Appendix C

Dam Management Plans

Lamprey River Water Management Plan

August 2013

DAM MANAGEMENT PLAN

Beaver Pond Dam (State Dam ID #061.07)

Figure 1 – Beaver Pond Dam and outlet structure taken on October 2, 2007.

Introduction

Beaver Pond Dam (lat. 43° 06 ’24”, long. -71° 19’ 43”) is located on the North Branch River in Bear Brook State Park in Deerfield, New Hampshire. This dam impounds the headwaters of the North Branch River, which then flows southwest from the dam and joins the main stem of the Lamprey River approximately eight miles downstream in Raymond, New Hampshire. The start of the Designated River is approximately 18 miles further downstream of the confluence of the North Branch River and the Lamprey River.

This dam is owned by the State of New Hampshire Department of Resources and Economic Development (DRED) and managed by the Division of Parks (see contact information). This dam is active and its use is for recreation. A beach and campground are located along the northern shoreline of Beaver Pond, which is effectively a widened portion of the North Branch River.

Dam Design

The dam was built prior to 1985 and was last reconstructed in 1992. The dam consists of earthen material while its outlet structure is constructed of concrete and wood, which has slots for the installation of stoplogs (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

There are no flowage requirements or rights. However, recreation in or on Beaver Pond is expected by those with reservations in the campground.

Riparian Property Obligations or Agreements

There are no riparian property obligations or agreements as the dam and impoundment are located entirely within Bear Brook State Park.

Water Quality Requirements or Limits

According to the dam owner there are no water quality requirements or limits associated with this dam.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Beaver Pond Dam is 66.5 acre-feet (ac-ft), while its permanent storage volume is 16.5 ac-ft, for a difference of 50 ac-ft (2.2 million cu. ft. or 16.3 million gallons). The drainage area behind the dam is 4 sq. miles. When compared with the other dams in this Water Management Planning Area the permanent storage volume and contributing drainage area these values are relatively low. Therefore, the water available for flow management from this dam is also considered to be low.

Potential Impacts of Storage and Release of Relief Flows

Upstream of the dam and within the impoundment storage area there is a small area of mapped forested and shrub wetland. The inundation of this area by the storage of water for flow management could negatively impact it.

Any flow released from Beaver Pond Dam would travel via the North Branch River into the main stem of the Lamprey River. There are no other dams on the North Branch River between Beaver Pond Dam and the confluence with the Lamprey River and it would not be necessary to coordinate release efforts with any other dam operators to ensure conveyance of the released flow to the Lamprey River. However, one additional consideration should be the presence of an extensive area of wetlands located approximately 3 miles downstream of Beaver Pond Dam along the North Branch River. These wetlands could potentially cause undesirable attenuation of the relief stream flow by temporarily storing the released water. Insufficient information is available to determine the amount of water that could be stored by these wetland areas and the resulting impacts on any flow management actions.

Beaver Pond is located within Bear Brook State Park and there is a developed beach along a portion of its northern shoreline. The raising or lowering of the water surface could potentially impact the use of the beach by campers staying at the neighboring state-run campground.

Potential for Dam Management to Support Instream Flow Requirements

The potential for using Beaver Pond Dam for flow management on the Lamprey Designated River is considered low. Although the dam is publicly owned, the shoreline of its pond is undeveloped and the dam is located in the upper Lamprey River Basin; these favorable attributes are offset by the relatively small volume of water potentially available, the potential impact to wetlands, its distance upstream from the Lamprey Designated River and the potential impact to water recreation activities in a State Park.

Dam Management Activity

No dam management activity is required at this time.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Beaver Pond Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: Department of Resources and Economic Development
Address: P.O. Box 1856, Concord, NH, 03301
Contact: Mr. Seth Prescott
Phone: 603-271-2606
Email: sprescott@dred.state.nh.us

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Beaver Pond Dam Characteristics

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**2**
Freeboard (ft)	**NA**
Type of spillway controls or outlet works	**Stops Logs**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**50**
Drainage area (sq. miles)	**4**
Maximum storage (ac-ft)	**66.5**
Normal or permanent storage (ac-ft)	**16.5**
Total discharge capacity (cfs)	**NA**
Maximum unoperated discharge (cfs)	**NA**
Design storm discharge (cfs)	**NA**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**NA**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #061.07.

Note:

NA- not available from NH Dams Data Sheet.

DAM MANAGEMENT PLAN

Deer Pond Dam (State Dam ID #184.11)

Figure 1 – Deer Pond Inlet and outlet structure, provided by the DES Dam Bureau.

Introduction

Deer Pond Dam (lat. 43° 05’ 11”, long. -71° 12’ 01”) is located off of Brown Road in Nottingham, New Hampshire. This dam impounds a tributary to Mountain Brook, which discharges into the lower portion of Pawtuckaway Lake. This portion of the lake drains into the Pawtuckaway River at Dolloff Dam before joining the main stem of the Lamprey River in Epping, New Hampshire. Deer Pond Dam lies approximately 17 miles upstream of the start of the Designated River. This dam is privately owned (see contact information), is active and its use is for recreation.

Dam Design

The dam was constructed in 1963. The dam consists of earthen material, while its outlet structure is a 20 inch outside diameter HDPE pipe invert (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the owner there are no flowage requirements or rights.

Riparian Property Obligations or Agreements

According to the owner there are no riparian property obligations or agreements, although he does keep the water level in the pond as constant as he can.

Water Quality Requirements or Limits

According to the owner there are no water quality requirements or limits associated with this dam.

Assessment of Potential Water Availability

DES Dam Bureau files show that the maximum storage volume for Deer Pond Dam is 174 acre-feet (ac-ft), while its permanent storage volume is 100 ac-ft, for a difference of 74 ac-ft (3.2 million cu. ft. or 24.1 million gallons). When compared with the other dams being evaluated as part of this study, the permanent storage volume of Deer Pond Dam is relatively low. In addition, the drainage area behind the dam is only 0.61 sq. miles, which, due to its small area, would provide limited runoff to the impoundment following any drawdown in water levels. Therefore, the water available from this dam for flow management is considered to be low.

Potential Impacts of Storage and Release of Relief Flows

The reach of Mountain Brook downstream of the dam to Pawtuckaway Lake is largely rural with few structures built in or adjacent to the river. In addition, mapped wetlands are sparse within the impoundment storage area and below the dam. Therefore, inundation of these areas by the storage of water or dam releases for flow management would have little impact on wetland areas.

Any release of water from Deer Pond Dam would discharge downstream to Pawtuckaway Lake. Due to the large storage volume of Pawtuckaway Lake, the impact of the release of water from Deer Pond Dam on the lake would be minimal. Release of water from Deer Pond would have to be coordinated with releases from the two dams on Pawtuckaway Lake to be effective.

Potential for Dam Management to Support Instream Flow Requirements

The potential for managing this dam to support instream flows on the Lamprey Designated River is considered low. The major limitations for the use of Deer Pond Dam for flow management of the Lamprey Designated River include: the small drainage area behind the dam; the limited storage volume of the dam; the need to retrofit the outlet to allow for the managed release of water; and the potential reduction in effectiveness due to the presence downstream of Pawtuckaway Lake.

Dam Management Activity

Since the potential use of Deer Pond Dam for maintaining instream flow on the Lamprey Designated is considered low, no dam management activity is required at this time.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Deer Pond Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information
Owner: Mr. Chris Stillbach
Address: 36 Brook Drive, Simsbury, CT 06070, or
60 Brown Road, Nottingham, NH 03037
Phone: 860-651-3296
Email:

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Deer Pond Dam Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**12**
Freeboard (ft)	**3**
Type of spillway controls or outlet works	**Pipe Invert**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**38**
Drainage area (sq. miles)	**0.61**
Maximum storage (ac-ft)	**174**
Normal or permanent storage (ac-ft)	**100**
Total discharge capacity (cfs)	**1362**
Maximum unoperated discharge (cfs)	**1362**
Design storm discharge (cfs)	**128**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**NA**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #184.11.

Note:

NA – not available from NH Dams Data Sheet.

DAM MANAGEMENT PLAN

Doles Marsh Dam (State Dam ID #183.18)

Figure 1 – Doles Marsh Dam and outlet structure, photos taken October 2, 2007.

Introduction

Doles Marsh Dam (lat. 43° 10’ 27”, long. -71° 11’ 21”) is located in the Doles Marsh Wildlife Management Area off of Route 43 in Northwood, New Hampshire. Doles Marsh Dam impounds a tributary of the Bean River, which flows southeast to the North River and joins the Lamprey River immediately upstream of the Lamprey Designated River in Epping, New Hampshire. Doles Marsh Dam lies approximately 15 miles upstream of the start of the Designated River.

This dam is owned by the State of New Hampshire Fish and Game Department (see contact information) on land owned by the State of New Hampshire Department of Resources and Economic Development. The dam is active and its use is to create and maintain waterfowl habitat.

Dam Design

The dam was constructed in 1976 and consists of earthen material, while its outlet structure is constructed of concrete, which also has slots for wooden stop logs (Figure 1).
Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the owner there are no flowage requirements or rights.

Riparian Property Obligations or Agreements

According to the owner there are no riparian property obligations or agreements as the dam and land are located on land owned by the State of New Hampshire.

Water Quality Requirements or Limits

According to the owner there are no water quality rights or agreements.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Doles Marsh Dam is 104 acre-feet (ac-ft), while its permanent storage volume is 41 ac-ft, for a difference of 63 ac-ft (2.7 million cu. ft. or 21 million gallons). The drainage area behind the dam is 0.52 sq. mi., which, due to its small area, would provide limited runoff to the impoundment following any drawdown in water levels. When compared with the other dams in this Water Management Planning Area, the available permanent storage volume and contributing drainage area of Doles Marsh Dam are small. Therefore, the water available for flow management from this dam is considered to be low.

Potential Impacts of Storage and Release of Relief Flows

Water released from Doles Marsh Dam flows through several ponds and wetland areas before joining the Lamprey Designated River. The presence of the ponds and wetland areas could attenuate flows released from Doles Marsh Dam by temporarily storing the released water. Insufficient information is available to determine the amount of water that could be stored by the ponds and wetland areas and the resulting impacts on flow management actions. Doles Marsh Dam impounds an extensive wetland system that supports waterfowl habitat in the Doles Marsh Wildlife Management Area. According to the New Hampshire Fish and Game Department the impoundment is drained about one summer out of ten to promote vegetation growth. As a result, any flow management actions taken (storage or release of water) should be coordinated with the owner to maximize the use of the stored water and to minimize any impacts to the extensive wetlands at the site.

Potential for Dam Management to Support Instream Flow Requirements

Factors favoring the use of Doles Marsh Dam for flow management include; an operable outlet structure; a maintenance program that releases water from storage; and, the location of its discharge point upstream of the beginning of the Lamprey Designated River. The limiting factors include the relatively small volume of water available, the small contributing drainage area, the number of ponds and wetlands downstream that could reduce the effectiveness of any dam releases and the potential restriction for water fowl and wildlife management of only lowering the impoundment level one summer in ten or longer (last maintenance release over 15 years ago)' and the timing of the release. The water level is lowered from mid-June to mid-September. The marsh needs to be returned to full level by late September to support migrating waterfowl and winter home building by muskrats and beavers. Due to these limitations, the

potential for the management of this dam to meet the instream flow requirements is considered low.

Dam Management Activity

Due to the potential impact of any water releases from Doles Marsh Dam on its management objectives, to support of water fowl and wildlife, no dam management activity is required at this time.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Doles Marsh Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: New Hampshire Fish and Game Department
Address: 11 Hazen Drive, Concord, NH 03301
Contact: Mr. Edward G. Robinson
Phone: 603-271-2461
Email: Edward.Robinson@wildlife.nh.gov

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Doles Marsh Dam Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**8**
Freeboard (ft)	**2.5**
Type of spillway controls or outlet works	**Stoplogs**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**25**
Drainage area (sq. miles)	**0.52**
Maximum storage (ac-ft)	**104**
Normal or permanent storage (ac-ft)	**41**
Total discharge capacity (cfs)	**316**
Maximum unoperated discharge (cfs)	**226**
Design storm discharge (cfs)	**63**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**NA**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #183.18.

Note:

NA – not available from NH Dams Data Sheet.

DAM MANAGEMENT PLAN

Dolloff Dam (State Dam ID #184.02)

Figure 1 – Dolloff Dam and outlet structure, photos taken August 2005.

Introduction

Dolloff Dam (lat. 43° 04’ 20”, long. -71° 09’ 07”) is one of four dams that store water in Pawtuckaway Lake. This dam is located on the south side of Pawtuckaway Lake at the end of Dolloff Dam Road in Nottingham, New Hampshire. Pawtuckaway Lake was formed when two smaller ponds were raised by dams. The watershed that drained to the south end is 30% of the Pawtuckaway Lake’s total watershed. See Figure 1.

Dolloff Dam affects flow in the Pawtuckaway River which joins the Lamprey River in Epping, New Hampshire. Dolloff Dam lies approximately 14 miles upstream of the start of the Lamprey Designated River.[1] The dam is owned by the State of New Hampshire Water Division (see contact information). The dam is active and its use is for recreation.

Dam Design

The dam was built in 1842 and reconstructed in 1974. Constructed of concrete and earth materials, it has a concrete outlet structure that includes slots for wooden stop logs (Figure 1). Three stoplog bays allow the operation of releases from the dam. Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau, which owns the dam. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

[1] This Lamprey Designated River describes the segment designated in 1990 and identified by the legislature in 2002 as the subject for the Instream Flow Pilot Program. The legislature subsequently designated the remainder of the Lamprey River for protection in 2011—the newly designated segments are not part of the Lamprey River Water Management Plan.

