can be greater without causing harm to the ecological community. A multiplier ("F" shown in Table 4) is applied to the amount representing 25% or, in the case of Class 3, 50%, of the Q99 flow to calculate the amount flow can be reduced in bioperiods other than the Rearing and Growth bioperiod. The magnitude of the factor "F" is determined by the difference between the base low flow in the Rearing and Growth bioperiod (as represented by the bioperiod Q99) and the base low flow during the bioperiod during which the factor would apply (e.g. the overwinter bioperiod Q99). Factors must be calculated at each location for each bioperiod individually using methods developed by the USGS. The approach introduces a degree of site-specificity into the standards since the factor differs from location to location reflecting differences between river and stream systems in their ability to provide water during dry periods and works to maximize the amount of water available for human use without significantly impacting stream ecology.



### Groundwater Withdrawals

Pumping groundwater from a well depletes stream flow in two ways; by removing water directly from the stream bed through induced infiltration and by capturing groundwater that would have discharged to the stream and contributed to stream flow. Groundwater is the primary contributor to the natural base flow of a stream and is critical to sustaining flows during dry periods.

A number of factors contribute to how groundwater withdrawal influences the location, extent, and timing of stream flow depletion. These include the volume of water withdrawn, the duration and seasonal timing of pumping, geologic characteristics of the aquifer, well depth, and distance from the stream among others.

DEP is developing guidance, *Guidelines for Evaluating Groundwater Withdrawals against the Stream Flow Standards* recommending a tiered approach to evaluating the impact of ground water withdrawal on stream depletion. Most simply, a comparison between the volume removed and the Flow Criteria for the Class of stream impacted by that withdrawal can verify consistency with the Maximum Flow Reduction Rule. More sophisticated techniques that incorporate additional information on the characteristics of the specific site under analysis are also described in the Guidance. DEP recommends these more rigorous analyses be performed in situations where the water user desires to maximize yield through managing the amount, timing, and duration of well pumping while maintaining adequate stream flows to remain consistent with the standards.

Text Box 8

Beginning in year 10 following adoption of a stream's classification, water users who operate groundwater withdrawals are required to comply with the stream flow criteria on a cumulative impact basis. At this time, it is anticipated that sufficient data will be available to support the modeling and analysis necessary to evaluate consistency with the stream flow standards taking into account all users impacting flow on a river or stream system.

In some river or stream systems the cumulative impact of multiple water users may result in non-compliance with the stream flow standards. When DEP determines that such a condition exists, the agency will begin development of a stream flow management plan to restore flow to levels consistent with the standards. This process may involve allocating water use among various current users and is expected to be accomplished only after detailed investigation, consultation and negotiation with all affected parties. The DEP may also enter into an agreement developed by others provided that the agreement meets the conditions established in the regulation concerning balancing of human and ecological needs and addresses all water users impacting stream flow within the area covered by the agreement.

### Flow Management Plans

The option to manage stream flow within a river system under the terms of a flow management plan provides an opportunity to maximize yield for human use while continuing to meet ecological needs. This can be achieved by tailoring flow management to the specific

characteristics of the system to a degree that is not possible under the more general regulatory approach specified in the stream flow regulation. The DEP envisions flow management plans to represent the best possible management approach for those systems where the available water has been over-allocated.

A Flow Management Plan may be proposed by DEP, current water users, or other interested parties at any time following the Classification of a river or stream system. Any proposed flow management plan is subject to the same adoption process as was used to adopt the stream classifications (see text box 3 on page 4). Public participation in the adoption process is required regardless of whether the plan was developed by DEP or another party. This process is intended to again allow for the general public to participate in the management of the State's water resources in a meaningful way. Once adopted, all users impacting flow within the river and stream system covered by the plan will be required to comply with the plan in order to remain in compliance with the Stream Flow Regulations.

