A Report to the Environment Committee of the Connecticut General Assembly Pursuant to Section 2 of Public Act 24-13 - An Act Concerning the Water Resources of the Upper Farmington River Valley

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Recommended courses of action for the Department of Energy and Environmental Protection (DEEP) to manage the waters contained in Colebrook River Lake between the levels of seven hundred one feet and six hundred forty-one feet

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Commissioner
Connecticut Department of Energy and Environmental Protection

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Front cover- the "tower" at Colebrook River Lake Dam is 243 feet tall. The vertical white line has the elevation in feet above sea level. The reservoir level in this photo, taken on October 17, 2017 is 641.1 feet. The elevation of 708 feet is considered by the United States Army Corps of Engineers (USACE) to be the normal or permanent pool for flood risk management. Photo by the DEEP Fisheries Division.

Back cover- the village of Riverton has hosted a fishing derby to kick off the spring trout fishing season for 75 years. The derby continues to draw large numbers of anglers seeking to win a custom-made Hitchcock Chair for catching the largest trout (web photo circa 1980's).

EXECUTIVE SUMMARY

This draft report, prepared for the Connecticut General Assembly's Environment Committee, outlines recommendations for managing certain waters contained in Colebrook River Lake (CRL) per Public Act 24-13. The primary goal of this report is to lay out a plan for optimal flow management on the Farmington River to balance needs for fish, wildlife, recreation, river health, flood mitigation, tourism, hydropower, and safety by utilizing established water storage zones, or "pools" within CRL and adhering to seasonal flow targets.

Per authority provided in Public Act 24-13, as well as a letter sent to Department of Energy and Environmental Protection (DEEP) by the Metropolitan District (MDC) (Appendix C), DEEP will make requests to release the water stored between elevations 644-701 feet in CRL to achieve the targeted releases shown in Table 1. The plan provides DEEP with options to modify the volume requested for release based on environmental conditions such as surface flows monitored by the United States Geologic Survey (USGS), trends in precipitation data as published by the Connecticut Interagency Drought Workgroup, the pool elevation within CRL, and local/regional weather forecasts and conditions. It is important to note that all existing legal and statutory "rules" of the river would remain in place.

To determine the targeted release values in Table 1, this report considers the following factors:

A. Fish and Wildlife: Special focus on maintaining cold-water flows critical for trout survival and supporting a sustainable "Survivor Strain" brown trout program. Water stored in the Fisheries pools are to be used to manage for optimal habitat.

B. Recreation and Tourism: Adjusted flow levels to enhance recreational activities like fishing, tubing, and kayaking while ensuring economic benefits through tourism.

C. Flood Risk Reduction: The United States Army Corps of Engineers (USACE) maintains elevation levels to accommodate floodwaters, with strategic storage reallocations to minimize sudden, large-volume releases.

D. Hydropower: Continued support for energy generation at existing facilities without negatively affecting river operations.

E. Safety: Collaborative efforts to prevent excessively high flows and flooding downstream, considering unpredictable weather events. USACE decisions will always have to take priority.

F. Stakeholder Engagement: Extensive consultations with government bodies, Non-Governmental Organizations (NGOs), and community members to ensure all interests are represented.

G. Challenges: Lower-than-expected natural inflows and potential dry years pose sustainability issues, requiring flexible management and possibly reduced flow targets.

Table 1. Targeted release values by month from Colebrook River Lake Dam in Cubic Feet per Second (CFS).

Month	Targeted Release (CFS)
January	125
February	125
March	150
April	200
May	200
June	250
July	300
August	250
September	125
October	125
November	125
December	125

The three existing legal and statutory "rules" of the river:

1. MDC shall pass 50 cubic feet per second from Goodwin Dam, at all times.
2. MDC shall pass from Goodwin Dam all "natural" inflow up to 150 cubic feet per second.
3. MDC shall pass from Goodwin Dam all releases from the Otis Reservoir.

This detailed framework prioritizes ecological preservation, recreational benefits, and flood risk management while addressing legislative requirements and stakeholder expectations. The Farmington River is a great example of a flow-managed river that supports many uses. These uses all rely upon the availability of high-quality water impounded in both CRL and the West Branch Reservoir. Effectively balancing the requirements for various fish, wildlife, and human uses is critical for maintaining the river as we have known it for future generations.

Note on pool elevations. All elevations (feet) in this report refer to Mean Sea Level (MSL) (National Geodetic Vertical Datum 1929) unless otherwise noted.

Public Act 24-13 requires DEEP to prepare a report with recommendations on management of the waters contained in the storage space in CRL between elevations 641 and 701 feet. However, elevation "641" should be elevation "644" feet as originally defined when the CRL Dam was constructed. The CT Department of Public Health approved the abandonment of water stored between elevations 644 and 701 feet in the "Amended Source Abandonment Permit" issued January 2024, and in its the letter to Commissioner Dykes, MDC only relinquished rights to control of the water stored between those elevations.

DEEP believes the pool between elevations 644 and 701 feet, approximately 10 billion gallons (BG), is sufficient to meet the legislative intent of optimizing flow on the Farmington River. After construction of the dam and reservoir were completed, revised operating procedures were developed and the boundary elevations of the various storage zones were adjusted by USACE to more accurately reflect the intended storage capacities of the individual storage zones. This is why some boundary elevations in this report, such as 701.2 feet vs 701.0 feet differ from the elevations in the original contract agreement.

The unique ability to ameliorate summertime low flows and elevated water temperatures with high-quality cold water provides ideal conditions for optimizing brown trout growth and survival in the Farmington River. For over 30 years, the Fisheries Division has been managing the "Survivor" strain of brown trout in the Farmington River. Anglers from across the world travel to Connecticut to try and land their own "Survivor". View a short video about this special fish. Photo by DEEP Fisheries Division.

INTRODUCTION AND BACKGROUND

The Farmington River has a rich history of use, including powering multiple industries and supplying ice and drinking water to residents of growing metropolitan areas. The Farmington River watershed is approximately 600 square miles (Figure 1). The Farmington River originates in Massachusetts and is the largest tributary to the Connecticut River in CT. The mainstem of the Farmington River begins in New Hartford, CT at the confluence of the East and West branches of the Farmington River. Much of the smaller East Branch watershed in Connecticut consists of the Barkhamsted Reservoir and Lake McDonough, both owned by the MDC. The Barkhamsted Reservoir is the primary source of drinking water for the greater Hartford area.

The West Branch watershed originates in Becket, MA and flows southeast to Connecticut through CRL, managed by the USACE, and then into West Branch Reservoir (AKA "Hogback" or "Goodwin" Reservoir), managed by MDC. In Otis, MA, Otis Reservoir drains into the West Branch Farmington River and can be a significant source of flow at times. The design and operation of CRL and West Branch Reservoir support exceptional cold-water habitat and a world-class year-round trout fishery in downstream reaches of the Farmington River. The river also supports recreation for many people who enjoy whitewater kayaking, canoeing, and tubing through "Satan's Kingdom" and other parts of the river. The largest tributary to the West Branch Farmington River is the Still River, including Sandy Brook. With a watershed comprising about 50 square miles, the Still River is a key contributor to water temperature and flow conditions in the West Branch of the Farmington River.

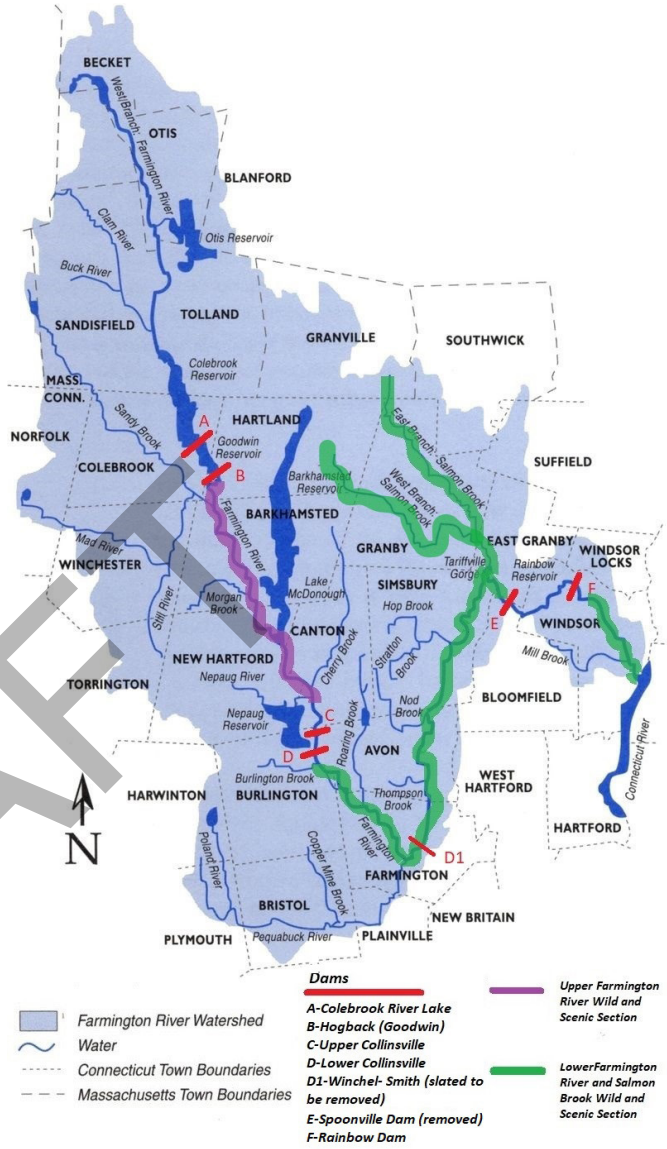


Figure 1. The Farmington River Watershed. Base map courtesy of the Farmington River Watershed Association. Dams and boundaries of the Wild and Scenic sections added by CT DEEP.