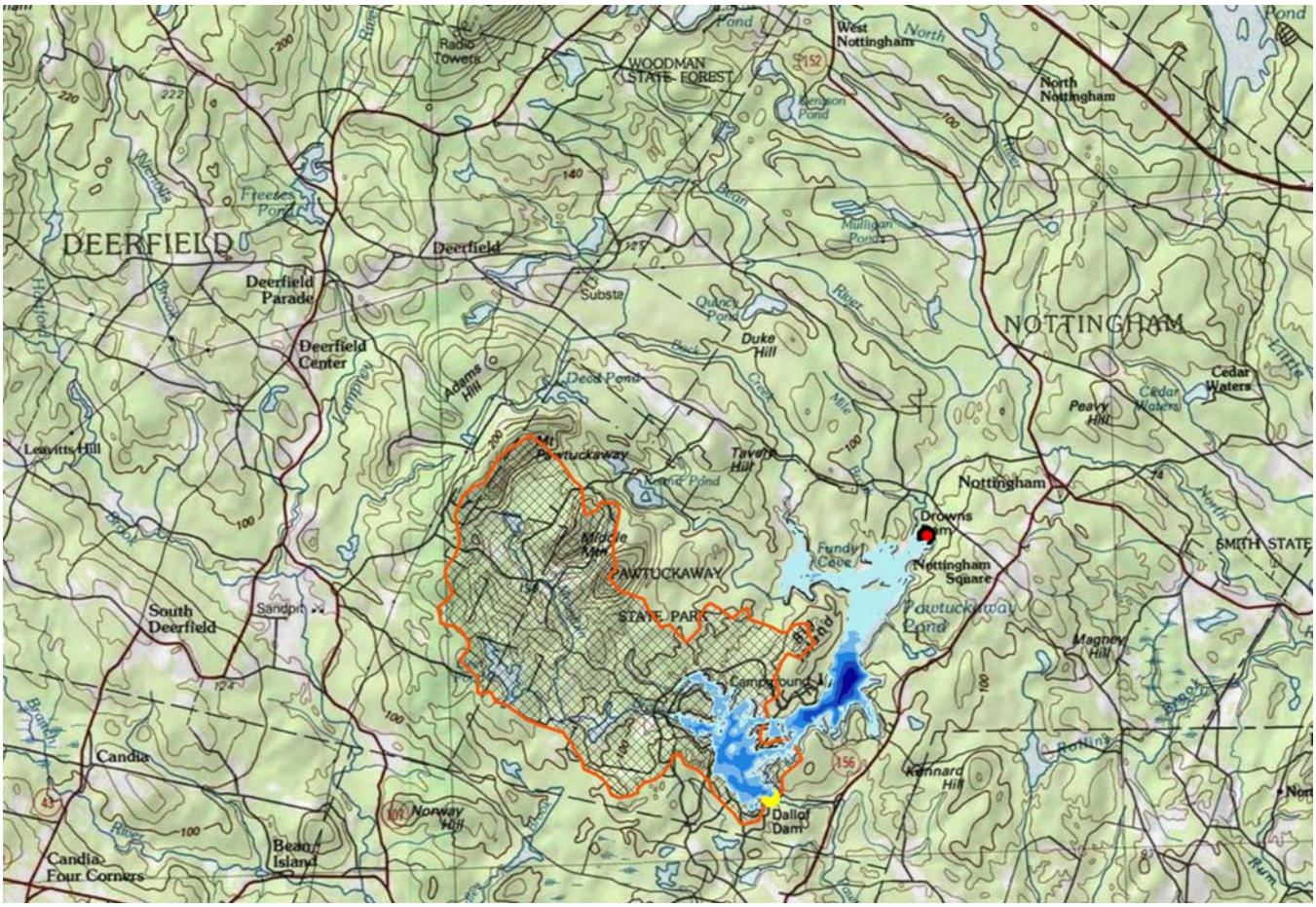

Figure 2 – Dolloff Dam at south end of Pawtuckaway Lake and the drainage area for the southern part of pond.

Protected Flow, Flowage Rights or Contractual Obligations

A 1992 lake level investigation was initiated by lake property owners concerned that the practice of drawing the lake down seven feet was harming the fishery. DES concluded that historical practices would continue. A 2000 lake level investigation and hearing set the operating water levels for Pawtuckaway Lake, as memorialized in "The Notice of Decision of Determination of Lake Level" (DES 2000). Following this Decision, lake levels were managed to draw the lake down seven feet by November 30 and returned to full pool by June 1st.

In 2012, a new lake level investigation was conducted and a hearing was held in June of that year. In 2013, DES changed the lake's management conditions from those under the 2000 NOD (DES 2013). The 2013 Notice established that the annual drawdown level for Pawtuckaway Lake shall be maintained at 4.8 feet in order to achieve a lake level of 20.2 feet by November 30th and a lake level of 25 feet at the gauge on the Dolloff Dam by June 1st. A lake level of 25 feet is considered full pool. Implementation of this change in the winter draw down levels will be conducted over a period of four years with the drawdown target to be decreased by 0.5 feet each year until the new target level of 4.8 feet is attained (20.2 on the gauge at Dolloff Dam). The 4.8 foot fall drawdown retains over 2 feet of storage that allows for a winter relief pulse of 0.64 feet to support instream

flows. Dolloff Dam is to be operated in conjunction with Drowns Dam to maintain these water levels, which are managed to serve public interests including recreational opportunities, aquatic habitat, and water quality.

Riparian Property Obligations or Agreements

Since 2000, DES has utilized Dolloff Dam to manage Pawtuckaway Lake levels by approximating the historical median levels to meet the conditions of the 2000 DES Notice of Decision. The 2000 Notice of Decision describes the conditions for an annual fall drawdown and spring fill where by November 30th the lake would be lowered 7 feet to a level of 18 feet on the gauge at Dolloff Dam and returned to a lake level of 25 feet by June 1st (DES 2000). This 2000 Decision was reconsidered in a Lake Level Investigation during 2012-2013 and a new Decision was reached in 2013. The 2013 Decision changed the annual fall drawdown from 7 to 4.8 feet below full pond, which is to be achieved by November 30, and provide for the return to full lake level of 25 feet by June 1st. Lake level between spring and fall, depending on inflow, is maintained at 25 feet as measured on the staff gauge at Dolloff dam.

Water Quality Requirements or Limits

There are no site-specific water quality requirements or limits associated with this dam.

Assessment of Potential Water Availability

Releasing water from storage is one way to offset Lamprey River flow deficits by providing a relief flow pulse. Dolloff Dam is one of the two dams controlling Pawtuckaway Lake that could be used to release water for a relief flow to attain downstream water quality standards.

The DES Dam Bureau files show the maximum storage volume for Dolloff Dam (Pawtuckaway Lake) is 11,700 acre-feet (ac-ft). GIS assessments by Watershed Management Bureau using bathymetry developed in 2011 and 2012 defined its permanent storage volume as 7954 ac-ft, for a difference of 3746 ac-ft (163 million cu. ft. or 1221 million gallons). The permanent storage of Pawtuckaway Lake is the largest of the lakes within the Lamprey River Water Management Planning Area. The drainage area behind the dam is 20.3 sq. miles, which due to its large area provides considerable runoff potential for refilling the impoundment. This watershed represents 11% of the Lamprey River watershed.[2] The surface area of the lake is 783 acres. Therefore, the potential volume of water available for flow management from Pawtuckaway Lake through this dam or Drowns Dam is the highest among the dams in this Water Management Planning Area.

Each of the bioperiods except Spring Flood has a bioperiod-specific flow to be released as the relief flow to maintain protected flows. The volume of water to be added to the release, and its equivalent discharge value and the estimated water level change for each bioperiod, are summarized in Table 2. The relief flow volume and flow rate values in Table 2 are based on supporting the Rare and Critical flow requirements 90 percent of the time, and includes a 20 percent buffer. The twenty percent buffer recognizes that there are unquantified losses that may cause attenuation of flow between the location of the release and the Designated River. The

[2] Relative to the USGS stream flow gauge 01073500 Lamprey River Near Newmarket, NH

Spring Flood bioperiod will not be managed because historically there have been very few low-flow events during this time.

Because of lake management, the volume of the lake is changed through the year, thereby affecting the amount of water in storage that could be available for a relief flow release. Following the Spring Flood bioperiod, the impoundment is expected to be at full pool as the starting point for the summer season. Full lake is the level of the Dolloff Dam's spillway, which is at 25 feet as measured on the staff gauge at Dolloff dam.

The lake level is usually above 25 feet (full) after the spring melt and declines below this level by mid-July, resulting in minimal water passing downstream. During the bioperiods of early summer through early fall (Clupeid Spawning, GRAF Spawning, and Rearing and Growth), protected instream flows can be supported by relief flows released from storage in Pawtuckaway Lake. Release volumes for summer and fall bioperiods include flow from Mendums Pond. A relief flow release during the three summer periods represents lake level declines of 0.14, 0.02 or 0.05 feet, respectively. Management conditions on releases will be applied to ensure that the lake's recreational use, wildlife, fish and water quality are protected, or these releases will be curtailed.

Under the 2000 Notice of Decision, each fall, beginning in early October, water was released from Dolloff Dam (in combination with Drowns Dam at the northern end of the lake). The goal of the drawdown under the 2000 Decision was to lower the lake by seven feet (to 18 feet on the gage by November 30).[3] The annual seven-foot drawdown release currently supports most of the Salmon Spawning bioperiods instream flow needs without active management for protected instream flows.

Protected flows during the October 7 through December 8 bioperiod are usually met because of the fall lake drawdown. A pulse may be applied during this bioperiod if protected flows are not being maintained by managing the timing and release rate of the fall drawdown. The annual fall drawdown will be managed such that the volumes leaving Drowns and Dolloff Dams are proportional to the subwatershed areas of the northern and southern pond areas; namely, 70% via Drowns Dam and 30% via Dolloff Dam. Achieving the 4.8 foot drawdown level will be targeted for November 30.

During the Overwintering bioperiod, relief flows will be provided from some of the water retained from the 4.8 foot annual fall drawdown. At the final lake level of 4.8 feet below full pool, one relief flow release is possible during the winter. The reduction of lake level for this release is expected to be 0.65 feet (about 8 inches) or less.

Refilling the lake has historically begun between mid-January and early-February. From late January continuing through May, the DES Dam Bureau adds stoplogs to reduce the outflow from the dam and refill the lake to its full lake stage of 25 feet by June 1 (DES 2000). As the Spring Flood bioperiod approaches, depending on spring flood storage needs, the water stored for the Overwintering bioperiod may be saved to maintain stream flows during the Spring Flood bioperiod, or released before the Spring Flood bioperiod to provide additional flood storage, as the

[3] The lake was rarely dropped to 18 feet -- the 1982-2012 median winter lake level is deepest in mid- to late January at about 18.7 feet or 6.3 feet below full pond.

DES Dam Bureau deems necessary. Relief flow releases are not proposed during the Spring Flood bioperiod because there is insufficient storage to both fill the lake and maintain downstream flows. At the end of the Spring Flood bioperiod, the water level should again be at full lake level and have sufficient storage to support management, public recreation and lake ecology during the next three bioperiods of early summer through early fall.

Potential Impacts of Storage and Release of Relief Flows

Impacts of the water management actions on existing wetland in Pawtuckaway Lake are limited. Except for Burnham's Marsh, there are few mapped wetlands within the impoundment area of the dam. Burnham's Marsh is separated from the lake by Burnham's Marsh Dam, so the storage or release of water from Dolloff or Drowns dam for flow management would have little potential impact on wetlands in Burnham's Marsh.

Mapped wetland areas are present below the dam in the riparian area along the Pawtuckaway River. These wetlands could reduce the effectiveness of any flow released from Dolloff Dam by temporarily storing the released water. A test relief pulse, conducted in September 2012, demonstrated that these wetlands have little discernible impact on the flow or timing of the pulse.

Pawtuckaway Lake has been a nesting area for up to two Common Loon pairs. Common Loons are state-listed as Threatened. Loon nesting success is sensitive to water level changes because changes of six inches or more have the potential to either flood the nest or strand it above the reach of the parents. The primary nesting period for loons is May 15 through July 15, although secondary nesting periods occur later in the year if the initial nesting attempt fails. Water levels should not vary more than 6 inches to support loon nesting success.

Managing water levels on Pawtuckaway Lake for the purpose of flow management on the Lamprey Designated River should not have a significant effect on shoreline properties or on recreational opportunities on the Lake. DES has defined a limit of 18 inches below full pond level of the total water level change caused by management and by the usual decline—this would represent an extreme condition that would occur very infrequently, if at all. In addition, 18 inches is considered to be within the natural range of variability for summer lake levels.

The period of most common management needs is from July 5 through October 6. Thirty-four of 56 years would have required no management and twelve years would have required only one management event. A single management event during this time of year would change the lake level by 0.05 feet (0.6 inches). During the driest two years on record, six relief flows would have been applied throughout the spring, summer and fall, for a cumulative lake level effect of four inches.

The change in winter drawdown practices is expected to reduce both the amount and residence time of phosphorus in the lake. The reduction in phosphorus will reduce the likelihood of algal blooms. The summer releases are unlikely to either promote or retard algal blooms.

The DES Dam Bureau has assessed the difference in flood protection resulting from a reduced winter drawdown. Because the difference on lake volume between 7 feet and 5 feet of drawdown

is relatively small, the increase in flood protection attributable to a deeper drawdown is small. Further, the DES Dam Bureau will always have the ability to manage Pawtuckaway Lake dams for the protection of health and safety such that water may be released to help preempt the effects of an incoming storm.

Potential for Dam Management to Support Instream Flow Requirements

The overall potential for using Dolloff Dam for flow management to support the instream flow requirements on the Lamprey Designated River is high due to the public ownership of the dam, the amount of storage potentially available, the large drainage area above the dam and the existence of an outlet structure designed to manage water levels.

Dam Management Activity

Pawtuckaway Lake is controlled by two operable dams. Water can be released from Pawtuckaway Lake from either Dolloff Dam or Drowns Dam or from a combination of both dams. When compared with Drowns Dam, Dolloff Dam is slightly farther from the beginning of the Lamprey Designated River (14 miles versus 10 miles). Releases from Dolloff Dam to provide for flow management will be coordinated with the timing and volume of Drowns Dam releases. Non-winter releases would also be coordinated with releases from Mendums Pond. DES will not conduct flow releases for stream flow protection during the spring bioperiod.

Dolloff Dam's primary use is described by the DES Dam Bureau as recreation. The uses of Dolloff Dam will be expanded to include instream flow. The DES Dam Bureau, as the owner of the dam, will be responsible for the operation of the dam to support the protected instream flows on the Lamprey Designated River. If a flow management release becomes necessary, water may be released from Dolloff Dam to create a relief flow pulse to support the protected instream flows on the Lamprey Designated River. The Dam Bureau will take such actions as are necessary to operate the stoplogs at Dolloff Dam to increase flow from Pawtuckaway Lake by the amount shown in Table 2 beginning at a start time identified by the Instream Flow Program. The DES Watershed Management Bureau will identify when flow management is needed and notify the DES Dam Bureau of an approaching event.

Relief flows may be released to support the protected instream flows during five of the six bioperiods. Flow management releases will occur when daily mean discharge falls below the Critical or Rare protected flow magnitudes for longer than its catastrophic duration (DES 2009). No relief flows will be released from Pawtuckaway Lake during the Spring Flood bioperiod (March 1 to May 4).[4] For the Clupeid Spawning, GRAF Spawning, and the Rearing and Growth bioperiods (May 5 to October 6), relief flows will be generated by releases from both Mendums Pond and Pawtuckaway Lake. The volume released from each lake will be proportional to its surface area such that each lake has the same change in water level. During the annual fall drawdown, which occurs during the Salmon Spawning bioperiod (October 7 – December 8), the drawdown may be configured as a pulse to support instream flows. Releases from Pawtuckaway

[4] Minimum flows for the maintenance of downstream flow will be supported during spring refilling.