### **How does the new Stream Flow Regulation affect me?**

If you appreciate Connecticut's diverse natural wildlife and enjoy taking advantage of the many opportunities for water-based recreation provided in our State, the revised Stream Flow Regulation provides enhanced protection for those activities. The regulations also establish a strong foundation for managing Connecticut's drinking water supplies, helping insure that adequate water supplies are available today and for future generations at reasonable cost.

In the event that a severe drought does occur, all water users will be asked to reduce their demand so that critical human and ecological needs can both be met. Demand management by residential water consumers typically will involve such simple actions such as limiting lawn watering, car washing, or implementing other measures to conserve water until conditions improve. Wasting water through carelessness or inefficient water use practices however is never acceptable, even during times of relative abundance. The stream flow regulation is designed to enhance the State's ability to manage our water resources efficiently and encourage citizens to participate in the stewardship of what is arguably our most valuable natural resource.

Balancing human needs for water with the water needed to sustain healthy natural ecosystems is a daunting task. The regulation provides numerous opportunities for citizens to participate in the process of achieving the appropriate balance through active participation in the Classification process. Once classifications have been established, the general public also plays a key role in reviewing water diversion permits proposed by the DEP under regulations adopted governing those programs. One of the most important actions citizens can take is to participate actively in the local land use decision-making process that determines how land is developed within your Town. Ultimately, how we manage the land dictates the quality and quantity of water in our groundwater aquifers, streams, and rivers.

If you are serviced by a public or private water utility, you may experience a modest increase in the cost of water to offset the costs of maintaining water supply infrastructure or to develop new supplies that will insure water is available even if extreme drought occurs. Phasing of the regulatory requirements as they apply to water supply utilities is designed to defer the need to develop new supply sources until opportunities for meeting current and projected future needs through demand management and efficient use of existing supplies have been fully explored.

## **Record Keeping and Reporting**

The proposed regulation requires water users to compile certain types of information regarding their use of water; primarily data concerning the amount of water pumped from a well or released over a dam on a daily basis. This data is to be retained on site and made available to the DEP upon request. This information is necessary to evaluate the impact of the water use on the stream or river system and ultimately document compliance with the Stream Flow Standards. Additional data and information concerning water used by water utilities is available to DEP in the Water Supply Plans that are reviewed by DEP as part of the agency's consultation with the Department of Public Health that ultimately approves or disapproves these documents.

## **Additional Information**

The DEP is committed to moving forward to implement the proposed revised stream flow regulations in concert with other State agencies, municipal governments, regulated water utilities, and, importantly the general public. Information concerning upcoming public meetings or formal hearings related to the adoption of the Stream Flow Standards will be posted on DEP's website as well as through traditional media outlets such as local newspapers. For information on specific stream flow related questions, please contact the DEP Bureau of Water Management and Land Reuse at (860) 424-3020.

## **Acknowledgements**

The Department would like to thank the members of the Commissioner's Advisory Group and the workgroups who donated their time and expertise to assist the Department in developing the proposed Stream Flow Regulations.

### **Commissioner's Advisory Group**

Betsey Wingfield – Bureau of Water Management and Land Reuse  
Ralph Abele – US Environmental Protection Agency  
Jack Betowski – Connecticut Department of Public Utility Control  
Linda Bireley – Fisheries Advisory Council  
Ellen Blashinski – Connecticut Department of Public Health  
Darrell Smith – Connecticut Department of Public Health  
Eric Brown – Connecticut Business and Industry Association  
Virginia de Lima – US Geological Survey  
David Silverstone – South Central Regional Water Authority  
Marc Smith – The Nature Conservancy  
Kurt Strasser – University of Connecticut School of Law  
Lynn Werner – Housatonic Valley Authority