About Colebrook River Lake

In many USACE flood control areas water is only stored when necessary, during times of excessive precipitation. However, the construction of CRL Dam resulted in legislation, policies, and standard operating procedures that allocated several water storage zones based on elevation (herein referred to as "pools") to various entities and help to manage releases from said pools for various purposes.

Colebrook River Lake multi-purpose storage zones

The following is a listing of the different existing water storage zones (AKA pools) and elevations by controlling entity. Please refer to Appendix A1/A2 for schematics of these storage zones. The origin of the specified boundary elevations for the various storage zones (pools) was in the "*Contract between the USA and MDC for Water Storage Space in Colebrook River Reservoir -1965*", which was revised in 1975. After construction of the dam and reservoir were completed, revised operating procedures were developed and the boundary elevations of the various storage zones were adjusted by USACE

to more accurately reflect the intended storage capacities of the individual storage zones. This is why some boundary elevations in this report, such as 701.2 feet vs 701.0 feet differ from the elevations in the original contract agreement. The information on storage zones was obtained from notes from a meeting on October 29, 1998 between MDC, the USACE, DEEP, Farmington River Power Company, and Stanley Works to discuss operational releases from CRL during low flows and from schematics provided by MDC (Appendix A1/A2).

-Flood Control Zone (USACE): Elevations 708.0 to 761.0 feet.
Note that this zone contains the ***"Spring Pool" AKA "Spring Shad" Fishery Storage (USACE/DEEP) 708.0 to 714.5 feet.*** This 1.63 BG is retained until DEEP requests specific withdrawal or July 1, whichever comes first. The USACE must have CRL's surface at elevation 708 or lower by July 1 until April 1 unless there is a need to store floodwater. USACE decisions regarding release or storage have priority.

-Fall Trout Fishery Storage Zone (DEEP): Elevations 701.2 to 708.0 feet.
This 1.63 BG pool is exclusively allocated for improving fish habitat and is retained until the DEEP requests withdrawal.

-Water Supply Zone (MDC): Elevations 598.0 to 701.2 feet.
The traditional use of this pool was to support riparian releases for the Farmington River Power Company and to hold for potential future water supply. MDC has relinquished its rights to the 10 BG "water supply zone" storage space located between elevations 644 to 701 feet per the letter to Commissioner Dykes (Appendix C). MDC retains its rights to the pre-existing 3.5 BG "water supply" zone storage space located between elevations 598 to 644 feet.

-Dead Storage Zone: Elevations 567.0 to 598.0 feet.

A long history of flow modification

The flow of water within the Farmington River has been altered since early colonial times through the construction of multiple dams along the mainstem river and tributaries. Some of the earliest dams, built with local old growth timber, were used to power gristmills, sawmills, and support manufacturing. Most of these dams no longer exist as they have been lost to major flood events. More recently, construction of the Goodwin Dam (AKA Hogback Dam) est. 1960, the Colebrook River Lake Dam est. 1969, and associated infrastructure have resulted in complex laws and policies to support natural resources, recreation, flood mitigation, hydropower, and manufacturing. ***It is important to note that the river conditions, as many have come to know it and use it during dry and warm summer months, rely completely on augmentation of flow via release of high-quality cold water stored within CRL (Figure 2) and MDC's West Branch Reservoir.***

Colebrook River Lake and the control tower on October 17, 2017 when the surface elevation was 641.1 feet. Photo by the DEEP Fisheries Division

Flow augmentation: recent background

The MDC has been seeking release from financial obligations associated with its contract with the USACE that require MDC to pay a certain percentage of maintenance costs at CRL in exchange for the rights to the water storage space in CRL between a pool elevation of 644 feet and 701 feet, a volume of approximately 10 BG when full (Appendix A1/A2). As part of this effort to obtain release from contractual obligations, MDC functionally relinquished its rights to the 10 BG pool beginning in the spring of 2022, leading to noticeable deviations from past flow regimes in the West Branch and mainstem of the Farmington River.

During dry periods, especially during May-August, flows were lower than in past years as MDC was no longer making contractual riparian releases for the Farmington River Power Company from the 10 BG pool. Due to the lack of riparian releases, DEEP released 1.5 BG of the water from its Fisheries Pool in 2022 to maintain suitable conditions for fish and aquatic resources.

During wet periods in 2023, CRL was often at atypically high levels due to the lack of riparian releases, leading to more high volume releases over a short period of time by the USACE to return the lake to levels required for flood control purposes (at or below pool elevation 708 feet). These releases, determined essential for flood mitigation watershed-wide, produced downstream flows up to 1,000 to 2,000 cubic feet per second (CFS) during which time the river was unusable for most users.The deviations from “normal” flow patterns in 2022 caused anglers, other recreationists, and members of the public to contact elected officials, DEEP, MDC, and the USACE to express concern, especially during the summer of 2022 when flows in the river were consistently low and many members of the public perceived CRL as being “full”.

Flow augmentation: current situation

Public Act 24-13 (Appendix B) was signed by Governor Lamont on May 14, 2024. Section 1 requires DEEP, in consultation with the MDC, to request that the USACE release or hold back water in CRL as needed to achieve an optimum flow in the Farmington River for such purposes as fish and wildlife, recreation, the river’s health, flood risk reduction, tourism, hydropower, and safety. Section 2 requires DEEP to submit a report on recommended courses of action for the state to manage waters contained within CRL between pool elevations of 644 feet to 701 feet (i.e., the pool relinquished by MDC) by January 1, 2025.

Concurrently, the MDC put forth an interim 2024 minimum flow regime for the period from May 1 through December 31 in a letter to DEEP Commissioner Dykes (Appendix C). This regime assumes DEEP will make requests to the USACE to release water from the 10 BG pool between 644 and 701 feet elevation in CRL in order to make up any difference between the recommended minimum flow value (Table 2) and obligatory releases by MDC (see call out box below). Note that these releases would be separate and distinct from any releases from the 1.63 BG Spring Fisheries Pool (708 to 714.5 feet) or the 1.63 BG Fall Fisheries Pool (701 to 708 feet) that DEEP has rights to and manages as needed exclusively for fisheries resources.

View of the West Branch Reservoir from the access road on top of the Colebrook River Lake Dam on October 17, 2017. Photo by the DEEP Fisheries Division.

MDC indicated that their proposed 2024 minimum flow regime is loosely based on historical average augmentation release rates primarily resulting from riparian releases made by MDC at the request of the Farmington River Power Company (as noted previously, MDC is no longer making such riparian releases). The interim regime also reflects suggestions from DEEP Fisheries Division staff to allocate more water during fall months to provide adequate habitat for trout spawning and egg incubation.

This plan conforms to the framework for Farmington River flows developed in the 1992 Farmington River Instream Flow Study that was prepared as part of the Wild and Scenic designation process and is also represented in the 2013 update of the Upper Farmington River Management Plan (plan developed for management of the designated Wild and Scenic Upper Farmington River by the Farmington River Coordinating Committee).

Table 2. Targeted release values by month from Colebrook River Lake Dam (CFS). The targeted release value includes natural inflow up to 150 CFS (with a minimum of 50 CFS required of MDC at all times) and any release from the Otis Reservoir. Values for the months of September to March were modified or established by DEEP.