Lake will be in combination with releases from Mendums Pond, except during the Overwintering bioperiod (December 9 – February 28) when Mendums will not be used.

Flow conditions will be evaluated by DES to determine management need and relief flow release effects based on the records from the United States Geological Survey gaging station Lamprey River near Newmarket, New Hampshire (0173500). If a flow management release is needed, then DES Dam Bureau will release a two-day relief flow from Drowns, Dolloff, or both dams at rates described in Table 2.

DES will also post a notification of approaching management on its website. DES will send an email notification to the Town of Nottingham and to the president of the Pawtuckaway Lake Improvement Association.

To protect the State-listed threatened Common Loon nesting cycle, no relief flow releases will be applied between May 15 and July 15 that would result in reducing the water level more than six inches (combined with natural decline) when any successful loon nesting is occurring. DES will notify NH Fish and Game, The Loon Preservation Committee and the Pawtuckaway Lake Improvement Association of approaching management conditions and request their determination of whether loons are currently actively nesting on the Lake during that period. From July 15 through August 15, DES will consult with NH Fish and Game and The Loon Preservation Committee to determine whether relief flow releases for stream flow protection will affect loon nesting.

In the event of the need for relief flows from Pawtuckaway Lake between May 5 and October 6, the maximum water level drawdown shall not result in the Lake water level dropping more than 18 inches below the spillway crest.

The annual fall drawdown will be managed such that the volumes released from Drowns and Dolloff Dams are proportional to the subwatershed areas of the northern and southern pond areas; approximately, 70% via Drowns Dam and 30% via Dolloff Dam.

Only one Overwintering pulse is possible based upon the amount of water in storage in the winter. Such a release may have to come from Dolloff Dam because of physical restrictions at Drowns Dam.

Schedule for Dam Management Plan Implementation

This Dam Management Plan will be put into practice after adoption of the Lamprey Water Management Plan. The operations for releases under this Dam Management Plan for the period March 1 through December 8 will begin with the first bioperiod start following adoption. Management during the December 9 through February 28 Overwintering bioperiod includes a change in the annual drawdown to 4.8 feet instead of ~7 feet. This change will be implemented over four years by reducing the drawdown approximately 6 inches each year. During these first four years, no Overwintering bioperiod releases will be applied, barring any unforeseen or unusual circumstances.

Estimated Cost of the Implementation of the Dam Management Plan

The specific actions associated with the implementation of the Dam Management Plan for Dolloff Dam include the placement or removal of stop logs from the dam. This work requires that at least one trained DES employee travel to the site to either place or remove a pre-determined number of stop logs from the dam structure. These trips are expected to include management actions at Drowns Dam and Mendums Pond Dam. The estimated costs associated with this work will be dependent upon the number of personnel involved, the number of site visits required to perform the necessary flow management releases and the travel time and mileage. Accounting for any costs associated with this program will be made through the two-year evaluation period following the approval of this plan.

Dam Owner and Contact Information

Owner: New Hampshire Water Division
Address: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
Contact: Mr. James Gallagher
Phone: 603-271-1961
Email: james.gallagher@des.nh.gov

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

References

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/29/03.

Department of Environmental Services (DES) 2000. Notice of Decision on Determination of Lake Level. Dated December 19, 2000.

Department of Environmental Services (DES) 2009. Final Lamprey Protected Instream Flow Report. Prepared by Normandeau Associates, Inc., Rushing Rivers Institute and the University of New Hampshire. NHDES-R-WD-08-26.

Department of Environmental Services (DES) 2013. Notice of Decision on Determination of Lake Level. August 2013.

Table 1 – Dolloff Dam Characteristics

Elevation (ft) of recreation pool or height relative to lowest spillway	**250.40**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**243.11**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**28**
Freeboard (ft)	**4**
Type of spillway controls or outlet works	**Stop Logs**
Dimensions of spillway controls or outlet works	**41 ft**
Surface area (ac) of impoundment at maximum impoundment	**783***
Drainage area (sq. miles)	**21**
Maximum storage (ac-ft)	**11,700**
Normal or permanent storage (ac-ft)	**11,500**
Total discharge capacity (cfs)	**1,012**
Maximum unoperated discharge (cfs)	**2,900**
Design storm discharge (cfs)	**2,325**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**290**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #184.02.
* - From GIS coverages

Note: NA – not available from NH Dams Data Sheet

Table 2 – Two-Day Flow Release Contribution from Drowns or Dolloff Dams in the Event of Instream Flow Water Management.

Bioperiod name	Period	Relief volume needed to meet 90% of historical deficits (ac-ft)	Relief volume needed to meet 90% of historical deficits with 20% buffer (ac-ft)	Two-day flow release contribution from Pawtuckaway (cfs) [74.7%]	Change in water level from full pool using releases that meet 90% of historical deficits w/ 20% buffer (feet)	Water source
Overwintering	Dec 9 – Feb 28	216	259	65*	0.65 – starting from 4.8 ft below full – not from full pool	Water retained from Pawtuckaway Lake from annual fall drawdown.
Spring Flood	Mar 1 – May 4	-	-	-	-	No active management planned
Clupeid Spawning	May 5 – Jun 19	118	142	27	0.14	from storage and drawdown
GRAF Spawning	Jun 20 – Jul 4	20	24	4.5	0.02	from storage and drawdown
Rearing &Growth	Jul 5 – Oct 6	47	56	10.5	0.05	from storage and drawdown
Salmon Spawning	Oct 7 – Dec 8	75	90	17	Occurs during annual fall drawdown	Annual, fall drawdown.
Mendums		265	Acres at full recreational pool [25.3% of combined Mendums and Pawtuckaway surface areas]			
Pawtuckaway		783	Acres at full recreational pool [74.7% of combined Mendums and Pawtuckaway surface areas]			
* Overwintering release is from Pawtuckaway Lake only.						

DAM MANAGEMENT PLAN

Drowns Dam (State Dam ID #184.04)

Figure 3 *– Dam and outlet structure, photos taken August 2005.*

Introduction

Drowns Dam (lat. 43º 06’ 26”, long. -71º 07’ 31”) is one of four dams that store water in Pawtuckaway Lake. The dam is located on the north side of Pawtuckaway Lake off of Fernald Road in Nottingham, New Hampshire. Pawtuckaway Lake was formed when two smaller ponds were raised by dams. The watershed that drained to the northern pond is 70% of the Pawtuckaway Lake’s total watershed. See Figure 1.

Drowns Dam affects flows in the drainage of Mile Brook, which flows north to the Bean River, a tributary of the North River. The North River flows southeast to join the Lamprey River at a point immediately upstream of the start of the Lamprey Designated River[5] in Epping, New Hampshire. Drowns Dam is approximately 10 miles upstream of the start of the Designated River. The dam is owned by the State of New Hampshire Water Division (see contact information). The dam is active and its use is for recreation.

Dam Design

The dam was built in 1842 and reconstructed in 1964. The dam is constructed of concrete, stone and earth materials and has a concrete outlet structure that includes slots for wooden stop logs (Figure 1). A single stop log bay allows operation of releases from the dam. Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau, which owns the dam. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

[5] This Lamprey Designated River describes the segment designated in 1990 and identified by the legislature in 2002 as the subject for the Instream Flow Pilot Program. The legislature subsequently designated the remainder of the Lamprey River for protection in 2011—the newly designated segments are not part of the Lamprey River Water Management Plan.

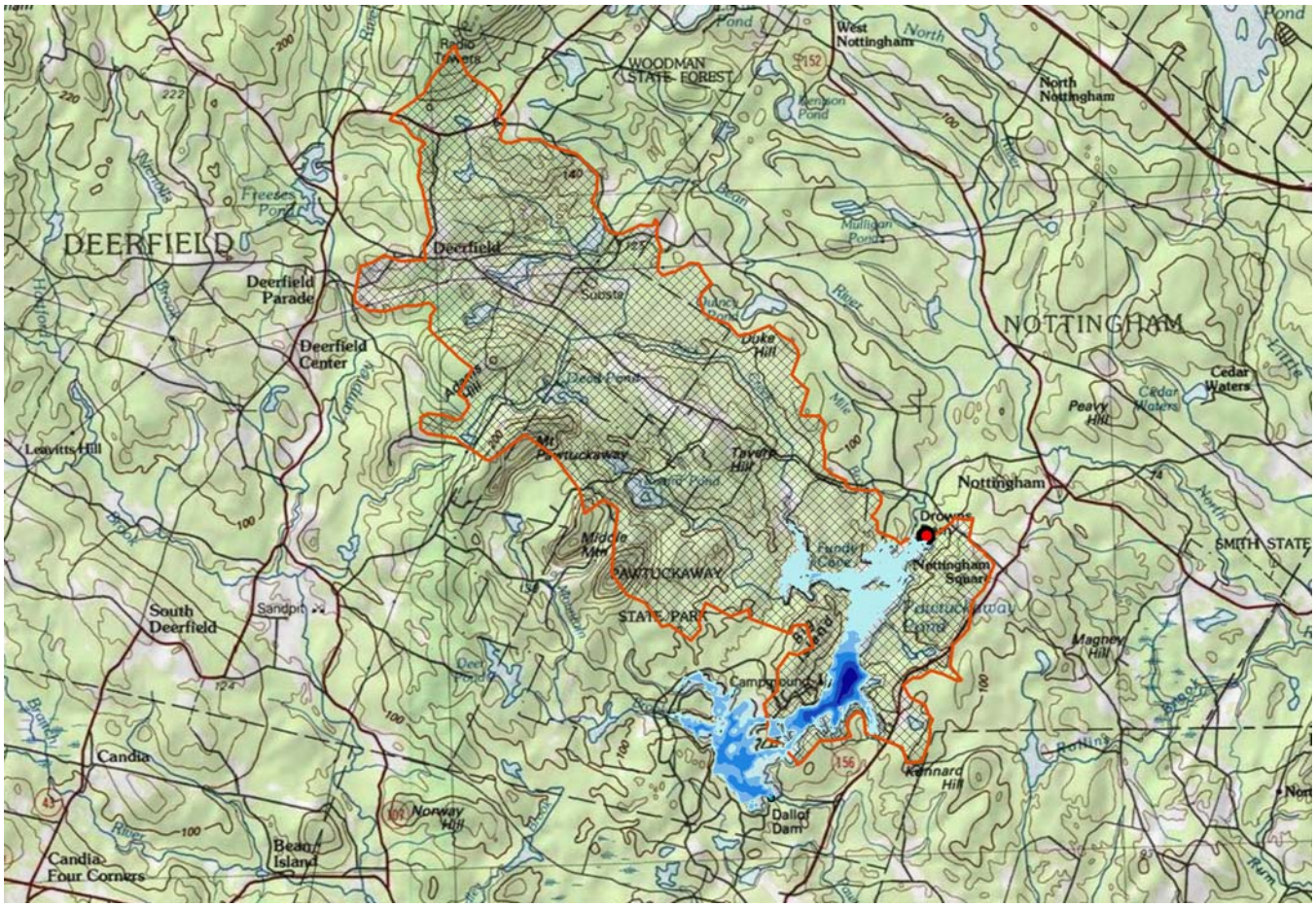

Figure 4 *– Drowns Dam at north end of Pawtuckaway Lake and the drainage area for the northern part of pond.*

Protected Flow, Flowage Rights or Contractual Obligations

A 1992 lake level investigation initiated by lake property owners concerned that the practice of drawing the lake down seven feet over the winter was harming the fishery was concluded by DES deciding that historical practices would continue. A 2000 lake level investigation and hearing set the operating water levels for Pawtuckaway Lake as memorialized in "The Notice of Decision of Determination of Lake Level" (DES 2000). Following this Decision, lake levels were managed to draw the lake down seven feet by November 30 and returned to full by June 1st.

In 2012, a new lake level investigation was conducted and a hearing was held in June of that year. In 2013, DES changed the lake's management conditions from those under the 2000 NOD (DES 2013). The 2013 Notice established that the annual drawdown level for Pawtuckaway Lake shall be maintained at 4.8 feet in order to achieve a lake level of 20.2 feet by November 30th and a lake level of 25 feet at the gauge on the Dolloff Dam by June 1st. A lake level of 25 feet is considered full pond. Implementation of this change in the winter draw down levels will be

conducted over a period of four years with the drawdown target to be decreased by 0.5 feet each year until the new target level of 4.8 feet is attained (20.2 on the gauge at Dolloff Dam). The 4.8 foot fall drawdown retains over two feet of storage that allows for a winter release of 0.65 feet to support instream flows. Drowns Dam is to be operated in conjunction with Dolloff Dam to maintain these lake levels, which are managed to serve public interests including recreational opportunities, aquatic habitat, and water quality.

Riparian Property Obligations or Agreements

Since 2000, DES has utilized Drowns Dam to manage Pawtuckaway Lake levels by approximating the historical median levels to meet the conditions of the 2000 DES Notice of Decision. The 2000 Notice of Decision describes the conditions for an annual fall drawdown and spring fill where, by November 30, the lake would be lowered 7 feet to a level of 18 feet on the gauge at Dolloff Dam and returned to a lake level of 25 feet by June 1st (DES 2000). This 2000 Decision was reconsidered in a Lake Level Investigation during 2012-2013 and a new Decision was reached in 2013. The 2013 Decision changed the annual fall drawdown from 7 to 4.8 feet below full pond, which is to be achieved by November 30, and provides for the return to full lake level of 25 feet by June 1st. Lake level between spring and fall, depending on inflow, is maintained at 25 feet as measured on the staff gauge at Dolloff dam.

Water Quality Requirements or Limits

There are no site-specific water quality requirements or limits associated with this dam.

Assessment of Potential Water Availability

Releasing water from storage is one way to offset Lamprey River flow deficits by providing a relief flow pulse. Drowns Dam is one of the two dams controlling Pawtuckaway Lake that could be used to release water for a relief flow to attain downstream water quality standards.

The DES Dam Bureau files show the maximum storage volume for Drowns Dam (Pawtuckaway Lake) is 11,700 acre-feet (ac-ft). GIS assessments by Watershed Management Bureau using bathymetry developed in 2011 and 2012 defined its permanent storage volume as 7954 ac-ft, for a difference of 3746 ac-ft (163 million cu. ft. or 1221 million gallons). The permanent storage of Pawtuckaway Lake is the largest of the lakes within the Lamprey River Water Management Planning Area. The drainage area behind the dam is 20.3 sq. miles, which due to its large area provides considerable runoff potential for refilling the impoundment. This watershed represents 11% of the Lamprey River watershed.[6] The surface area of the lake is 783 acres. Therefore, the potential volume of water available for flow management from Pawtuckaway Lake through this dam or Dolloff Dam is the highest among the dams in this Water Management Planning Area.