### **Scientific and Technical Workgroup**

Peter Aarrestad – DEP Inland Fisheries Division  
Lee Dunbar – WPLR Planning and Standards Division  
Bob Gilmore – WPLR Inland Water Resources Division  
Rick Jacobsen – DEP Inland Fisheries Division  
Elizabeth Ahern – US Geological Survey  
Colin Apse – The Nature Conservancy  
Jim MacBroom – Milone & MacBroom  
Piotr Parasiewicz – University of Massachusetts  
David Radka – Connecticut Water Company  
Doug Thompson – Connecticut College  
Glenn Warner – Connecticut Institute of Water Resources

### **Policy and Implementation Workgroup**

Lee Dunbar – WPLR Planning and Standards Division  
Robert LaFrance – Commissioner's Office  
Melanie Attwater Young – Connecticut Department of Agriculture  
Gil Bligh – City of New Britain  
Betsey Gara – Connecticut Water Works Association  
Darrell Smith – Connecticut Department of Public Health  
Kirt Mayland – Trout Unlimited  
Margaret Minor – Rivers Alliance  
Marc Taylor – Pomperaug Study  
Peter Gallant – Tighe & Bond  
Kachina Walsh Weaver – Connecticut Conference of Municipalities  
Maureen Westbrook – Connecticut Water Company

### **Scientific Support Staff**

Mary Becker – WPLR GIS and hydrologic analysis  
Chris Bellucci – WPLR GIS and hydrologic analysis  
Corrinne Fitting – WPLR Groundwater Hydrology

## Summary of Stream Flow Criteria

<b>System in which stream flow is controlled by a release from reservoir storage</b>			
<b>MINIMUM FLOW RELEASE RULE</b>			
<b>CLASS</b>	<b>0-5 years</b>	<b>6-11 years</b>	<b>11+ years</b>
<b>Class 1</b>	Run of River operation only		
<b>Class 2</b>	Existing Practice	75% of Natural Inflow	
<b>Class 3</b>	Existing Practice	Low Level Release plus Drought Triggers	Multi-Level Release plus Drought Triggers
<b>Class 4</b>	Existing Practice	Existing Practice or 0.1 cfs/m or alternative acceptable to Commissioner	
<b>System in which stream flow is controlled by surface or groundwater withdrawal</b>			
<b>MINIMUM FLOW REDUCTION RULE</b>			
<b>CLASS</b>	<b>0-5 years</b>	<b>6-11 years</b>	<b>11+ years</b>
<b>Class 1</b>	Existing Practice	0.05 X Q99 individual basis	0.05 X Q99 cumulative basis
<b>Class 2</b>	Existing Practice	0.25 X Q99 X F individual basis	0.25 X Q99 X F cumulative basis
<b>Class 3</b>	Existing Practice	0.50 X Q99 X F individual basis	0.50 X Q99 X F cumulative basis
<b>Class 4</b>	Existing Practice		
<b>FLOW MANAGEMENT PLAN OR AGREEMENT</b>			
<b>All Classes</b>	Effective upon adoption by the Commissioner		

**Table Notes:**

1. Permitted groundwater diverters operating in compliance with the terms of a permit shall be considered in compliance with the stream flow regulations.
2. Flow Management Plans or Agreements may be proposed at any time but in all cases must be adopted in accordance with the public participation requirements of the stream flow regulations
3. Q is in reference to the naturally occurring stream flow that would exist absent human intervention
4. F is defined as the ratio of the Q99 for the bioperiod in which consistency with the rule is being evaluated to the Q99 for the Rearing and Growth bioperiod.
5. Permits authorizing utilization of a new source or expanding the use of an existing source shall require compliance with the final (11+ years) standards.
6. The implementation schedule above may be extended provided the Commissioner issues an Order that includes an alternative schedule to bring the water user into compliance.
7. Leakage and spillage may be used to comply with release requirements
8. Dams operated in instantaneous run of river mode with no withdrawal from the reservoir shall be considered to be in compliance with the stream flow regulations and are exempt from monitoring and reporting requirements.
9. The Commissioner may approve alternative compliance criteria provided it is demonstrated that compliance with the alternative compliance criteria will achieve consistency with the narrative standards for the river or stream system.