Month	Targeted Release (CFS)
January	125
February	125
March	150
April	200
May	200
June	250
July	300
August	250
September	125
October	125
November	125
December	125

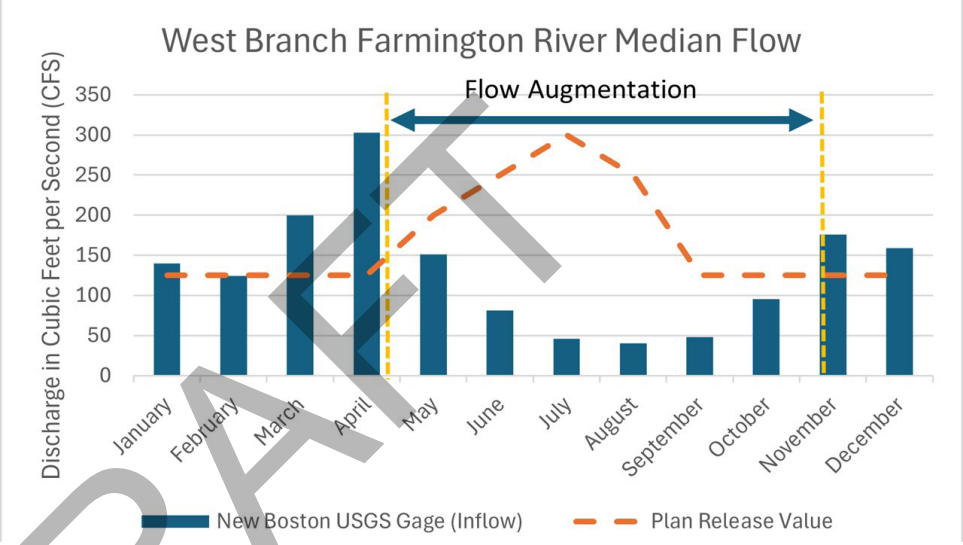


Figure 2. A comparison of the long-term monthly median (N=111 years) inflow to Colebrook River Lake (New Boston USGS stream gage data shown as blue bars) and the targeted release values from the 10 BG storage pool of water (elevation 644 to 701 shown as an orange dashed line) by month. It is important to note that the targeted release values during the summer flow augmentation period (start and end dates indicated by vertical broken yellow lines) are much higher then natural inflow. In years when inflow is below the long-term median requested, release values will likely be lower than planned to ensure enough water is reserved to provide suitable flows and water temperatures for trout for the entirety of the year.

Converting Cubic Feet Per Second to Gallons Per Day

This report contains values for discharge or flow in CFS, but also references volumes in gallons (often as billion gallons = BG). The conversion of discharge to gallons is often calculated to determine how much water is being released from the various storage zones (pools) and how long that release can be sustained. The formula used to calculate gallons per day = cubic feet per second x 7.481 gallons/cubic foot x 24 hours/day x 60 minutes/hour x 60 seconds/minute (or for simplicity, gallons per day = CFS x 0.6463). Appendix E shows conversion from CFS to (million gallons per day) MGD for 0 to 500 CFS in 5 CFS increments.

MANAGEMENT OF RELEASES

DEEP evaluates inflow, CRL surface elevation (Appendix D), water temperature, and weather forecasts to inform decisions about release requests (Table 3). In particular, DEEP relies heavily upon the streamflow measured at gages maintained by the United States Geological Survey on the West Branch Farmington River at New Boston, MA (gage number 01185500), West Branch Farmington River at Riverton, CT (gage number 01186000), and Still River at Robertsville, CT (gage number 01186500). DEEP will communicate any requested changes to prevailing releases to both the USACE and MDC via a weekly email request, usually on Friday (unless there is an immediate need).

Occasionally, there may be a need for a short-term temporary change in the flow regime to facilitate recreational, scientific, or infrastructure maintenance activities. Any request to modify the targeted release should be sent to DEEP at least two weeks in advance via email to deep.inland.fisheries@ct.gov or by phone to 860-424-3474.

The USACE must maintain CRL, except in time of flood, at or below elevation 708 feet (the normal or permanent pool for flood risk management) from July 1 to April 1. In wet years, when water in CRL is approaching 708 feet and inflow values are much above normal between July 1 and April 1, DEEP recommends increasing monthly flow values (Table 3) in the West Branch Farmington River to reduce the need for the USACE to release large volumes of water over a short period of time.

Data Used to Inform Decisions

DEEP uses the categories of surface river flow (much above normal, above normal, normal, below normal, much below normal), as published by the United States Geologic Survey (USGS) for stream gages in New Boston, Riverton, and Robertsville to inform water release decisions.

DEEP follows trends in precipitation data (abnormally dry, moderate drought, severe drought, extreme drought, and exceptional drought), as published by the Connecticut Interagency Drought Workgroup and by the pool elevation within Colebrook River Lake to inform water release decisions.

This process would mimic the natural hydrology in the West Branch of the Farmington River by providing more flow during periods of heavy precipitation. During these periods of higher than normal flow, the Reservoir Control Center program (part of the USACE) reviews river levels basin wide for the Connecticut River and makes appropriate releases to prevent downstream flooding and facilitate safety (potentially overriding release values in Table 2). As this program mitigates against flooding for the entire Connecticut River Basin, certain hydrologic conditions may dictate the timing and frequency of large volume releases or holdbacks (holdbacks may reduce flows to as low as 50 CFS) from CRL. USACE decisions to release or holdback water will always have to take priority.

Table 3. Goals and strategies to maintain optimal flow in the Farmington River based upon the amount of water available from precipitation. In "wet" years with above normal or much above normal precipitation, releases may not be needed from the 10 BG storage pool. DEEP will collaborate with the USACE and MDC to minimize extended periods of high flows in the river. During "dry" years with below normal or much below normal precipitation, releases may need to be reduced to ensure some water can be released throughout the entire "dry" period.

Precipitation year to date and recent past	Overall Goal for Releases from the 10 BG pool	Strategy for Release
Much above normal	Mitigate against chronic elevated flows which could impact recreation, safety, and flood risk.	Reduce / do not request releases if water exceeds elevation 708. Likely no need to augment as the USACE will likely need to release water temporarily held in the flood zone to drop to elevation 708. Collaborate with the USACE and MDC to minimize chronic high flows while concurrently mitigating downstream flooding.
Above normal		
Normal	Implement the proposed targeted release values. Augmentation of flows are needed in summer months.	In a normal year there will likely be adequate water to support the targeted releases.
Below normal	Conserve water.	Request a reduced volume of release. Follow targeted release volumes for key times to support recreation, like weekends and holidays.
Much below normal		Request lower release values to support suboptimal habitat (95 CFS). Take action to protect fish and wildlife and river health.

During a dry year, the planned flow regime is unsustainable. In years with below normal or much below normal inflow and pool elevation indicates less than 50% capacity (approximately 673 feet), the DEEP may make alterations to the minimum release values.

The northern portion of Colebrook River Lake during the fall of 2016. The entire flow of the West Branch of the Farmington River (15.9 CFS at the New Boston gage on 10/21/16 at 11:00 am) can be seen flowing under the Harvey Mountain Bridge and into the remaining Colebrook River Lake pool (elevation of 634.9 feet). The deck of the bridge is exposed when the lake is at 646.5 feet.
Photo by the DEEP Fisheries Division

The release volumes in this plan equate to a total annual release of 37.4 BG of water if implemented in full, which is more than three times the water that can be stored between elevations 644 and 701 feet in CRL. During a dry year, the planned flow regime is unsustainable. In years with below normal or much below normal inflow and pool elevation indicates storage is below 50% capacity (approximately 673 feet), DEEP may make alterations to the minimum release values (Table 4). During below normal inflow or much below normal inflow the actual releases would need to be managed at a lower level (possibly much lower). Under these conditions, we recommend more sustainable values as described within the Farmington River Instream Flow Study.

Table 4. Colebrook River Lake surface elevations for July, August, September, and after September with associated release action. Elevation values were based on average weekly elevation data from 1993-2023 provided by the MDC (Appendix D). As the total volume of this plan equates to more than three times the volume of water that can be stored at one time, responsible management to prevent 100% use of the pool is advised during "dry" periods.

Elevation/Date	Action
Above 690.0 feet prior to July 1 or	Proceed with targeted release values as described in Table 2
689.9 to 680.0 feet prior to August 1 or	
679.9 to 665.0 feet prior to September 1 and after	
689.9 to 680.0 feet prior to July 1 or	Reduce targeted release values in Table 2 depending on environmental conditions at the time and rate of water use by the targeted releases
679.9 to 670.0 feet prior to August 1 or	
664.9 to 655.0 feet prior to September 1 and after	
Less than 680.0 feet prior to July 1 or	Greatly reduce targeted release values in Table 2 to the suboptimal scenario from the Farmington River Instream Flow Study (95 CFS)
Less than 670.0 feet prior to August 1 or	
Less than 655.0 feet prior to September 1 and after	

National Wild and Scenic Designations

Much of the watershed has been designated as a National Wild and Scenic River. The upper section (14 miles) from the confluence with the Nepaug River upstream to the West Branch Reservoir was established in 1994 and is overseen by the Farmington River Coordinating Committee. The lower section (37 miles) and the Salmon Brook Watershed (26 miles), established in 2019, is overseen by the Lower Farmington River & Salmon Brook Wild and Scenic River Committee. The lower Wild and Scenic section begins 0.2 miles below the lower Collinsville Dam and ends at the confluence with the Connecticut River (*excluding a section from the former Spoonville Dam downstream to one half mile below the Rainbow Dam*).