Each of the bioperiods except Spring Flood has a bioperiod-specific flow to be released as the relief flow to maintain protected flows. The volume of water to be added to the release, and its equivalent discharge value and the estimated water level change for each bioperiod, are summarized in Table 2. The relief flow volume and flow rate values in Table 2 are based on

[6] Relative to the USGS stream flow gauge 01073500 Lamprey River Near Newmarket, NH

supporting the Rare and Critical flow requirements 90 percent of the time and includes a 20 percent buffer. The twenty percent buffer recognizes that there are unquantified losses that may cause attenuation of flow between the location of the release and the Designated River. The Spring Flood bioperiod will not be managed because historically there have been very few low-flow events during this time.

Because of lake management, the volume of the lake is changed through the year, thereby affecting the amount of water in storage that could be available for a relief flow release. Following the Spring Flood bioperiod, the impoundment is expected to be at full pool as the starting point for the summer season. Full lake is the level of the Dolloff Dam's spillway, which is at 25 feet as measured on the staff gauge at Dolloff dam.

The lake level is usually above 25 feet (full) after the spring melt and declines below this level by mid-July, resulting in minimal water passing downstream. During the bioperiods of early summer through early fall (Clupeid Spawning, GRAF Spawning, and Rearing and Growth), protected instream flows can be supported by relief flows released from storage in Pawtuckaway Lake. Release volumes for summer and fall bioperiods include flow from Mendums Pond. A relief flow release during the three summer periods represents lake level declines of 0.14, 0.02 or 0.05 feet, respectively. Management conditions on releases will be applied to ensure that the lake's recreational use, wildlife, fish and water quality are protected, or these releases will be curtailed.

Under the 2000 Notice of Decision, each fall, beginning in early October, water was released from Dolloff Dam (in combination with Drowns Dam at the northern end of the lake). The goal of the drawdown under the 2000 Decision was to lower the lake by seven feet (to 18 feet on the gage by November 30).[7] The annual seven-foot drawdown release currently supports most of the Salmon Spawning bioperiods instream flow needs without active management for protected instream flows.

Protected flows during the October 7 through December 8 bioperiod are usually met because of the fall lake drawdown. A pulse may be applied during this bioperiod if protected flows are not being maintained by managing the timing and release rate of the fall drawdown. The annual fall drawdown will be managed such that the volumes leaving Drowns and Dolloff Dams are proportional to the subwatershed areas of the northern and southern pond areas; namely, 70% via Drowns Dam and 30% via Dolloff Dam. Achieving the 4.8 foot drawdown level will be targeted for November 30.

During the Overwintering bioperiod, relief flows will be provided from some of the water retained from the 4.8 foot annual fall drawdown. At the final lake level of 4.8 feet below full pool, one relief flow release is possible during the winter. The reduction of lake level for this release is expected to be 0.65 feet (about 8 inches) or less.

Refilling the lake has historically begun between mid-January and early-February. From late January continuing through May, the DES Dam Bureau adds stoplogs to reduce the outflow from

[7] The lake was rarely dropped to 18 feet -- the 1982-2012 median winter lake level is deepest in mid- to late January at about 18.7 feet or 6.3 feet below full pond.

the dam and refill the lake to its full lake stage of 25 feet by June 1 (DES 2000). As the Spring Flood bioperiod approaches, depending on spring flood storage needs, the water stored for the Overwintering bioperiod may be saved to maintain stream flows during the Spring Flood bioperiod, or released before the Spring Flood bioperiod to provide additional flood storage, as the DES Dam Bureau deems necessary. Relief flow releases are not proposed during the Spring Flood bioperiod because there is insufficient storage to both fill the lake and maintain downstream flows. At the end of the Spring Flood bioperiod, the water level should again be at full lake level and have sufficient storage to support management, public recreation and lake ecology during the next three bioperiods of early summer through early fall.

Potential Impacts of Storage and Release of Relief Flows

Impacts of the water management actions on existing wetland in Pawtuckaway Lake are limited. Except for Burnham's Marsh, there are few mapped wetlands within the impoundment area of the dam. Burnham's Marsh is separated from the lake by Burnham's Marsh Dam, so the storage or release of water from Dolloff or Drowns dam for flow management would have little potential impact on wetlands in Burnham's Marsh.

Mapped wetland areas are present below the dam in the riparian area along the Pawtuckaway River. These wetlands could reduce the effectiveness of any flow released from Dolloff Dam by temporarily storing the released water. A test relief pulse, conducted in September 2012, demonstrated that these wetlands have little discernible impact on the flow or timing of the pulse.

Pawtuckaway Lake has been a nesting area for up to two Common Loon pairs. Common Loons are state-listed as Threatened. Loon nesting success is sensitive to water level changes because changes of six inches or more have the potential to either flood the nest or strand it above the reach of the parents. The primary nesting period for loons is May 15 through July 15, although secondary nesting periods occur later in the year if the initial nesting attempt fails. Water levels should not vary more than 6 inches to support loon nesting success.

Managing water levels on Pawtuckaway Lake for the purpose of flow management on the Lamprey Designated River should not have a significant effect on shoreline properties or on recreational opportunities on the Lake. DES has defined a limit of 18 inches below full pond level of the total water level change caused by management and by the usual decline—this would represent an extreme condition that would occur very infrequently, if at all. In addition, 18 inches is considered to be within the natural range of variability for summer lake levels.

The period of most common management needs is from July 5 through October 6. Thirty-four of 56 years would have required no management and twelve years would have required only one management event. A single management event during this time of year would change the lake level by 0.05 feet (0.6 inches). During the driest two years on record, six relief flows would have been applied throughout the spring, summer and fall, for a cumulative lake level effect of four inches.

The change in winter drawdown practices is expected to reduce both the amount and residence time of phosphorus in the lake. The reduction in phosphorus will reduce the likelihood of algal blooms. The summer releases are unlikely to either promote or retard algal blooms.

The DES Dam Bureau has assessed the difference in flood protection resulting from a reduced winter drawdown. Because the difference on lake volume between 7 feet and 5 feet of drawdown is relatively small, the increase in flood protection attributable to a deeper drawdown is small. Further, the DES Dam Bureau will always have the ability to manage Pawtuckaway Lake dams for the protection of health and safety such that water may be released to help preempt the effects of an incoming storm.

Potential for Dam Management to Support Instream Flow Requirements

The overall potential for using Drowns Dam for flow management to support the instream flow requirements on the Lamprey Designated River is high due to the public ownership of the dam, the amount of storage potentially available, the large drainage area above the dam, the existence of an outlet structure designed to manage water levels and its proximity to the beginning of the designated river.

Dam Management Activity

Pawtuckaway Lake is controlled by two operable dams. Water can be release from Pawtuckaway Lake from either Dolloff Dam or Drowns Dam or from a combination of both dams. When compared with Dolloff Dam, Drowns Dam is slightly closer to the beginning of the Lamprey Designated River (10 miles versus 14 miles.) Releases from Downs Dam to provide for flow management would have to be coordinated with the timing and volume of Dolloff Dam releases. Non-winter releases would also be coordinated with releases from Mendums Pond. DES will not conduct flow releases for stream flow protection during the Spring bioperiod.

Drowns Dam's primary use is described by the Dam Bureau as recreation. The uses of Drowns Dam will be expanded to include management for instream flow protection. The DES Dam Bureau, as the owner of the dam, will be responsible for the operation of the dam to support the protected instream flows on the Lamprey Designated River. If a flow management release becomes necessary, water may be released from Drowns Dam to create a relief flow pulse to support the protected instream flows on the Lamprey Designated River. The Dam Bureau will take such actions as are necessary to operate the stoplogs at Drowns Dam to increase flow from Pawtuckaway Lake by the amount shown in Table 2 beginning at a start time identified by the Instream Flow Program. The DES Watershed Management Bureau will identify when flow management is needed and notify the DES Dam Bureau of an approaching event.

Relief flows may be released to support the protected instream flows during five of the six bioperiods. Flow management releases may occur if the daily mean discharge falls below the Critical or Rare protected flow magnitudes for longer than its catastrophic duration (DES 2009). No relief flows will be released from Pawtuckaway Lake during the Spring Flood bioperiod (March 1 to May 4).[8] For the Clupeid Spawning, GRAF Spawning, and the Rearing and Growth

[8] Minimum flows for the maintenance of downstream flow will be supported during spring refilling.

bioperiods (May 5 to October 6), relief flows will be generated by releases from both Mendums Pond and Pawtuckaway Lake. The volume released from each lake will be proportional to its surface area such that each lake has the same change in water level. During the annual fall drawdown, which occurs during the Salmon Spawning bioperiod (October 7 – December 8), the drawdown may be configured as a pulse to support instream flows. Releases from Pawtuckaway Lake will be in combination with releases from Mendums Pond, except during the Overwintering bioperiod (December 9 – February 28) when Mendums Pond will not be used.

Flow conditions will be evaluated by DES to determine management need and relief flow release effects based on the records from the United States Geological Survey stream flow gaging station Lamprey River near Newmarket, New Hampshire (0173500). If a flow management release is needed, then Dam Bureau will release a two-day relief flow from Drowns, Dolloff, or both dams at rates described in Table 2.

DES will post a notification of approaching management on its website. DES will send an email notification to the Town of Nottingham and to the president of the Pawtuckaway Lake Improvement Association.

To protect the State-listed threatened Common Loon nesting cycle, no relief flow releases will be applied between May 15 and July 15 that would result in reducing the water level more than six inches when any successful loon nesting is occurring. DES will notify NH Fish and Game, The Loon Preservation Committee and the Pawtuckaway Lake Improvement Association of approaching management conditions and request their determination of whether loons are currently actively nesting on the Lake during that period. From July 15 through August 15, DES will consult with NH Fish and Game and The Loon Preservation Committee to determine whether relief flow releases for stream flow protection will affect loon nesting.

In the event of the need for relief flows from Pawtuckaway Lake between May 5 and October 6, the maximum water level drawdown shall not result in the Lake water level going below 18 inches below the spillway crest.

The annual fall drawdown will be managed such that the volumes released from Drowns and Dolloff Dams are proportional to the subwatershed areas of the northern and southern pond areas: namely, 70% via Drowns Dam and 30% via Dolloff Dam.

Only one Overwintering pulse is possible based upon the proposed change in storage. Use of Drowns Dam during the Overwintering bioperiod may not be possible because of a remnant channel obstruction described as a coffer dam, which is located upstream of Drowns Dam. This coffer dam reduces flow to Drowns Dam as water level in the lake falls, and stops flow when water levels fall to 5.4 feet below full lake level.

Schedule for Dam Management Plan Implementation

This Dam Management Plan will be put into practice after adoption of the Lamprey Water Management Plan. The operations for releases under this Dam Management Plan for the period March 1 through December 8 will begin with the first bioperiod start following adoption.

Management during the December 9 through February 28 Overwintering bioperiod includes a change in the annual drawdown to 4.8 feet instead of ~7 feet. This change will be implemented over four years by reducing the drawdown approximately 6 inches each year. During these first four years, no Overwintering bioperiod releases will be applied, barring any unforeseen or unusual circumstances.

Estimated Cost of the Implementation of the Dam Management Plan

The specific actions associated with the implementation of the Dam Management Plan for Drowns Dam would include the placement or removal of stop logs from the dam. This work would require that, at least, one trained DES employee travel to the site to either place or remove a pre-determined number of stop logs from the dam structure. These trips are expected to also include management actions at Dolloff Dam and Mendums Pond Dam. The estimated costs associated with this work will be dependent upon the number of personnel involved, the number of site visits required to perform the necessary flow management actions and the travel time and mileage. Accounting for any costs associated with this program will be made through the two-year evaluation period following the approval of this plan.

Dam Owner and Contact Information

Owner: New Hampshire Water Division
Address: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
Contact: Mr. James Gallagher
Phone: 603-271-1961
Email: james.gallagher@des.nh.gov

Conversion Factors for Volume and Flow Units

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1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
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References

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Department of Environmental Services (DES) 2013. Notice of Decision on Determination of Lake Level. August 2013.

Table 1 - Dam Characteristics

Elevation (ft) of recreation pool or height relative to lowest spillway	**241.30**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**18**
Freeboard (ft)	**NA**
Type of spillway controls or outlet works	**Stop Logs**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**738***
Drainage area (sq. miles)	**20.3***
Maximum storage (ac-ft)	**11,700**
Normal or permanent storage (ac-ft)	**7,954***
Total discharge capacity (cfs)	**1,631**
Maximum unoperated discharge (cfs)	**NA**
Design storm discharge (cfs)	**2,080**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**290**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #184.04 except those marked with an asterisk which are from recent GIS evaluations.

Note: NA – not available from NH Dams Data Sheet.

Table 2 – Two-Day Flow Release Contribution from Drowns or Dolloff Dams in the Event of Instream Flow Water Management.

Bioperiod name	Period	Relief volume needed to meet 90% of historical deficits (ac-ft)	Relief volume needed to meet 90% of historical deficits with 20% buffer (ac-ft)	Two-day flow release contribution from Pawtuckaway (cfs) [74.7%]	Change in water level from full pool using releases that meet 90% of historical deficits w/ 20% buffer (feet)	Water source
Overwintering	Dec 9 – Feb 28	216	259	65*	0.65 – starting from 4.8 ft below full – not from full pool	Water retained from Pawtuckaway Lake from annual fall drawdown.
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Mendums		265	Acres at full recreational pool [25.3% of combined Mendums and Pawtuckaway surface areas]			
Pawtuckaway		783	Acres at full recreational pool [74.7% of combined Mendums and Pawtuckaway surface areas]			
* Overwintering release is from Pawtuckaway Lake only.						

DAM MANAGEMENT PLAN

Drowns Dike (State Dam ID #184.19)

Figure 1 – Southern and northern sides of Drowns Dike, photos taken October 3, 2007.

Introduction

Drowns Dike (lat. 43° 06’ 26”, long. -71° 07’ 23”) is one of four dams that store water in Pawtuckaway Lake. It is located at the end of Beech Road and east of Drowns Dam in Nottingham, New Hampshire. Drowns Dike is located in the drainage of Mile Brook, which flows north to the Bean River, a tributary of the North River. The North River flows southeast to join the Lamprey River immediately upstream of the start of the Lamprey Designated River in Epping, New Hampshire. Drowns Dike is approximately 10 miles upstream of the start of the Designated River. The dam is owned by the State of New Hampshire Water Division (see contact information).