Kiosks like this one bordering the river educate visitors and river users about the history of the river and the benefits it provides. Photo by the DEEP Fisheries Division.

ACHIEVING OPTIMAL FLOWS

1. FISH AND WILDLIFE

The Farmington River is unique as it is the largest "tailwater" fishery in Connecticut. The design and operation of the CRL and Goodwin (Hogback) dams result in the ability to augment flows during typical low flow summer months with very cold (approximately 55 F) and well-oxygenated water, providing beneficial summertime conditions for trout. Additionally, the warmer than natural water temperatures (provided by the bottom releases) in fall and early spring create an extended growing season for trout. The Farmington River Instream Flow Study defines the optimal flow to support fishing as a range of 150 to 350 CFS. Angler surveys, conducted by the DEEP Fisheries Division, indicate conditions are favorable for fishing when flows below the Still River are 150-400 CFS. Without the ability to artificially augment natural flows to achieve these discharge rates, the fisheries of the West Branch of the Farmington River would be dramatically different. The availability of cold-water releases from upriver dams allows the Fisheries Division to manage a world-class trout fishery in the Farmington River. The Fisheries Division's unique "Survivor" strain brown trout" program uses a combination of wild brown trout and hatchery-reared holdover brown trout that have successfully lived in the river for at least a year as spawning stock to produce a strain of trout uniquely adapted to the Farmington River.

In addition to the unique water quality and quantity found in the Farmington River, the lands within the watershed have remained largely undeveloped and forested. The large block of connected forest, wetlands, lakes, ponds, and rivers within the Farmington River watershed provide habitat for a diverse range of amphibians, reptiles, birds, mammals, and invertebrates.

Fisheries Pools in Colebrook River Lake

The DEEP controls two 1.6 BG "pools" of water storage space in CRL allocated exclusively for fisheries use (Appendix A1/A2). The "***fall pool"*** is a stand-alone storage space located between elevation 701 to 708 feet. This water is for fisheries use only and is released at DEEP's discretion.

The "***spring pool"*** is located within the flood control storage space owned and controlled by the USACE (elevation 708 to 714.5 feet), which was established during the construction of the dam to increase the amount of water to support diadromous fish runs, especially American shad. However, by July 1 of each year, to prepare for potential excessive inflow (tropical storms, hurricanes, etc.) the USACE must ensure adequate capacity for flood storage by keeping the water at elevation 708 feet or lower (except when absorbing flood water). The spring pool, if not used by July 1, has traditionally been allowed to "float" on top of the MDC's 10 BG pool for use by the DEEP later in the calendar year. This plan envisions relocating the spring pool (1.6 BG) to be within the 10 BG storage space. As such, any water above elevation 708 will be at the discretion of the USACE year-round.

Water temperature and fish habitat: Water temperature is critical to maintain the world class trout fishery in the Farmington River. Occasionally, a combination of low precipitation and excessively warm air temperatures (especially warm overnight temperatures) will result in elevated water temperatures. The DEEP Fisheries Division monitors environmental conditions within the Farmington River and releases water from DEEP's fisheries pools to mitigate detrimental conditions for trout.

Table 5. Recommended actions to maintain optimal flow in the Farmington River for ***"Fish and Wildlife"*** based upon the amount of water available as a result of precipitation. Utilize the 10 BG storage pool in conjunction with DEEP's two fisheries pools to maintain optimal flows for fish and wildlife, while considering impact of releases on other stakeholder categories and adjusting as practical. In "wet" years with above normal or much above normal precipitation, releases may not be needed from the 10 BG storage pool. DEEP will collaborate with the USACE and MDC to mitigate against chronic high flows in the river. During "dry" years with below normal or much below normal precipitation, releases may need to be lowered to ensure some water can be released throughout the entirety of the "dry" period.

Precipitation Much Below Normal	Precipitation Below Normal	Precipitation Normal	Precipitation Above Normal	Precipitation Much Above Normal
Adjust releases to be much lower than Table 2 monthly target values. Augment flows, as possible, to ensure adequate water temperature for trout, spawning habitat, and/ or egg incubation (sub optimal habitat flow of 95 CFS).	Adjust releases to be lower than Table 2 monthly target values as practical, augment flows to ensure adequate water temperature for trout, spawning habitat, and/or egg incubation. Adjust releases to be lower than monthly values (optimal habitat value of 150 CFS).	Use Table 2 monthly target values.	Adjust releases to be higher than Table 2 monthly target values as practical, adjust timing of releases to facilitate fishing and other recreation.	Adjust releases to be higher than Table 2 monthly target values as practical, occasional large volume releases to mitigate against flooding.

The habitat provided by the Farmington River supports a diverse biological community. Photos by the DEEP Fisheries Division.

2. RECREATION

As the Farmington River drops in elevation from West Branch Reservoir to Rainbow Reservoir, one can float or paddle through a variety of conditions. Alternating sections of rapids and long slow pools offer a varied combination of experiences. The Farmington River also has several sections in which white water rapids reach world-class conditions during elevated flows (Satan's Kingdom and Tarriffville Gorge). Optimal flow conditions for tubing, canoeing, paddleboarding, and kayaking are varied and can occur at some frequency during normal, above normal, and much above normal flow conditions. As precipitation and runoff wane, flow augmentation is required to support these activities. When pool elevations indicate that storage is less than 50% capacity, resulting from prolonged below normal or much below normal flow conditions, the targeted releases will not be sufficient to provide sustained periods of elevated flows desirable for some recreational activities.

Table 6. Actions to maintain optimal flow in the Farmington River for ***"Recreation"*** based upon the amount of water available as a result of precipitation. In "wet" years with above normal or much above normal precipitation, releases may not be needed from the 10 BG storage pool. DEEP will collaborate with the USACE and MDC to mitigate against chronic high flows in the river. During "dry" years with below normal or much below normal precipitation, releases may need to be lowered to ensure some water can be released throughout the entirety of the "dry" period.

Precipitation Much Below Normal	Precipitation Below Normal	Precipitation Normal	Precipitation Above Normal	Precipitation Much Above Normal
Adjust releases to be much lower than Table 2 monthly target values. Augment flows to facilitate fishing, boating, and tubing on important weekends/holidays during traditional use if possible.	Adjust flows to be lower than Table 2 monthly target values as practical. Augment flows to facilitate fishing, boating, and tubing on weekends/ holidays during traditional use if needed and the volume of water will be sustainable if conditions degrade into "much below normal".	Use Table 2 monthly target values. Support requests for changes to monthly values for special events on as needed basis.	Adjust releases to be higher than Table 2 monthly target values as practical, adjust timing of releases to facilitate fishing, boating, and tubing on weekends/ holidays during traditional use.	Adjust releases to be higher than Table 2 monthly target values as practical, occasional large volume releases to mitigate against flooding, adjust timing of releases to facilitate fishing, boating, and tubing on weekends/ holidays during traditional use.

Paddling down river in a canoe or kayak is a great way to experience the Wild and Scenic River. The late David P. Sinish (red and yellow kayak). Photo by the Farmington River Watershed Association.

Tubing is supported through a vendor located at Satan's Kingdom. The cold water and augmented flows make this activity popular even when other rivers do not have enough flow. Photo by the Farmington River Watershed Association.

Table 7. Flow values for recreational activities from the Farmington River Instream Flow Study. Preliminary conclusions on the minimum and optimum flow levels for the primary recreational uses were developed by integrating results of the surveys and field evaluations. Those findings were presented to representatives of the major user groups and were revised based on their input. Other local experts were also contacted for their opinions on critical issues such as how different flows affect safety considerations. Note that the values below are for flow just below the confluence with the Still River and not for the West Branch Reservoir release itself.

Activity	Minimum Flow (CFS)	Optimal Range (CFS)
Tubing	100 150*	200-980 250-350*
Canoeing	250	360-980
Kayaking	250	540-980
Paddleboarding*	50	100-700
Fishing	100	150-350
Scenic Enjoyment	N/A	240-540

*Values provided by Farmington River Tubing. Operation of the concession is suspended at values 100 CFS or less or 1000 CFS or more.

**Please note that at the time of the 1992 Instream Flow Study, paddleboarding was not a popular recreational activity. The values for paddleboarding were estimated by DEEP for this report and as paddleboarding primarily occurs on the impoundment in Collinsville, most flows are likely within an optimal range.

The river has world-class white water when flows are too high for many other recreational uses.

Photo by the Farmington River Watershed Association

3. THE RIVER'S HEALTH

As flow in the Farmington River is highly managed, a mandate to ensure "river health" can be interpreted as ensuring that management of the river continues to support the diverse flora and fauna that have come to call the watershed home. This plan does not deviate from management that has occurred over the past several decades and as such will continue to support fish and wildlife in the Farmington River as we know it.

High flow events are part of the ecology of a natural river and result in important natural processes such as redistribution of stream bottom substrates, channel reconfiguration, and deposition of large wood material that provides important in-water habitat. In regulated rivers like the Farmington River, high flow events only result when the water levels exceed the spillway height or purposeful releases are made through discharge infrastructure. Fortunately for the Farmington River, the Still River and Sandy Brook are not fully regulated and can offer natural high flows as they occur.

An angler enjoying an afternoon fishing at the confluence of the Still River and West Branch of the Farmington River. Summer fog is common along the river as the cold water release interacts with warmer and humid air. Photo by the DEEP Fisheries Division

Table 8. Actions to maintain optimal flow in the Farmington River for "***The River's Health"*** based upon the amount of water available as a result of precipitation. In "wet" years with above normal or much above normal precipitation, releases may not be needed from the 10 BG storage pool. DEEP will collaborate with the USACE and MDC to mitigate against chronic high flows in the river. During "dry" years with below normal or much below normal precipitation, releases may need to be lowered to ensure some water can be released throughout the entirety of the"dry" period.

Precipitation Much Below Normal	Precipitation Below Normal	Precipitation Normal	Precipitation Above Normal	Precipitation Much Above Normal
Adjust releases to be much lower than Table 2 monthly target values, likely to suboptimal habitat level of 95 CFS. Augment flows, when needed, to mitigate against elevated water temperature.	Adjust releases to be lower than Table 2 monthly target values, likely to optimal habitat level of 150 CFS. Augment flows, when needed, to mitigate against elevated water temperature.	Use Table 2 monthly target values.	Adjust releases to be higher than Table 2 monthly target values as practical.	Adjust releases to be higher than Table 2 monthly target values as practical, occasional large volume releases to mitigate against flooding.

4. FLOOD RISK REDUCTION

Following catastrophic flooding in August of 1955, a network of flood control dams was constructed by the USACE across the state. In the Farmington River watershed, these include dams on the Mad River, Sucker Brook, and the West Branch of the Farmington River. The primary function of CRL Dam is flood mitigation. The facility is one of many in the Connecticut River watershed that are operated in sync to manage flows from the headwaters to the river's mouth in Old Saybrook. To be able to absorb any major runoff from large scale precipitation events, USACE is required to keep the water behind the dam below elevation 708 feet from July 1 through April 1. The "Spring Fisheries Pool" is held temporarily by the USACE from elevation 708 to 714.5 feet until July 1. Any large releases of water over a short duration may occur after storage from a large precipitation event where water is above the 708 elevation level. The standard operating procedure for USACE Reservoir Control Center (RCC) is to get back to 100% capacity for flood storage (back to 708) as quickly as possible, within USACE standards for release, so the USACE can best handle the next precipitation event. DEEP envisions relocating the spring pool (1.6 BG) within the 10 BG storage space. As such, any water above elevation 708 feet would be managed at the discretion of the USACE year-round. This small change in operation will likely reduce the number of short duration large volume water releases needed by the USACE to remain at or below elevation 708.

Table 9. Actions to maintain optimal flow in the Farmington River for ***"Flood Risk Reduction"*** based upon the amount of water available as a result of precipitation. In "wet" years with above normal or much above normal precipitation, releases may not be needed from the 10 BG storage pool. DEEP will collaborate with the USACE and MDC to mitigate against chronic high flows in the river. During "dry" years with below normal or much below normal precipitation, releases may need to be lowered to ensure some water can be released throughout the entirety of the "dry" period.

Precipitation Much Below Normal	Precipitation Below Normal	Precipitation Normal	Precipitation Above Normal	Precipitation Much Above Normal
N/A for releases; capture any excess inflow.	N/A for releases; capture any excess inflow.	Use Table 2 monthly target values.	Adjust releases to be higher than Table 2 monthly target values as practical. Collaborate with the USACE and MDC to keep CRL at or below elevation 708 feet. USACE decisions to release or holdback water have priority.	Adjust releases to be much higher than Table 2 monthly target values as practical, occasional large volume releases to mitigate against flooding. When pool elevation exceeds elevations 708 feet the USACE takes on full management of releases. Additionally, if there are flooding concerns for the Connecticut River basin, the USACE will step in to modify releases for flood control purposes in the basin. USACE decisions to release or holdback water have priority.

Occasionally, during periods of sustained high precipitation, water spills over the Goodwin Dam. A key function of the Colebrook River Dam (far background in photo) is to mitigate against flooding in the watershed. Photo by the Farmington River Watershed Association.

5. TOURISM

Connecticut has many attributes attractive to a wide variety of vacationers and stay-cationers. The Farmington River and surrounding public lands are one such attraction. This plan supports tourism through maintaining river flows as they have been for decades. We do not envision any negative impact to tourism resulting from this plan.

With folks traveling from far and wide to fish the Farmington (over 100,000 hours of fishing effort annually) or to float the many miles of wild and scenic river, the Farmington River is a destination for many. The draw for recreation, wildlife watching, hiking nearby state forest trails, and of course fishing, brings millions of dollars annually to the State of Connecticut.
Photo by the DEEP Fisheries Division (top left); by Raymond Lass (top right); by the Farmington River Watershed Association (bottom).

6. HYDROPOWER

Currently, there are three facilities capable of using the river to generate power: Goodwin Dam (AKA Hogback), Upper Collinsville Dam, and Rainbow Dam (Figure 1).

Goodwin Hydroelectric Project (FERC Project P-4297) is a 3.2-megawatt (MW) hydropower facility with two Francis turbines owned and operated by the MDC that became operational in 1986. The facility operates under a Federal Energy Regulatory Commission (FERC) exemption in run-of-river mode with an operational range of 100 to 400 CFS. No fish passage facilities are present at the Goodwin Hydroelectric Project. (MDC stocks the West Branch Reservoir annually with trout).

Upper Collinsville Project (P-10822) is a 1 MW hydropower facility with a single vertical Kaplan turbine operated by the Town of Canton that became operational in 2023. The facility operates under a FERC license in run-of-river mode with an operational range of 277 to 636 CFS. The Town of Canton constructed and operates upstream and downstream fish passage facilities designed and currently being evaluated in consultation with DEEP, United States Fish and Wildlife Service (USFWS), and National Ocean and Atmospheric Administration (NOAA).

Rainbow Dam, the most downstream dam on the Farmington River, is an 8.2 MW hydropower facility with two vertical Francis turbines owned and operated by Stanley Black and Decker (SBD) subsidiary Farmington River Power Company that became operational in 1925. SBD has a longstanding riparian flow agreement with the MDC that allows SBD to request upstream releases necessary to operate their hydropower works within certain limits. The turbines at this facility are aging. Current upstream and downstream fish passage is ineffective, causing the fish ladder to be closed. Rainbow Dam is the subject of significant advocacy from members of the environmental community due to the negative impacts to fish passage, streamflow, and toxic algal blooms in Rainbow Reservoir.

The flows proposed in this plan may impact hydro operations differently, depending on where in the watershed the facilities listed above are located. However, the targeted flows outlined in this plan will provide consistency and predictability that hydro facilities can factor into their plans for water management and energy generation.

What is old is also new. A view looking downstream from the Route 179 bridge in Collinsville, CT. On the left is the "Collins Company," established in 1826 to manufacture edge-based tools like axes and scythes. The stone dams still visible today were built in 1867 to increase the amount of water available to power machinery. To the right is the newly operational upper Collinsville Hydropower facility operated by the town of Canton. Photo by DEEP Fisheries Division.

7. SAFETY

Safety will be managed on the Farmington River primarily by preventing excessively high flows, if possible. For the purpose of this report, under very high flow conditions resulting from excessive amounts of precipitation over a short period of time (flash flooding) or from large sustained storms like hurricanes, releases would not be requested from water within the 10 BG pool. Additionally, if there are flooding concerns for the Connecticut River basin, the USACE will step in to modify releases for flood control purposes. USACE decisions to release or holdback water have priority over other uses.

The DEEP will work collaboratively with the USACE to use Colebrook River Dam as well as other flood control dams within the watershed to protect against loss of life and/or property. When and where possible, excessive runoff can be retained (to a point) to prevent catastrophic flooding. The Farmington River has a network of medium to large tributaries, which do not have any mechanism to control excessive runoff, so in some cases even though water is being retained upstream, mainstem flows below the Still River could be extremely high and dangerous.

Table 10. Actions to maintain optimal flow in the Farmington River for ***"Safety"*** based upon the amount of water available as a result of precipitation. In "wet" years with above normal or much above normal precipitation, releases may not be needed from the 10 BG storage pool. DEEP will collaborate with the USACE and MDC to mitigate against chronic high flows in the river. During "dry" years with below normal or much below normal precipitation, releases may need to be lowered to ensure some water can be released throughout the entirety of the "dry" period.