Dam Design

The dike was originally constructed in 1842 and consists of earth and rock material. There are no outlet structures and, as a result, there is no operation of or controlled discharge from the dike (Figure 1). Details on the design and operation of the dike were obtained from the records of the Department of Environmental Services (DES) Dam Bureau, its owner. The information required by Env-Wq 1906.04 on the characteristics of the dike is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

A lake level investigation and hearing set the desired operating water levels at Pawtuckaway lake. The dike is used to manage water levels to serve public interests including recreational opportunities, aquatic habitat, and water quality. Also, seasonal drawdown levels were established to provide for spring flood abatement.

Riparian Property Obligations or Agreements

Drowns Dike, along with Drowns Dam, Dolloff Dam and Gove Dike, are used to manage water levels to maximize public recreation on Pawtuckaway Lake.

Water Quality Requirements or Limits

There are no water quality requirements or limits**.**

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Drowns Dike is 4,320 acre-feet (ac-ft), while its permanent storage volume is 3,564 ac-ft, for a difference of 756 ac-ft (33 million cu. ft. or 250 million gallons). When compared with the other dams being evaluated as part of this study the permanent storage volume of Drowns Dike is considerably higher. The drainage area behind the dam is 21 sq. miles, which due to its large area would provide considerable runoff to the impoundment following any drawdown in water levels. Therefore, the water available for flow management from this dam is high compared to other dams in this Water Management Planning Area.

Potential Impacts of Storage and Release of Relief Flows

One impact of the storage and subsequent release of water from the Drowns Dike for flow management would be the change in the Pawtuckaway Lake water level. Large changes in water level could affect recreation on the lake as well as waterfront residential property. There are a number of mapped riparian wetland areas below the dam along the unnamed tributary as well as along the Bean River and North River which could reduce the effectiveness of any relief flow released from Drowns Dike by temporarily storing the released water. Insufficient information is available to determine the amount of water that could be stored by the wetland areas and the resulting impacts on any flow management activities.

Mapped wetland areas are sparse within the flood impoundment storage area above the dam. Therefore, inundation of this area by the storage of water and dam releases for flow management would have little potential impact on wetland areas above the dam.

Potential for Dam Management to Support Instream Flow Requirements

The potential for operation of Drowns Dike to support instream flows is very low. Drowns Dam, which is located in the same vicinity as Drowns Dike, has an existing outlet structure designed for managing water levels in Pawtuckaway Lake. There is no outlet structure on Drowns Dike to manage water releases so flow management would require extensive modification of the dam. Drowns Dam would be used in preference to Drowns Dike.

Dam Management Activity

No dam management activity is currently required for Drowns Dike due to the presence Drowns Dam nearby.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Drowns Dike, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: New Hampshire Water Division
Address: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
Contact: Mr. James Gallagher
Phone: 603-271-1961
Email: jgallagher@des.state.nh.us

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Drowns Dike Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**12**
Freeboard (ft)	**4**
Type of spillway controls or outlet works	**None**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**900**
Drainage area (sq. miles)	**21**
Maximum storage (ac-ft)	**4,320**
Normal or permanent storage (ac-ft)	**3,564**
Total discharge capacity (cfs)	**NA**
Maximum unoperated discharge (cfs)	**NA**
Design storm discharge (cfs)	**NA**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**2,080**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #184.19.

Note:

NA – not available from NH Dams Data Sheet.

DAM MANAGEMENT PLAN

Freeses Pond Dam (State Dam ID #061.02)

Figure 1 – Freeses Pond Dam and outlet structure, photos taken October 2, 2007.

Introduction

Freeses Pond Dam (lat. 43° 09' 01", long. -71° 14' 04") is located on the Lamprey River near the intersection of Routes 107 and 43 in Deerfield, New Hampshire. Freeses Pond Dam lies approximately 28 miles upstream of the start of the Lamprey Designated River. This dam is owned by the Town of Deerfield and operated by the Deerfield Board of Water Commissioners (see contact information). The dam is active and is used for recreation.

Dam Design

The dam was reconstructed in 1987 and it consists of stone and concrete. The outlet structure has slots for wooden stop logs (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam operator. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the operator of the dam, there are no flowage requirements or rights.

Riparian Property Obligations or Agreements

According to the operator of the dam, there are no riparian property obligations or agreements.

Water Quality Requirements or Limits

According to the operator, there are no site specific water quality requirements or limits associated with this dam.

Assessment of Potential Water Availability

Freeses Pond is bisected by Route 107, with a 13-foot arched corrugated metal pipe culvert under the road dividing the upper pond from the lower pond. DES Dam Bureau files show the maximum storage volume for Freeses Pond, including both the upper and lower pond, is 432 acre-feet (ac-ft). Its permanent storage volume, measured at the sill of the 17-foot lower spillway, is 66.3 ac-ft for the downstream and upstream ponds. Additional water below the lower spillway could be released by removing stop logs.

The drainage area upstream of the dam is 8.58 square miles and includes the 17-acre Meadow Lake—another impoundment in the Lamprey Water Management Plan. When compared with the other dams in this Water Management Planning Area, the storage volume and the contributing drainage area for Freeses Pond Dam result in a moderate potential for water management use. However, Freeses Pond's surface area represents only 5% of the combined surface areas of it, Pawtuckaway Lake and Mendums Pond, the latter two being the impoundments with high potential for dam management. Mendums Pond surface area is five times, and Pawtuckaway Lake is 14 times, the size of Freeses Pond.

Potential Impacts of Storage and Release of Relief Flows

Within the impoundment area of Freeses Pond Dam there are extensive areas of mapped wetlands, particularly in the portion of the impoundment located on the northeast side of Route 107. Excessive or repeated inundation and draining of these areas by the storage and release of water for flow management on the Lamprey Designated River could negatively impact them. Insufficient information is available to quantify the resulting impacts of flow management actions. Freeses Pond is managed for recreation, and raising or lowering the water surface could potentially impact recreation opportunities on the pond. The beginning of the Designated River is 28 miles downstream of the dam and there are several ponds and wetland complexes along this portion of the Lamprey River. The temporary storage of water released from the dam by these features could reduce the effectiveness of a flow management action.

Potential for Dam Management to Support Instream Flow Requirements

The overall potential for using Freeses Pond Dam for flow management to support the instream flow requirements on the Lamprey Designated River is moderate. Factors considered favorable for the use of Freeses Pond Dam for flow management on the Lamprey Designated River include: the size of the contributing drainage area upstream of the dam; the amount of water potentially available for flow management; and an existing outlet structure that can be used to regulate dam releases.

Factors considered unfavorable for flow management include: the distance (28 miles) that the dam is located from the start of the Lamprey Designated River; the number of ponds and wetlands located between the dam and the start of the Designated River; and the potential impact of flow management on the wetlands and recreation.

An assessment of the water level changes that might occur under a relief flow release as part of a dam management action showed that the water level changes in Onway Lake would be small, especially if releases were in combination with Pawtuckaway Lake and Mendums Pond. See Table 3 – Water Level Change on Freeses Pond, Mendums Pond and Pawtuckaway Lake with Flow Management. The maximum annual water level change if Freeses Pond were to provide the entire relief flow would be over 10 feet. (Assumes that one management event will occur during each bioperiod except the Spring Flood bioperiod.) A more likely scenario would be water releases from Freeses Pond in combination with releases from Mendums Pond and Pawtuckaway Lake. The releases would be prorated based on their surface areas. With the combined effect of the three lakes, the annual water level change would be 0.52 feet. Winter releases solely from Pawtuckaway are anticipated that would make the annual change in Freeses Pond 0.28 feet.

Dam Management Activity

Since the potential for its use for flow management on the Lamprey Designated River is only moderate due largely to the distance of the impoundment from the Designated River, no dam management activity is currently required. Freeses Pond represents the second alternate should a contingency be needed.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Freeses Pond Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: Town of Deerfield, Deerfield Water Commission
Address: P.O. Box 159, Deerfield, NH 03037
Contact: Mr. John Dubiansky, Chairman, Deerfield Water Commission
Phone: 603-463-8811

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Freeses Pond Dam Characteristics

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**12.5**
Freeboard (ft)	**2**
Type of spillway controls or outlet works	**Stop logs**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**55.3**
Drainage area (sq. miles)	**8.58**
Maximum storage (ac-ft)	**192**
Normal or permanent storage (ac-ft)	**66.3**
Total discharge capacity (cfs)	**2460**
Maximum unoperated discharge (cfs)	**2460**
Design storm discharge (cfs)	**831.8**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**NA**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #061.02.
Note: NA – not available from NH Dams Data Sheet.

Table 2 – Freeses Pond relative to Mendums Pond and Pawtuckaway Lake.

	Acres of surface area	% of combined surface area	Size relative to Freeses Pond surface area
Mendums Pond	265	24.0%	4.8
Pawtuckaway Lake	783	71.0%	14.2
Freeses Pond	55.3	5.0%	1.0
Sum	**1103.3**	**100.0%**	

Table 3 – Water Level Change on Freeses Pond, Mendums Pond, and Pawtuckaway Lake with Flow Management.

Bioperiod name	Period	Release volume - 90% coverage with 20% buffer (ac-ft)*	Release volume in cubic feet	Drawdown using Freeses Pond only (feet)	Drawdown using Freeses Pond with Pawtuckaway and Mendums (prorated by area) (feet)
Overwintering	Dec 9 – Feb 28	259	11,290,752	4.69	0.23
Spring Flood	Mar 1 – May 4	-			
Clupeid Spawning	May 5 – Jun 19	142	6,168,096	2.56	0.13
GRAF Spawning	Jun 20 – Jul 4	24	1,045,440	0.43	0.02
R&G	Jul 5 – Oct 6	56	2,456,784	1.02	0.05
Salmon Spawning	Oct 7 – Dec 8	90	3,920,400	1.63	0.08
			Sum	**10.33**	**0.52**

*** Volume for a dam release that meets 90% of the historical (1976-2005) deficits of catastrophic and persistent low-flow events to which has been added a buffer of 20% as a contingency to account for unforeseen losses.**

DAM MANAGEMENT PLAN

Gove Dike (State Dam ID #184.03)

Figure 1 – Lake side of Gove Dike embankment, photo taken October 3, 2007.

Introduction

Gove Dike (lat. 43° 04' 50", long. -71° 08' 02") is one of four dams that store water in Pawtuckaway Lake. It is located on Shore Drive in Nottingham, New Hampshire. The dam is located in the drainage of an unnamed tributary to the Pawtuckaway River, which flows south to join the Lamprey River in Epping, New Hampshire. Gove Dike lies approximately 14 miles upstream of the start of the Lamprey Designated River. The dam is owned by the State of New Hampshire Water Division (see contact information).

Dam Design

The dike was originally built in 1842 and was last reconstructed in 1983. The dike consists of earth and rock material. It has no outlet structures and as a result, there is no operation of or controlled discharge from the dike (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau, its owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

A lake level investigation and hearing set the desired operating water levels at this lake. This dike is used to manage water levels to serve public interests including recreational opportunities, aquatic habitat, and water quality. Also, seasonal drawdown levels were established to provide for spring flood abatement.

Riparian Property Obligations or Agreements

Gove Dike, along with Dolloff Dam, Drowns Dam and Drowns Dike, is used to maintain water levels on Pawtuckaway Lake to maximize public recreational opportunities.

Water Quality Requirements or Limits

There are no water quality requirements or limits.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Gove Dike is 11,700 acre-feet (ac-ft), while its permanent storage volume is 11,500 ac-ft, for a difference of 200 ac-ft (8.7 million cu. ft. or 65 million gallons). When compared with the other dams being evaluated as part of this study, the permanent storage volume of this impoundment is large. The drainage area behind the dam is 21 sq. miles, which would provide considerable runoff to the impoundment following any drawdown in water levels.

Potential Impacts of Storage and Release of Relief Flows

One effect of the storage and subsequent release of water from the Gove Dike for flow management would be the change in the Pawtuckaway Lake water level. Large changes in water level could impact recreation on the lake as well as waterfront residential property. There are a number of mapped riparian wetland areas along the Pawtuckaway River below the dam which could reduce the effectiveness of relief flows released from Gove Dike by temporarily storing the released water. Insufficient information is available to determine the amount of water that would be attenuated by the wetland areas and the resulting impacts on any flow management activities.

Mapped wetland areas are sparse within the flood impoundment storage area above the dam. Therefore, inundation of this area by the storage of water and dam releases for flow management would have little potential impact on wetland areas above the dam.

Potential for Dam Management to Support Instream Flow Requirements

The potential for operation of Gove Dike to manage instream flows is very low. There is no outlet structure on Gove Dike to manage water releases. Flow management using Gove Dike would require extensive modification of the dam.

Dam Management Activity

No dam management activity is currently required for Gove Dike, due to the presence of Dolloff Dam nearby.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Gove Dike, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: New Hampshire Water Division
Address: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
Contact: Mr. James Gallagher
Phone: 603-271-1961
Email: jgallagher@des.state.nh.us

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Gove Dike Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**9**
Freeboard (ft)	**3.6**
Type of spillway controls or outlet works	**None**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**900**
Drainage area (sq. miles)	**21**
Maximum storage (ac-ft)	**11,700**
Normal or permanent storage (ac-ft)	**11,500**
Total discharge capacity (cfs)	**NA**
Maximum unoperated discharge (cfs)	**NA**
Design storm discharge (cfs)	**2,080**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**261**

Source of information: DES Dam Bureau, NH Dams data Sheet for Dam #184.03.
Note:

NA – not available from NH Dams Data Sheet.

DAM MANAGEMENT PLAN

Hoar Pond Dam (State Dam ID #078.07)

Figure 1 – Hoar Pond Dam and outlet structure, photos taken October 3, 2007.

Introduction

Hoar Pond Dam (lat. 43° 02’ 53”, long. -71° 05’ 11”) is located on an intermittent tributary to the Lamprey River off of Beniah Lane in Epping, New Hampshire. This dam is owned by the Town of Epping (see contact information). The dam is active and is used for recreation. Hoar Pond lies approximately 8 miles upstream of the start of the Lamprey Designated River. Hoar Pond is also located within the well protection area for some of the Town of Epping’s water supply wells.

Dam Design

The dam was originally constructed in 1900 and was repaired in 1989. The original dam consisted of a concrete wall and a wood tongue-and-groove wall with earthen fill. The dam has been partially breached, and beaver have constructed an upstream dam that now controls the water level in the pond (Figure 1). Details on the design and operation of the Hoar Pond Dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the owner there are no flowage requirements or rights.

Riparian Property Obligations or Agreements

According to the owner there are no riparian property obligations or agreements.

Water Quality Requirements or Limits

According to the owner, Hoar Pond is located within the protection radius of two of Epping Water and Sewer's bedrock water supply wells.