Precipitation Much Below Normal	Precipitation Below Normal	Precipitation Normal	Precipitation Above Normal	Precipitation Much Above Normal
N/A for releases; capture any excess inflow.	N/A for releases; capture any excess inflow.	Use Table 2 for monthly target values.	Adjust releases to be higher than Table 2 monthly target values as practical. Maintain elevation of 708 feet.	Adjust releases to be higher than Table 2 monthly target values as practical, occasional large volume releases to mitigate against flooding. When the pool exceeds elevation 708 feet the USACE takes on full management release values. Additionally, if there are flooding concerns for the Connecticut River basin, the USACE will step in to modify releases for flood control purposes in the basin.

The Farmington River means so much to so many. Photo by CT DEEP Fisheries Division

CONCLUSION

This plan was developed by the DEEP in consultation with the MDC, the USACE, NGOs, and other stakeholders to fulfill the requirements set forth in Section 2 of Public Act 24-13. The Farmington River has a long history of supporting a variety of natural resources and recreational activities. The world class brown trout fishery, developed by the DEEP Fisheries Division, is a direct result of coordinated management of high-quality cold water stored within CRL and the West Branch Reservoir when natural conditions would otherwise be unfavorable for trout survival.

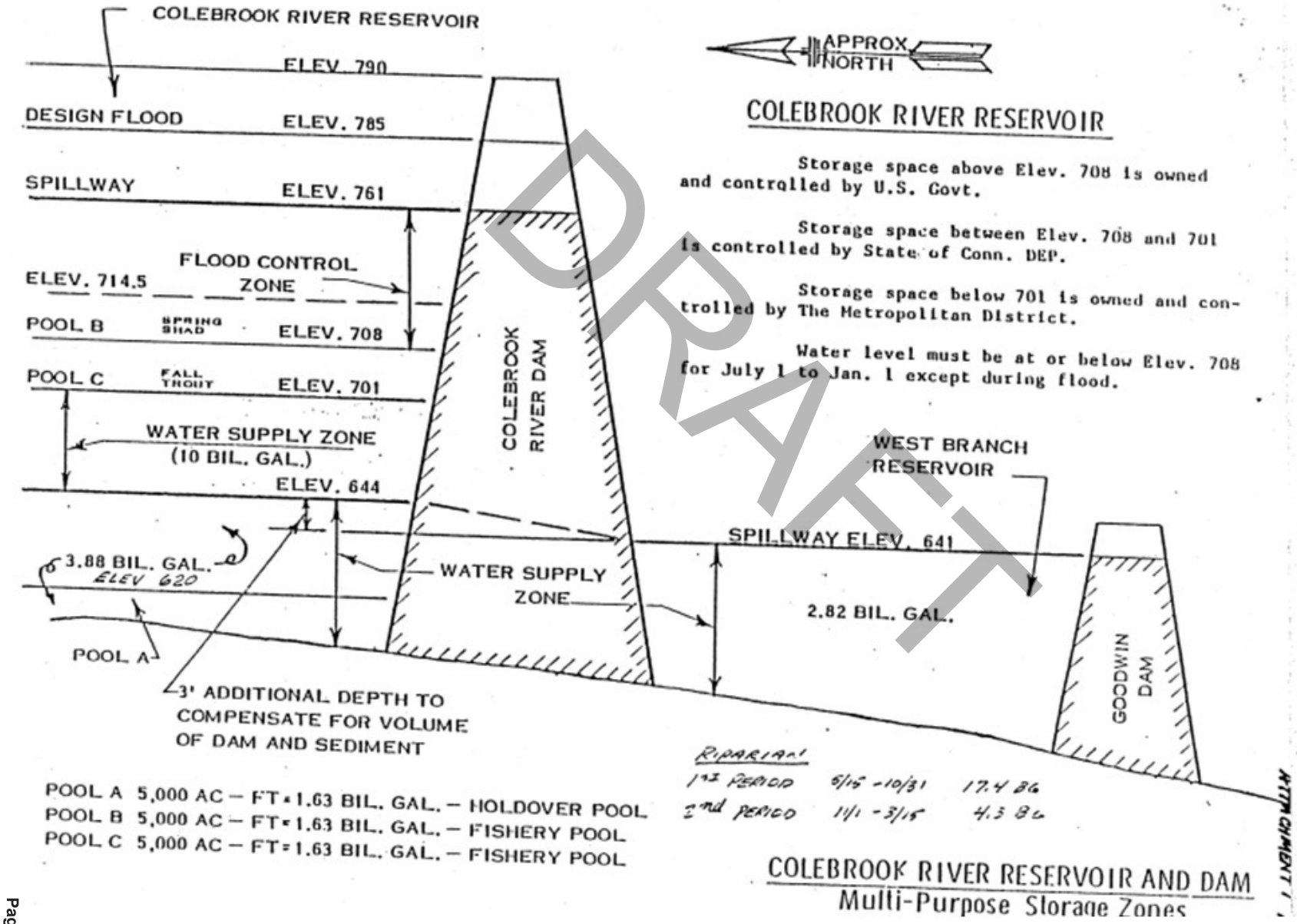
This plan describes how DEEP intends to manage and request releases (or holdbacks) from water between elevations 644 and 701 feet in CRL to achieve an optimum flow for the varied purposes delineated in Section 2 of Public Act 24-13.

A cool fall morning on the river. Photo - Tom Cameron

STAKEHOLDER ENGAGEMENT AND ACKNOWLEDGMENT

Forthcoming after comments have been received.

Appendix A1: Schematic of pool names and elevations for water behind Colebrook River Lake Dam (MDC memo).



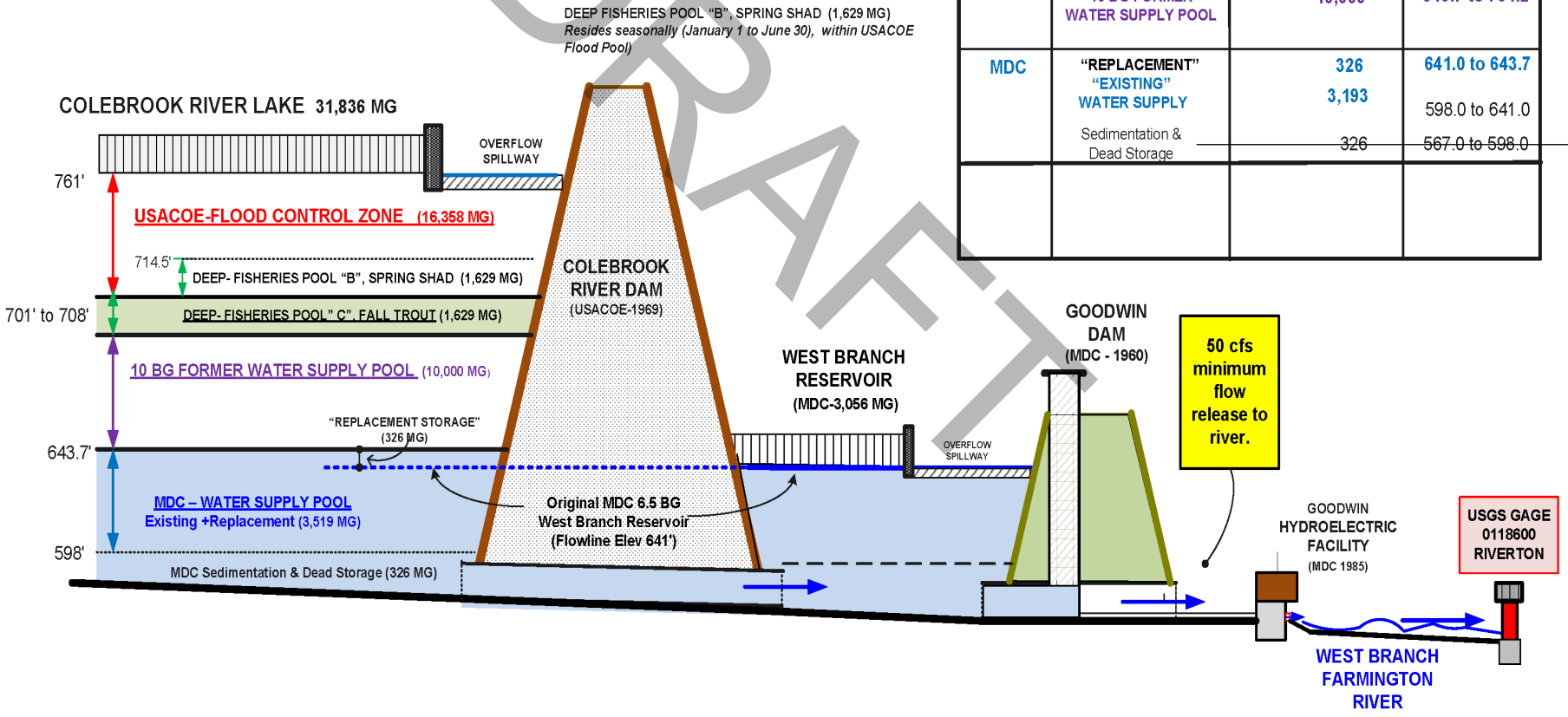
Appendix A2: Schematic of water storage allocations for Colebrook River Lake (Jim Randazzo, MDC).