Assessment of Potential Water Availability

The maximum and permanent storage volumes for Hoar Pond Dam are both reported as 65 acre-feet (ac-ft), thus there is no additional storage volume available from this dam. The drainage basin upstream of the dam is only 0.52 square miles, which limits the potential amount of runoff to refill the pond. When compared to other dams in the Water Management Planning Area, both the permanent storage volume and contributing drainage area associated with Hoar Pond Dam are low. Therefore, the water available from this dam for flow management is considered low. In addition, water levels in the pond appear to be controlled by a beaver dam, which allows for some seepage downstream to the outlet stream. The lack of an engineered outlet structure further limits the availability of water from this dam for flow management.

Potential Impacts of Storage and Release of Relief Flows

Since the release of water from this dam cannot be controlled, this dam cannot be used for the storage and release of water for flow management on the Lamprey Designated River.

Potential for Dam Management to Support Instream Flow Requirements

Due to the lack of any additional storage, the limited size of the contributing drainage area and the lack of an operating outlet control structure, Hoar Pond Dam has been eliminated from consideration for flow management activities at this time.

Dam Management Activity

Since there is insufficient drainage area to replenish the impoundment and since the dam cannot be used for the storage or release of water without significant alterations, no dam management activity is currently required.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Hoar Pond Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: Town of Epping
Address: 157 Main Street, Epping, NH 03042
Contact: Mr. Dean Shankle, Town Administrator
Phone: 603-679-5441
Email: administrator@townofepping.com

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Hoar Pond Dam Characteristics

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**5.8**
Freeboard (ft)	**NA**
Type of spillway controls or outlet works	**None**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**26**
Drainage area (sq. miles)	**0.43**
Maximum storage (ac-ft)	**65**
Normal or permanent storage (ac-ft)	**65**
Total discharge capacity (cfs)	**NA**
Maximum unoperated discharge (cfs)	**NA**
Design storm discharge (cfs)	**162**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**223**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #078.07.
Note: NA – not available from NH Dams Data Sheet**.**

DAM MANAGEMENT PLAN

Lucas Pond Dam (State Dam ID #183.08)

Figure 1 – Lucas Pond Dam outlet structure, photos taken August 2005.

Introduction

Lucas Pond Dam (lat. 43° 10’ 55”, long. -71° 09’ 48”) is located on a tributary to the North River off of Lucas Pond Road in Northwood, New Hampshire. The North River flows southeast from the confluence with the unnamed tributary and joins the Lamprey River immediately above the start of the Designated River. Lucas Pond Dam lies approximately 15 miles upstream of the start of the Designated River. This dam is owned by the State of New Hampshire Fish and Game Department (see contact information). The dam is actively managed by the NH Fish and Game Department for recreation and fishing.

Dam Design

The dam was last reconstructed in 1979. The dam is constructed of concrete and slots are present for the installation of wooden stop logs (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the owner, there are no minimum flows, flowage rights or contractual obligations.

Riparian Property Obligations or Agreements

The New Hampshire Fish and Game Department has flowage rights over the “grantor’s land” according to the deed in the Departments file.

Water Quality Requirements or Limits

According to the owner, there are no water quality requirements or limits.

Assessment of Potential Water Availability

DES Dam Bureau records show the maximum storage volume for Lucas Pond Dam is 92 acre-feet (ac-ft), while its permanent storage volume is 40 ac-ft. The drainage area providing runoff to the dam is 1.16 square miles in size. When compared with the other dams in this Water Management Planning Area, both the permanent storage volume and drainage area associated with Lucas Pond Dam are low. Therefore, the water available for flow management from this dam is also considered to be low.

Potential Impacts of Storage and Release of Relief Flows

The reach of the North River downstream of the dam to the Lamprey River is largely rural and few structures are present in or adjacent to the river. There are no extensive wetland areas within the impoundment storage area that would be impacted by either water storage or dam releases for flow management. However, there are several mapped riparian wetland areas downstream of the dam which could reduce the effectiveness of any flow released from Lucas Pond Dam by temporarily storing the released water. Insufficient information is available to determine the amount of water that could be stored by the wetland areas and the resulting impacts on any flow management actions.

Potential for Dam Management to Support Instream Flow Requirements

The potential for the management of Lucas Pond Dam to support instream flows on the Lamprey Designated River is low. Factors favoring the use of Lucas Pond Dam for meeting instream flow requirements on the Lamprey Designated River include its contribution to flow above the start of the Designated River and a functioning outlet structure. Factors limiting the potential use of Lucas Pond Dam include: small volume of water available; small drainage area; the distance to the Designated River; and the existence of extensive downstream wetland areas, which could reduce the effectiveness of any dam releases.

Dam Management Activity

No dam management activity is required at this time.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Lucas Pond Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: New Hampshire Fish and Game Department
Address: 11 Hazen Drive, Concord, NH 03301
Contact: Mr. John Magee, Fish Habitat Biologist
Phone: 603-271-2744
Email: john.a.magee@wildlife.nh.gov

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Lucas Pond Dam Characteristics

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**NA**
Freeboard (ft)	**2**
Type of spillway controls or outlet works	**Stoplogs**
Dimensions of spillway controls or outlet works	**10**
Surface area (ac) of impoundment at maximum impoundment	**40**
Drainage area (sq. miles)	**1.16**
Maximum storage (ac-ft)	**92**
Normal or permanent storage (ac-ft)	**40**
Total discharge capacity (cfs)	**94**
Maximum unoperated discharge (cfs)	**94**
Design storm discharge (cfs)	**60**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**NA**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #183.08.
Note:

NA – not available from NH Dams Data Sheet.

DAM MANAGEMENT PLAN

Meadow Lake Dam (State Dam ID #183.16)

Figure 1 – Meadow Lake Dam and outlet structure, photos taken October 2, 2007.

Introduction

Meadow Lake Dam (lat. 43° 12’ 08”, long. -71° 12’ 29”) is located in Northwood Meadows State Park, which is off of Route 4 in Northwood, New Hampshire. This dam impounds a headwater tributary stream to the Lamprey River forming Meadow Lake. Meadow Lake Dam lies approximately 32 miles upstream of the start of the Designated Lamprey River. The dam is owned by the State of New Hampshire Division of Resources and Economic Development and operated by the Division of State Parks (see contact information). The dam is active and its use is for recreation.

Dam Design

The dam was originally built in 1975 and underwent reconstruction in 1991. The dam is constructed of earth materials and a corrugated metal pipe outlet (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the owner, there are no minimum release requirements, flowage rights or contractual obligations associated with this dam.

Riparian Property Obligations or Agreements

The dam owner provided no information as to whether there are any riparian property obligations or agreements. Considering that the lake is on state-owned land and the shoreline is undeveloped, DES believes that there are no such obligations or agreements.

Water Quality Requirements or Limits

According to the owner, there are no water quality requirements or agreements.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Meadow Lake Dam is 105 acre-feet (ac-ft), while its permanent storage volume is 85 ac-ft, for a difference of 20 ac-ft (0.87 million cu. ft. or 6.5 million gallons). The size of its contributing drainage area, 0.47 square miles, is relatively small and may not provide sufficient runoff to refill the lake during a period of below normal precipitation. When compared to other dams in this Water Management Planning Area, both the permanent storage volume and contributing drainage area associated with Meadow Lake Dam are low. Therefore, the water available for flow management from this dam is also considered to be low.

Potential Impacts of Storage and Release of Relief Flows

There are no significant wetlands mapped within Meadow Lake, so storage and release of water for relief flows would have no significant affect on wetlands within or immediately bordering the lake.

Below the dam there are extensive mapped wetland complexes, which could reduce the effectiveness of any flow released from Meadow Lake Dam by temporarily storing the released water. Insufficient information is available to determine the amount of water that could be stored by the wetland areas and the resulting impacts on any flow management actions.

Potential for Dam Management to Support Instream Flow Requirements

Meadow Lake Dam has low potential to support the instream flow requirements due to the small amount of water available, its small contributing drainage area, its distance upstream of the start of the Designated River, the presence of extensive wetlands immediately downstream of the dam, the need to retrofit the outlet structure and the potential impact of lowered water levels on its use for recreation within a State Park.

Dam Management Activity

No dam management activity is required at this time.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Meadow Lake Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no estimated costs.

Dam Owner and Contact Information

Owner: New Hampshire Department of Resources and Economic Development
Address: P.O. Box 1856, Concord, NH 03302-1856
Contact: Mr. Seth Prescott
Phone: 603-271-2606
Email: sprescott@dred.state.nh.us

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Meadow Lake Dam Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**2**
Freeboard (ft)	**NA**
Type of spillway controls or outlet works	**Pipe**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**17**
Drainage area (sq. miles)	**0.47**
Maximum storage (ac-ft)	**105**
Normal or permanent storage (ac-ft)	**85**
Total discharge capacity (cfs)	**59**
Maximum unoperated discharge (cfs)	**59**
Design storm discharge (cfs)	**31**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**NA**

Source of information: DES Dam Bureau, NH Dams data Sheet for Dam #183.16.

Note:

NA – not available from NH Dams Data Sheet.

DAM MANAGEMENT PLAN

Mendums Pond Dam (State Dam ID #184.01)

Figure 1 – Mendums Pond Dam and outlet structure, photos taken August 2005.

Introduction

Mendums Pond Dam (lat. 43° 09’ 46”, long. -71° 04’ 07”) is located on the Little River near Route 4 in Nottingham, New Hampshire. The bulk of Mendums Pond, however, is almost entirely in Barrington, NH. Little River flows seven miles southeast from the dam to its confluence with the Lamprey Designated River. The confluence is approximately six miles downstream of the start of the Designated River. The dam is owned by the State of New Hampshire Water Division (see contact information). The dam is active and its use is for recreation.

Dam Design

The dam was built in 1840 and underwent reconstruction in 1977. The dam is constructed of concrete and earth materials (Figure 1). Three gates are fitted in the stone outlet structure. Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau, the owner and operator of the dam. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the owner there are no minimum flows or contractual obligations.

Riparian Property Obligations or Agreements

The water level in Mendums Pond is controlled by DES's management of the dam and by weather conditions. During the fall, beginning around November 9, the water level in the pond is lowered by seven feet by opening one or more of the dam's three gates. In the spring, the gates are partially closed and snowmelt and spring runoff fill the impoundment. Refilling the lake historically has begun between mid-January and early February. From late January continuing through May, Dam Bureau reduces outflow in order to achieve full pond status by May 1. The dates of the drawdown and refilling are coordinated with the UNH Recreation Department's interest in boating competitions in the spring and fall.

Water Quality Requirements or Limits

According to the owner there are no site-specific water quality requirements or limits associated with this dam.

Assessment of Potential Water Availability

Releasing water from storage in a relief pulse is one way to offset Lamprey River flow deficits. The dam controlling Mendums Pond could be used to release water for a relief flow to attain downstream water quality standards.

DES Dam Bureau files show the maximum storage volume for Mendums Pond Dam is 3,330 acre-feet (ac-ft), while its permanent storage volume is 1,960 ac-ft. The size of the permanent storage of Mendums Pond is second only to Pawtuckaway Lake (7954 ac-ft) in the Lamprey River Water Management Planning Area. The drainage area upstream of the dam is 6.97 sq. miles, which provides considerable runoff potential for refilling the impoundment. This watershed represents 4% of the Lamprey River watershed.[9] The surface area of the pond is 265 acres. Therefore, the potential volume of water available for flow management from Mendums Pond is the second highest among the dams in this Water Management Planning Area.

Each of the bioperiods except Spring Flood and Overwinter has a bioperiod-specific flow to be released as the relief flow to maintain protected flows. The volume of water to be added to the release, and its equivalent discharge value and the estimated water level change for each bioperiod, are summarized in Table 2. The relief flow volumes in Table 2 are based on supporting the Rare and Critical flow requirements 90 percent of the time and includes a 20 percent buffer. The twenty percent buffer recognizes there are unquantified losses that may cause attenuation of flow between the release and the Designated River. Release volumes for most bioperiods include flow from Pawtuckaway Lake because of the availability of water from that location. Overwintering relief flows will not come from Mendums Pond because the

[9] Relative to the USGS stream flow gauge 01073500 Lamprey River Near Newmarket, NH

dam gates may be damaged by icing. The Spring Flood bioperiod will not be managed because historically there have been very few low-flow events during this time.

Because of lake management, the volume of the lake is changed through the year affecting the water in storage that could be available for a relief flow release. Following the Spring Flood bioperiod, the impoundment is expected to be at full pool as the starting point for the hydrologic year.

During the bioperiods of early summer through early fall (Clupeid Spawning, GRAF Spawning, and Rearing and Growth), protected instream flows can be supported by relief flows released from storage in Mendums Pond. Release volumes for summer and fall bioperiods include flow from Pawtuckaway Lake because of the availability of water from that location.

The annual seven-foot, fall drawdown releases currently support most Salmon Spawning bioperiods instream flow needs without active management for protected instream flows. A pulse may be applied during this bioperiod if protected flows are not being maintained by managing the timing and release rate the fall drawdown. Active management of the annual fall drawdown is expected to provide all the water necessary to support this bioperiod's protected instream flow.

Potential Impacts of Storage and Release of Relief Flows

Although there are no extensive wetland areas mapped within the impoundment storage area, there are several mapped wetland areas in the riparian areas downstream of the dam which could reduce the effectiveness of flow releases from the dam by temporarily storing the released water. Insufficient information is currently available to determine the amount of water that could be stored by these wetland areas and the resulting effect on a flow management release.

Shorefront owners on Mendums Pond include residential properties and recreational facilities. Managing water levels on Mendums Pond for the purpose of flow management on the Lamprey Designated River is not likely to have a significant effect on shoreline properties or on recreational opportunities on the Pond because of the limited affects on lake level and the infrequent occurrence. DES has defined a limit of 18 inches of the total water level change caused by management and by the usual decline—this would represent a extreme condition that would occur very infrequently, if at all.

The period of most common management needs is from July 5 through October 6. From 1956 through 2011, 34 of 56 years would have required no management and twelve years would have required only one management event. A management event during this time of year would change the lake level by 0.05 feet (0.6 inches). During the driest two years on record, six relief flows would have been applied throughout the spring, summer and fall with a cumulative lake level effect of four inches.

Mendums Pond has been a nesting area for Common Loon pairs. Common Loons are state-listed as Threatened. Loon nesting success is sensitive to water level changes because changes of six inches or more have the potential to either flood the nest or strand it above the reach of the parents. The primary nesting period for loons is May 15 through July 15, although secondary nesting periods occur later in the year if the initial nesting attempt fails. Water levels should not vary more than 6 inches to support loon nesting success.

Nottingham Lake Dam, a dam located between Mendums Pond and the Designated River, needs to be operated such that water released from Mendums Pond continues downstream in a timely and unattenuated manner. Nottingham Pond Dam is located approximately 3.5 miles downstream of Mendums Pond Dam. Nottingham Pond Dam, which is privately owned, was recently reconstructed and is operated both for recreation and the production of hydroelectricity. Any releases from Mendums Pond Dam would have to be coordinated with the owner of the Nottingham Pond Dam to ensure that the water released would not be impounded, thereby reducing the effectiveness of the release or negatively impacting hydroelectric power production.

Potential for Dam Management to Support Instream Flow Requirements

The overall potential for using Mendums Pond Dam for flow management to support the instream flow protection on the Lamprey Designated River is high. Because flow released from Mendums Pond Dam would be conveyed to the Lamprey River via the Little River six miles below the start of the Designated River, flow management releases taken at this dam will not support the instream flow requirements upstream of the confluence. The area upstream of the confluence would be slightly under-supported if the flow deficits are very large, but will be supported the majority of the time. Additional flow management releases may need to be taken at dams further upstream in order to support the instream flow requirements on the upper portion of the Lamprey Designated River. Releases from Mendums Pond will be coordinated with releases from Pawtuckaway Lake.

Dam Management Activities

The Mendums Pond impoundment's primary purpose is currently described by the Dam Bureau as recreation. The purpose of Mendums Pond will be expanded to include instream flow.

DES Dam Bureau, as the owner of the dam, will be responsible for the operation of the dam to support the protected instream flows on the Lamprey Designated River. The Dam Bureau will take such actions necessary to operate the outlet gate at Mendums Pond Dam to increase flow from Mendums Pond by the amount shown in Table 2 beginning at a start time identified by the Instream Flow Program. If a flow management is needed, the DES Dam Bureau will release a two-day relief pulse from the dam. Flow conditions will be evaluated by DES to determine management need and relief flow release effects based on the records from the United States Geological Survey gauging station Lamprey River near Newmarket, New Hampshire (0173500). If a flow management release is needed, then DES Dam Bureau will release a two-day relief flow from Drowns, Dolloff, or both dams at rates described in Table 2.

DES will post a notification of approaching management on its website. DES will send an email notification to the Town of Nottingham, the Town of Barrington, the owner and operator of the Nottingham Lake Dam, and the director of the UNH Recreation Department.

Relief flows from Mendums Pond may be released to support the protected instream flows during four of the six bioperiods. Flow management releases may occur if the daily mean discharge falls below the Critical or Rare protected flow magnitudes for longer than its catastrophic duration (DES 2009). No relief flows will be released from Mendums Pond during the Spring Flood bioperiod (March 1 to May 4).[10] For the Clupeid Spawning, GRAF Spawning, and the Rearing and Growth bioperiods (May 5 to October 6), relief flows will be generated by releases from both Mendums Pond and Pawtuckaway Lake. The volume released from each lake will be proportional to its surface area such that each lake has the same change in water level. During the annual fall drawdown, which occurs during the Salmon Spawning bioperiod (October 7 – December 8), the drawdown may be configured as a pulse to support instream flows. No relief flows will be released from Mendums Pond during the Overwintering (December 9 – February 28) and the Spring Flood (March 1 – May 4) bioperiods.

In the event of the need for relief flows from Mendums Pond between May 5 and October 6, the maximum water level drawdown shall not result in a water level decline of more than 18 inches below the spillway crest.

To protect the State-listed threatened Common Loon nesting cycle, no relief flow releases will be applied between May 15 and July 15 that would result in reducing the water level more than six inches when any successful loon nesting is occurring. DES will notify NH Fish and Game, The Loon Preservation Committee of approaching management conditions and request their determination of whether loons are currently actively nesting on the Lake during that period. From July 15 through August 15, DES will consult with NH Fish and Game and The Loon Preservation Committee to determine whether relief flow releases for stream flow protection will affect loon nesting.

Any releases from Mendums Pond Dam will be coordinated with the owner or operator of the Nottingham Pond Dam to ensure that the water released would not be impounded within Nottingham Pond, thereby reducing the effectiveness of the release or negatively impacting hydroelectric power production. The DES Instream Flow Program will also provide the operators of Nottingham Lake Dam with notification 24 hours in advance that a release is to occur and that they are required to pass that release through their dam.

Schedule for Dam Management Plan Implementation

This Dam Management Plan will be put into practice upon adoption of the Lamprey River Water Management Plan.

Estimated Cost of the Implementation of the Dam Management Plan

[10] Minimum flows for the maintenance of downstream flow will be supported during spring refilling.

The specific actions associated with the implementation of the Dam Management Plan for Mendums Pond Dam would include the opening and closing of the outlet gate. This work would require that, at least, one trained DES employee travel to the site to open and then close the gate. These trips are expected to also include management of the Dolloff and Drowns Dams on Pawtuckaway Lake. The estimated costs associated with this work will depend on the number of personnel involved, the number of site visits required to perform the necessary flow management releases, travel time and mileage.

Dam Owner and Contact Information

Owner: New Hampshire Water Division
Address: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
Contact: Mr. James Gallagher
Phone: 603-271-1961
Email: james.gallagher@des.nh.gov

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

References

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/29/03.

Department of Environmental Services (DES) 2009. Final Lamprey Protected Instream Flow Report. Prepared by Normandeau Associates, Inc., Rushing Rivers Institute and the University of New Hampshire. NHDES-R-WD-08-26.

Table 1 – Mendums Pond Dam Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**224.50**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**231.82**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**31**
Freeboard (ft)	**7.3**
Type of spillway controls or outlet works	**Gate**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**265**
Drainage area (sq. miles)	**6.97**
Maximum storage (ac-ft)	**3330**
Normal or permanent storage (ac-ft)	**1960**
Total discharge capacity (cfs)	**1890**
Maximum unoperated discharge (cfs)	**1600**
Design storm discharge (cfs)	**NA**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**330**

Source of information: DES Dam Bureau, NHDAMS Data Sheet for Dam #184.01.

Note:

NA – not available from NH Dams Data Sheet

Table 2 – Mendums Pond flow releases supporting 90 percent of the historical 30-year Protected Instream Flow deficits (1976-2005) and the calculated changes in water level from full pool.

Bioperiod name	Period	Volume needed to meet 90% of historical deficits (ac-ft)	Volume needed to meet 90% of historical deficits with 20% buffer (ac-ft)	Two-day flow release contribution from Mendums (cfs) [25.3%]	Change in water level from full pool using releases that meet 90% of historical deficits w/ 20% buffer (feet)	Water source
Overwintering	Dec 9 – Feb 28	216	259	*-	-	Mendums Pond not used.
Spring Flood	Mar 1 – May 4	-	-	-	-	No active management planned
Clupeid Spawning	May 5 – Jun 19	118	142	9.1	0.14	from storage and drawdown
GRAF Spawning	Jun 20 – Jul 4	20	24	1.5	0.02	from storage and drawdown
Rearing &Growth	Jul 5 – Oct 6	47	56	3.5	0.05	from storage and drawdown
Salmon Spawning	Oct 7 – Dec 8	75	90	5.8	Occurs during annual 7 ft drawdown	From annual fall 7-foot drawdown

Mendums	265	Acres at full recreational pool [25.3% of combined Mendums and Pawtuckaway surface areas]
Pawtuckaway	783	Acres at full recreational pool [74.7% of combined Mendums and Pawtuckaway surface areas]

* Overwintering release is from Pawtuckaway Lake only.

DAM MANAGEMENT PLAN

North River Pond Dam (State Dam ID #184.05)

Figure 1 – North River Pond Dam and outlet structure, photos taken August 2005.

Introduction

North River Pond Dam (lat. 43° 11’ 33”, long. -71° 07’ 54”) is located on the North River off of North River Lake Road in Nottingham, New Hampshire. The North River flows southeast and joins the Lamprey River immediately upstream of the start of the Designated River. North River Pond Dam is approximately 15 miles above the start of the Designated River. The dam is owned by the State of New Hampshire Water Division (see contact information). The dam is active and its use is for recreation.

Dam Design

The original construction date of the North River Pond Dam is unavailable, but it last underwent reconstruction in 1973. The dam is constructed of concrete and earth materials and has a concrete outlet structure that includes slots for wooden stop logs (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau, which is the dam owner and operator. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the owner there are no minimum flows, flowage rights or contractual obligations.

Riparian Property Obligations or Agreements

According to the owner there are no written or otherwise documented agreements. Although, historically there has been a practice of management for recreation benefiting abutting littoral/riparian landowners.

Water Quality Requirements or Limits

According to the owner there are no site specific water quality requirements or limits associated with this dam.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for North River Pond Dam is 358 acre-feet (ac-ft), while its permanent storage volume is 106 ac-ft. When compared with the other dams in this Water Management Planning Area, the permanent storage volume of North River Pond Dam is relatively low. In addition, the contributing drainage area is 1.32 sq miles, which due to its modest size would require significant runoff to recover water levels in the impoundment following a flow release. Therefore, the water available from this dam for flow management is also considered to be low.

Potential Impacts of Flow Management

There are some forested and scrub-shrub wetland areas within the impoundment area, but their extent is limited. Therefore, inundation of these areas by the storage of water for flow management on the Lamprey Designated River should have little impact. However, there are several mapped riparian wetland areas and ponded areas located along the North River downstream of the dam. Their presence could reduce the effectiveness of any flow released from North River Pond Dam by temporarily storing the released water. Insufficient information is available to determine the amount of water that could be stored by the wetland areas and the resulting impacts on any flow management actions.

Managing water levels on North River Pond for flow management could also potentially affect neighboring residential properties as well as recreation opportunities on the Pond.

Potential for Dam Management to Meet Instream Flow Requirements

The overall potential for using the North River Pond Dam for flow management to maintain the instream flow requirements on the Lamprey Designated River is low. Factors considered favorable for the use of the North River Pond Dam for flow management on the Lamprey Designated River include an existing outlet structure that can be used to regulate dam releases. Factors considered unfavorable for flow management include: the distance from the dam to the Designated River (15 miles); the number of ponds and wetlands located along the North River that could reduce the effectiveness of any dam releases; the small size of the contributing drainage area would suggest a long period of time to recover from significant drawdowns; and, managing water levels could effect shoreland properties and recreation on North River Pond.

Dam Management Activity

No dam management activity is required at this time.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for North River Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: New Hampshire Water Division
Address: P.O. Box 95, 29 Hazen Drive, Concord, NH 03302-0095
Contact: Mr. James Gallagher
Phone: 603-271-1961
Email: james.gallagher@des.nh.gov

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – North River Pond Dam Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**200.75**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**196.76**
Height of the dam (ft) from toe to the highest point on the dam	**8**
Freeboard (ft)	**3**
Type of spillway controls or outlet works	**Stop Logs**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**80**
Drainage area (sq. miles)	**1.32**
Maximum storage (ac-ft)	**358**
Normal or permanent storage (ac-ft)	**106**
Total discharge capacity (cfs)	**1,012**
Maximum unoperated discharge (cfs)	**743**
Design storm discharge (cfs)	**75**
Estimated 50-year flood flow (cfs)	**75**
Estimated 100-year flood flow (cfs)	**404**

Source of information: DES Dam Bureau, NH Dam Data Sheet for Dam #184.05 and Dam #184.05 Operation & Maintenance Plan.

Note:

NA – not available from NH Dams Data Sheet.

DAM MANAGEMENT PLAN

Nottingham Lake Dam (State Dam ID #184.08)

Figure 1 – Nottingham Lake Dam and outlet structure, photo taken April 2009.

Introduction

The Nottingham Lake Dam (lat. 43° 7’ 11”, long. -71° 03’ 03”) is located on the Little River off of Mill Pond Road in Nottingham, New Hampshire. The Little River flows south and then east to join the Lamprey River in the upper half of the Designated River between Tuttle Road and Lee Hook Road in Lee, New Hampshire. Nottingham Lake Dam is approximately 3.5 miles upstream of the confluence of the Little River with the Lamprey Designated River. The dam is privately owned (see contact information), is considered active and is used for recreation. In addition, the dam is used for the production of hydroelectricity. The power plant includes two 6 kilowatt turbines with a maximum capacity of 12 KW, which is net metered into the local electrical grid.

Dam Design

The original construction date is unavailable. The dam was breached during a flood in April 2007 and rebuilt in 2008, and the lake was refilled in the spring of 2009. The dam is constructed of concrete and earth materials and has a concrete outlet structure (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

The manager of the dam indicated that they have flowage rights over private land, but no minimum flow or contractual obligations. For the production of hydroelectricity, the average operating head is 10 feet above the intake and the minimum necessary operating flow is 8.83 cubic feet per second (cfs), based on the specifications of turbine manufacturer. Stoplogs can be placed in the primary spillway to raise the water elevation for power production at low flows, but, typically, the water levels are not actively managed for power production.

Riparian Property Obligations or Agreements

There is in informal understanding with riparian property owners, but there is no written agreement.

Water Quality Requirements or Limits

The manager of the dam indicated that there are no site specific water quality requirements or limits associated with the dam.

Assessment of Potential Water Availability

Information provided to DES by the owner on the reconstructed dam indicates that the maximum storage volume for Nottingham Lake Dam is 265.9 acre-feet (ac-ft), while its permanent storage volume is 172.3 ac-ft. The water level in the impoundment and its volume can be controlled by stoplogs placed in the primary spillway and by the opening of a sluice gate used to drain the lake. The contributing drainage area is 14.6 square miles in size. When compared with the other dams in this Water Management Planning Area, the potentially available volume of Nottingham Lake Dam is moderate, while the size of its contributing area is relatively high.

Potential Impacts of Storage and Relief Flows

There are some mapped wetlands both bordering the lake and along the Little River downstream of the dam, but their extent is limited. Therefore, the impacts due to any flow management actions should also be limited.

Residential development borders the east and west shoreline of the lake. Although there is no written agreement there is an informal understanding between these landowners and the dam owner that water levels will be managed to limit the potential for flooding and to support water recreation (boating, fishing and swimming). There is no public access. The increase or decrease in water levels resulting from any flow management activities would need to support recreational use of the lake and should not should not unduly impact riparian landowners. Nottingham Lake Dam is used for the generation of hydroelectricity. According to the operator, electricity is typically produced during periods of spring runoff and summer storm events when there is sufficient hydraulic head to run the turbines. The electricity produced by

the turbines is used on site or distributed to the power grid. The owner of the dam has an agreement with the local electric utility for net metering of the surplus power.

Potential for Dam Management to Meet Instream Flow Requirements

The potential for operation of Nottingham Lake Dam to manage instream flows is moderate. Factors considered favorable for the use of Nottingham Lake Dam include the large volume of water between the impoundment's normal and maximum storage pools and an existing outlet structure that could be used to regulate dam releases.