West Branch Farmington River

COLEBROOK RIVER LAKE

Water Storage Allocations

ORIGINAL COLEBROOK / WEST BRANCH WATER STORAGE ALLOCATIONS			
AGENCY	ZONE / PURPOSE	STORAGE VOLUME (Million Gallons)	ELEVATION Ft. (NGVD 1929)
USACOE	FLOOD CONTROL	16,358	708.0 to 761.0
CT DEEP	FISHERIES Spring Pool "B" Shad	1,629 MG resides seasonally (January 1 to June 30) within USACOE Flood Control Zone	708.0 to 714.5
CT DEEP	FISHERIES Fall Pool "C" Trout	1,629	701.2 to 708.0
OPEN	10 BG FORMER WATER SUPPLY POOL	10,000	643.7 to 701.2
MDC	"REPLACEMENT"	326	641.0 to 643.7
	"EXISTING" WATER SUPPLY	3,193	598.0 to 641.0
	Sedimentation & Dead Storage	326	567.0 to 598.0



J. RANDAZZO Nov 2024

Appendix B: Public Act 24-13

Substitute House Bill No. 5355
Public Act No. 24-13

AN ACT CONCERNING THE WATER RESOURCES OF THE UPPER FARMINGTON RIVER VALLEY.

Be it enacted by the Senate and House of Representatives in General Assembly convened:
Section 1. (NEW) (Effective from passage) (a) The Commissioner of Energy and Environmental Protection, in consultation with the Metropolitan District Commission, shall make Colebrook River Lake Dam release and holdback requests to the United States Army USACE of Engineers, as needed, to achieve an optimum flow in the Farmington River for: (1) Fish and wildlife, (2) recreation, (3) the river's health, (4) flood risk reduction, (5) tourism, (6) hydropower, and (7) safety.

(b) Notwithstanding any provision of the general statutes or any special act, the Metropolitan District Commission shall release from the Goodwin Dam any amount of water released from the Colebrook Dam based on a request of the Commissioner of Energy and Environmental in furtherance of the provisions of subsection (a) of this section.

Sec. 2. (Effective from passage) Not later than January 1, 2025, within available resources, the Commissioner of Energy and Environmental Protection shall submit a report, in accordance with the provisions of section 11-4a of the general statutes, to the joint standing committee of the General Assembly having cognizance of matters relating to the environment, on recommended courses of action for the state to manage the waters contained in Colebrook River Lake between the levels of ***seven hundred one feet and six hundred forty-one feet***[1] in the event that the federal government releases the Metropolitan District Commission from responsibility for such waters. Such report shall address the state's interest in achieving an optimum flow for: (1) Fish and wildlife, (2) recreation, (3) the river's health, (4) flood risk reduction, (5) tourism, (6) hydropower, and (7) safety. The commissioner shall consult relevant stakeholders in the preparation of such report.
Approved May 14, 2024

[1] *Note on pool elevations. Public Act 24-13 requires DEEP to prepare a report with recommendations on management of the waters contained in the storage space in CRL between elevations 641 and 701 feet. However, elevation 641 should be elevation 644 feet as originally defined when Colebrook River Dam was constructed. The CT Department of Public Health approved the abandonment of water stored between elevations 644 and 701 feet in the "Amended Source Abandonment Permit" issued January 2024, and in its the letter to Commissioner Dykes, MDC only relinquished rights to control of the water stored between those elevations. DEEP believes the pool between elevations 644 and 701 feet, approximately10 billion gallons (BG), is sufficient to meet the legislative intent of optimizing flow on the Farmington River.*

Appendix C: MDC's letter to DEEP Commissioner Dykes concerning DEEP requests for releases of water impounded behind Colebrook Reservoir Dam between elevation 644 and 701.

MDC
The Metropolitan District
water supply · environmental services · geographic information

May 31, 2024

Commissioner Katie Dykes
State of Connecticut
Department of Energy and Environmental Protection
79 Elm Street
Harford, CT 06106-5127

Dear Commissioner Dykes:

As you may know, on July 20, 2023, the State Department of Public Health approved an application filed by MDC (attached) to abandon rights that the MDC may have in the Colebrook Reservoir as it relates to "future drinking water". As a result, the MDC no longer makes claim to water that may be impounded behind the Colebrook Dam at level 644 ft to level 701 ft and located in the Colebrook Reservoir.

As such, in the event that the department makes a request or series of requests of the USACE for release(s) of water impounded behind the Colebrook Reservoir Dam between elevation 701 and 644, the MDC does not object to any such requests or resulting releases since the MDC will not use the water storage space from which the requested water will be drawn.

MDC is committed to utilize its 6.5 BG, from both the "Existing 3.5 BG water supply" at level 598 ft to level 644 ft within Colebrook Reservoir, and the 3 BG water supply within Goodwin Reservoir, for the sole purpose to support Wild and Scenic. MDC, since January 2019, no longer prioritizes its available water for purposes to meet its riparian rights obligations, therefore releases can be prioritized based on recreation and fishing. MDC has notified Farmington Power Company of this fact, and provides financial compensation as authorized under contract.

MDC has met and discussed with state legislative leadership, Senator Seminara, and State Representative Anderson, ACOE and Stakeholders to review the traditional "Regime Flow" and determine if there is a more appropriate flow that would benefit the Farmington River Community.

MDC has offered based on historical releases prior to January 2019, recommendations of a minimum flow release strategy that can be offered as interim plan for 2024 starting in May outlined below in **Table 1** below:

555 Main Street, Hartford, Connecticut 06142-0800 telephone 860-278-7850 fax 860-251-6619
An Affirmative Action and Equal Opportunity Employer

TABLE 1

Month	Minimum Flow Release from West Branch
May	200
Jun	250
Jul	300
Aug	250
Sep	125
Oct	125
Nov	125
Dec	125

PROPOSED INTERIM FLOW RELEASE STRATEGY for 2024

The basic legal and statutory "rules" of the river will remain in place:

- 50 cubic feet per second (cfs) minimum flow from Goodwin Dam, at all times, as established under state statute;
- passing of all "natural" flows up to 150 cfs;
- passing of all releases from *Otis Reservoir;*
- passing of CT DEEP requested fisheries flow releases from DEEP fisheries pool storage in Colebrook;
- When minimum flows are not met by "natural" flows up to 150 cfs, the minimum release amount (provided in TABLE 1) will be met through the release of water from the 10 BG pool.

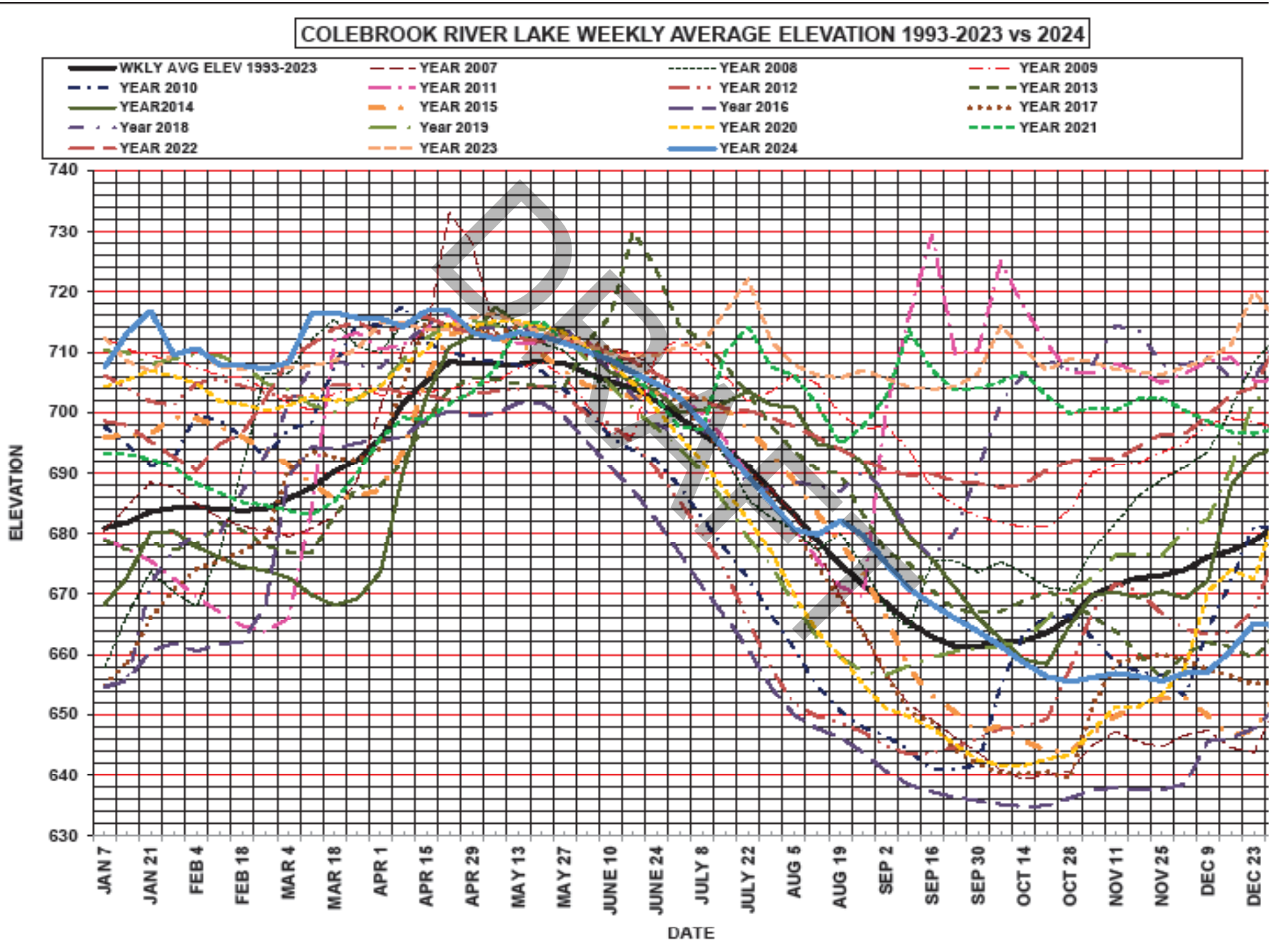
We fully support the State of Connecticut DEEP, ACOE, and the local community discussing the recreational priorities and augment the Farmington River flows as necessary.

Thank you for your attention.

Scott W. Jellison, P.E., CEO

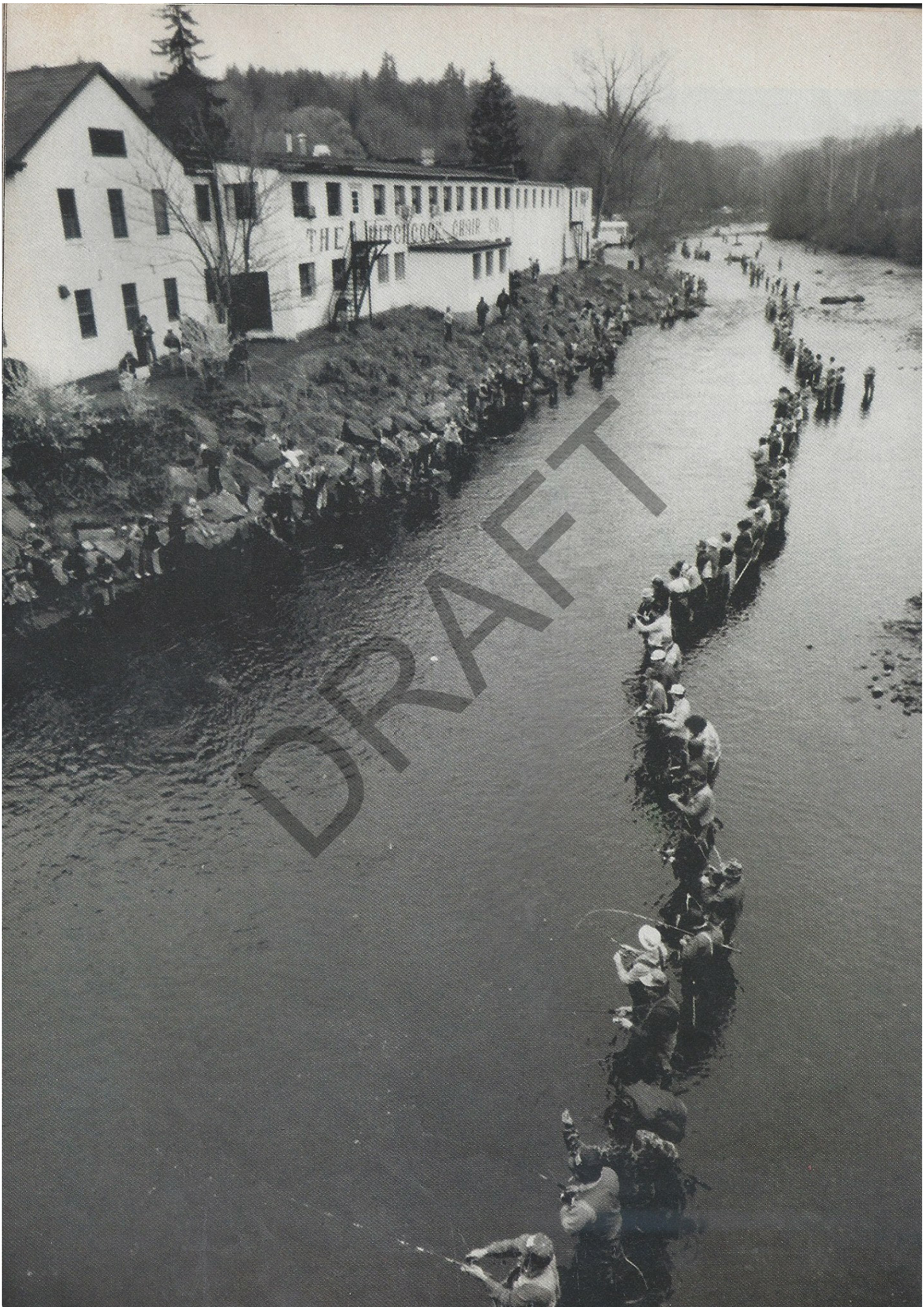
Cc: Chairman Donald Currey, MDC
Christopher Stone, MDC
Mr. Eric C. Pedersen, U.S. Army Corps of Engineers
Mr. Ryan T. Killman, U.S. Army Corps of Engineers
Senator Lisa Seminara
Representative Mark W. Anderson
Mr. Graham Stevens, Connecticut DEEP
Attorney Michael J. Cicchetti

Appendix D: Weekly average surface elevation of Colebrook River Lake since 1993 as compared to the overall average (solid black line). The solid blue line is 2024 data. Graphic courtesy Tim Anthony, MDC.



Appendix E: Table showing the conversion from Cubic Feet per Second (CFS) to Million Gallons per Day (MGD). The formula is CFS x 7.481 cubic feet/gallon x 24 hours/day x 60 seconds/minute x 60 minutes/hour. A simple formula is MGD = CFS x .6463

CFS	MGD	CFS	MGD	CFS	MGD	CFS	MGD	CFS	MGD
500	323.15	**400**	258.52	**300**	193.89	**200**	129.26	**100**	64.63
495	319.92	**395**	255.29	**295**	190.66	**195**	126.03	**95**	61.40
490	316.69	**390**	252.06	**290**	187.43	**190**	122.80	**90**	58.17
485	313.46	**385**	248.83	**285**	184.20	**185**	119.57	**85**	54.94
480	310.22	**380**	245.59	**280**	180.96	**180**	116.33	**80**	51.70
475	306.99	**375**	242.36	**275**	177.73	**175**	113.10	**75**	48.47
470	303.76	**370**	239.13	**270**	174.50	**170**	109.87	**70**	45.24
465	300.53	**365**	235.90	**265**	171.27	**165**	106.64	**65**	42.01
460	297.30	**360**	232.67	**260**	168.04	**160**	103.41	**60**	38.78
455	294.07	**355**	229.44	**255**	164.81	**155**	100.18	**55**	35.55
450	290.84	**350**	226.21	**250**	161.58	**150**	96.95	**50**	32.32
445	287.60	**345**	222.97	**245**	158.34	**145**	93.71	**45**	29.08
440	284.37	**340**	219.74	**240**	155.11	**140**	90.48	**40**	25.85
435	281.14	**335**	216.51	**235**	151.88	**135**	87.25	**35**	22.62
430	277.91	**330**	213.28	**230**	148.65	**130**	84.02	**30**	19.39
425	274.68	**325**	210.05	**225**	145.42	**125**	80.79	**25**	16.16
420	271.45	**320**	206.82	**220**	142.19	**120**	77.56	**20**	12.93
415	268.21	**315**	203.58	**215**	138.95	**115**	74.32	**15**	9.69
410	264.98	**310**	200.35	**210**	135.72	**110**	71.09	**10**	6.46
405	261.75	**305**	197.12	**205**	132.49	**105**	67.86	**5**	3.23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