Factors considered unfavorable for flow management include the use of the dam for hydroelectric production, and the potential impact that managing water levels could have on shoreline residential properties and recreational opportunities on Nottingham Lake.

Dam Management Activity

Nottingham Lake Dam will continue to be operated as a run-of-river hydroelectric facility and its use will be expanded to include instream flow. The required actions for the Affected Dam Owner are to ensure that relief flow resulting from dam management actions taken upstream of Nottingham Lake Dam at Mendums Pond Dam are conveyed through Nottingham Lake with minimal attenuation downstream of the dam. At the same time, operation of the dam under these provisions will not impact the hydroelectric operations of the dam

The Affected Dam Owner may use the relief flow released from Mendums Pond to generate power so long as they continue to pass inflow and meet Surface Water Quality Standards. DES is the owner and operator of the Mendums Pond dam and will contact the owner of the Nottingham Lake Dam through the contact information in this document when an instream flow relief event is imminent. The notification will be by phone and email at least 24 hours in advance of the intended relief flow release. The Affected Dam Owner will confirm receipt of this notification by phone or email. The owner will then operate Nottingham Lake Dam to pass the flow release volume downstream with the attenuation of flow.

Recordkeeping

Recordkeeping by Affected Water Users and Affected Dam Owners shall include documentation of the actions and the dates and times that management actions were taken to meet their Water Management Plans. This documentation shall include records of conditions affected by the management activities, including but not limited to changes in dam gate conditions, number of stoplogs in place, static water levels in impoundments, and pumping rates. From time to time, DES will conduct audits of the management activities taken by the Affected Water Users and Affected Dam Owners in response to protected stream flow conditions. These records will be retained and made available to DES on request. DES recommends, but does not require, that Affected Water Users and Affected Dam Owners create and retain documentation of the costs associated exclusively with water management activities defined by their Water Management Plans.

Schedule for Dam Management Plan Implementation

This Dam Management Plan will be put into practice upon adoption of the Lamprey Water Management Plan. Any additional coordination between DES and the Affected Dam Owner that is needed to implement the Dam Management Plan should be completed within one year of the adoption of the Lamprey River Water Management Plan. Any of the parties, the dam owner, dam operator or DES, may begin discussions with the other parties concerning activities or responsibilities under this Dam Management Plan within that year or afterwards.

Documentation of the operation plan during a release from Mendums Pond will be posted at the Nottingham Lake Dam facility. Operators of the Nottingham Lake Dam facility will read and sign an acknowledgement of receipt, understanding of the plan, and agreement to operate under this plan.

Estimated Cost of the Implementation of the Dam Management Plan

There are no significant costs associated with the development of the notification agreement.

Dam Owner and Contact Information

Owner: Mill Pond View LLC
Address: 224 Mill Pond Road, Nottingham, NH 03290
Contact: Mr. Lawrence P. Costa
Phone: 207-364-5866
Email: larrycosta@att.net

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Nottingham Lake Dam Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**143.9**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**144.4**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**133.6**
Height of the dam (ft) from toe to the highest point on the dam	**15**
Freeboard (ft)	**1.3**
Type of spillway controls or outlet works	**Gate**
Dimensions of spillway controls or outlet works	**2.5 ft x 2.5 ft**
Surface area (ac) of impoundment at maximum impoundment	**41**
Drainage area (sq. miles)	**14.6**
Maximum storage (ac-ft)	**266**
Normal or permanent storage (ac-ft)	**172**
Total discharge capacity (cfs)	**3,099**
Maximum unoperated discharge (cfs)	**2,316**
Design storm discharge (cfs)	**1,174**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**1174**

Source of information: Application to Construct or Reconstruct a Dam submitted by Mill Pond View, LLC to NH Dam Bureau and from owner.

Note:

NA – information not available from application.

DAM MANAGEMENT PLAN

Onway Lake Dam (State Dam ID #201.01)

Figure 1 – Onway Lake Dam, photo taken October 2, 2007.

Introduction

Onway Lake Dam (lat. 43° 02’ 04”, long. -71° 12’ 57”) is located on an unnamed tributary to the Lamprey River in Raymond, New Hampshire, approximately 19 miles upstream of the start of the Designated River. This dam is privately owned (see contact information) and actively managed for recreation.

Dam Design

The dam was constructed in 1915. The dam consists of a concrete and stone structure, which has slots for wooden stop logs (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the owner, there are no flowage requirements or rights.

Riparian Property Obligations or Agreements

According to the owner, there are no riparian property obligations or agreements.

Water Quality Requirements or Limits

According to the owner, there are no site specific water quality requirements or limits associated with this dam.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Onway Lake Dam is 881 acre-feet (ac-ft), while its permanent storage volume is 305 ac-ft, for a difference of 576 ac-ft (25 million cu. ft. or 190 million gallons). The contributing drainage area is 8.45 square miles. When compared with the other dams in this Water Management Planning Area, the potentially available volume of Onway Lake Dam and its contributing drainage area are relatively high. However, Onway Lake represents only 15% of the combined surface areas relative to the combined area with Pawtuckaway Lake and Mendums Pond, the two impoundments with high potential for dam management. Mendums Pond surface area is one and a half times and Pawtuckaway Lake, four times the size of Onway Lake.

Water levels in Onway Lake are managed on a seasonal basis. Starting in mid-October water levels are drawn down a maximum of three feet by removing stop logs from the dam. As a result, during the annual fall drawdown, approximately 250 ac-ft (80 million gallons) of water is released from the dam and into the drainage of the Lamprey River. During the spring (mid-April) water levels are monitored and following spring runoff the stop logs are replaced and the lake refilled.

Potential Impacts of Storage and Release of Relief Flows

Mapped wetlands are located within the impoundment storage area along the western part of Onway Lake. The inundation of these areas by the storage of additional water or the drawdown in water levels in these wetlands in response to a dam release could negatively impact them. Extensive wetland areas are also located along the outlet stream corridor and they could reduce the effectiveness of flows released from the dam.

Residential development is present along the northeast shoreline of Onway Lake and a four-season resort is located along the southern part of the lake. The water levels in the lake are managed for recreation which could be impacts by appreciably lowering the water surface of the lake.

An assessment of the water level changes that might occur under a relief flow release as part of a dam management action showed that the water level changes in Onway Lake would be small, especially if releases were in combination with Pawtuckaway Lake and Mendums Pond. See Table 3 – Water Level Change on Onway Lake, Mendums Pond, and Pawtuckaway Lake with Flow Management. The maximum annual water level change if Onway Lake were to

provide the entire relief flow would be 2.98 feet. (Assumes that one management event will occur during each bioperiod except the Spring Flood bioperiod.) A more likely scenario would be water releases from Onway Lake in combination with releases from Mendums Pond and Pawtuckaway Lake. The releases would be prorated based on their surface areas. With the combined effect of the three lakes, the annual water level change would be 0.46 feet. Winter releases solely from Pawtuckaway are anticipated that would make the annual change in Freeses Pond 0.25 feet.

Potential for Dam Management to Support Instream Flow Requirements

The overall potential for using Onway Lake Dam for flow management to support the instream flow requirements on the Lamprey Designated River is considered to be moderate. Factors considered favorable for the use of Onway Lake Dam for flow management include the large amount of water potentially available from the lake and an existing outlet structure that can be used to regulate dam releases.

Factors considered unfavorable for flow management include the dam's location 19 miles above the start of the Lamprey Designated River, the potential impact to wetlands around the lake, and the potential impact to neighboring properties and recreation.

Dam Management Activity

Since the potential for its use for flow management on the Lamprey Designated River is only considered moderate, no dam management activity is required at this time. Onway Lake represents the first alternate should a contingency be needed.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Onway Lake Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: J & D Realty Trust
Address: P.O. Box 779, Raymond, NH 03077
Contact(s): Mr. John Tracy or Mr. David Zaloga
Phone: 603-895-2165 (Tracy) or 603-895-2165 (Zaloga)
Email: None provided

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Onway Lake Dam Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**8.5**
Freeboard (ft)	**3**
Type of spillway controls or outlet works	**Stop Logs**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**192**
Drainage area (sq. miles)	**8.45**
Maximum storage (ac-ft)	**881**
Normal or permanent storage (ac-ft)	**305**
Total discharge capacity (cfs)	**352**
Maximum unoperated discharge (cfs)	**233**
Design storm discharge (cfs)	**187**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**NA**

Source of information: DES Dam Bureau, NH Dam Data Sheet for Dam #201.01.
Note: NA – not available from NH Dams Data Sheet.

Table 2 – Onway Lake relative to Mendums Pond and Pawtuckaway Lake.

	Acres of surface area	% of combined surface area	Size relative to Onway Pond's surface area
Mendums Pond	265	21.4%	1.4
Pawtuckaway Lake	783	63.1%	4.1
Onway Pond	192	15.5%	1.0
Sum	1240	100.0%	

Table 3 – Water Level Change on Onway Lake, Mendums Pond and Pawtuckaway Lake with Flow Management.

Bioperiod name	Period	Release volume - 90% coverage with 20% buffer (ac-ft)*	Release volume (cubic feet)	Drawdown using Onway Lake only (feet)	Drawdown using Onway Lake with Pawtuckaway and Mendums (prorated by area) (feet)
Overwintering *	Dec 9 – Feb 28	259	11,290,752	1.35	0.21
Spring Flood	Mar 1 – May 4	-			
Clupeid Spawning	May 5 – Jun 19	142	6,168,096	0.74	0.11
GRAF Spawning	Jun 20 – Jul 4	24	1,045,440	0.13	0.02
R&G	Jul 5 – Oct 6	56	2,456,784	0.29	0.05
Salmon Spawning	Oct 7 – Dec 8	90	3,920,400	0.47	0.07
			Sum	2.98	0.46

*** Volume for a dam release that meets 90% of the historical (1976-2005) deficits of catastrophic and persistent low-flow events to which has been added a buffer of 20% as a contingency to account for unforeseen losses.**

DAM MANAGEMENT PLAN

Piscassic Ice Pond Dam (State Dam ID #171.01)

Figure 1 – Piscassic Ice Pond Dam, photos taken October 3, 2007.

Introduction

Piscassic Ice Pond Dam (lat. 43° 02’ 02”, long. -70° 58’ 06”) is located on the Piscassic River approximately six miles upstream of the Lamprey Designated River and is crossed by Route 87 in Newfields, New Hampshire. This dam is privately owned (see contact information), is active and its use is for recreation.

Dam Design

The dam was constructed in 1939 and rebuilt in 1987. The dam consists of a concrete structure, which has slots for wooden stop logs (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the owner there are deeded flowage rights.

Riparian Property Obligations or Agreements

There are no riparian property obligations or agreements, although the owner maintains the pond water level at 21 inches during the summer so the neighbors can use the pond to water their gardens.

Water Quality Requirements or Limits

According to the owner there are no water quality requirements or limits.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Piscassic Ice Pond Dam is 109 acre-feet (ac-ft), while its permanent storage volume is 27 ac-ft, for a difference of 82 ac-ft (3.6 million cu. ft. or 27 million gallons). The size of its contributing drainage area is 4.24 square miles. When compared to other dams in this Water Management Planning Area, both the permanent storage volume and contributing drainage area associated with Piscassic Ice Pond Dam are low. Therefore, the water available from this dam for flow management is also considered to be low.

Potential Impacts of Storage and Release of Relief Flows

Extensive, palustrine, scrub-shrub, emergent and forested wetlands are mapped upstream of the dam and within the impoundment storage area. The inundation of these areas by the storage of water or the lowering of water levels during dam releases could affect these wetlands. Downstream of the dam along the Piscassic River are a number of ponds and extensive wetland areas, which could reduce the effectiveness of any flow released from the dam by temporarily storing the released water. Insufficient information is available to determine the amount of water that could be stored by the wetland areas and the resulting impacts on any flow management actions.

Potential for Dam Management to Support Instream Flow Requirements

Flow released from Piscassic Ice Pond Dam would be conveyed via the Piscassic River to the impoundment at the end of the Designated River. Therefore, flow released from Piscassic Ice Pond would have no effect on stream flow. As a result, flow management of the Piscassic Ice Pond Dam would not support instream flow requirements and for this reason it should not be considered as an option for storage or release of relief flows under the Water Management Plan.

Dam Management Activity

No dam management activity is required at this time.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Piscassic Ice Pond Dam, there is no proposed implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: Mr. Gilbert Lang
Address: Langs Lane, Newmarket, NH 03857
Phone: 603-659-2256
Email: None provided

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Piscassic Ice Pond Dam Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**12**
Freeboard (ft)	**6**
Type of spillway controls or outlet works	**Stop Logs**
Dimensions of spillway controls or outlet works	**4 ft by 2 ft**
Surface area (ac) of impoundment at maximum impoundment	**13.7**
Drainage area (sq. miles)	**4.24**
Maximum storage (ac-ft)	**109**
Normal or permanent storage (ac-ft)	**27**
Total discharge capacity (cfs)	**NA**
Maximum unoperated discharge (cfs)	**540**
Design storm discharge (cfs)	**NA**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**NA**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #171.01.

Note:

NA: not available from NH Dams Data Sheet

DAM MANAGEMENT PLAN

Socha Dam (State Dam ID #037.03)

Figure 1 – Socha dam and spillway, photos provided by DES Dam Bureau.

Introduction

The Socha Dam (lat. 43° 04’ 40”, long. -71° 18’ 52”) is located on a tributary of the North Branch River in Candia, New Hampshire, approximately 26 miles upstream of the start of the Lamprey Designated River. This dam is privately owned (see contact information), the property is posted and there is no public access. The dam is actively used for recreation.

Dam Design

The dam was last reconstructed in 1980 and it consists of an earth and concrete structure and an uncontrolled spillway (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

Dam owner did not respond to requests for information on whether there are any minimum flows, flowage rights or contractual obligations associated with this dam.

Riparian Property Obligations or Agreements

Dam owner did not respond to requests for information on whether there are any riparian property obligations or agreements associated with this dam.

Water Quality Requirements or Limits

Dam owner did not respond to requests for information on whether there are any water quality requirements or limits associated with this dam.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Socha Dam is 90 acre-feet (ac-ft), while its permanent storage volume is 45 ac-ft, for a difference of 45 ac-ft (2.0 million cu. ft. or 15 million gallons). The drainage area contributing runoff to this dam is 4.35 square miles. When compared to other dams in this Water Management Planning Area, both the permanent storage volume and the contributing drainage area associated with Socha Dam are low. Therefore, the water available from this dam for flow management is also considered to be low.

Potential Impacts of Storage and Release of Relief Flows

There are no mapped wetland areas within the impoundment of Socha Dam, so inundation of by the storage of water or water level reduction is unlikely to impact fringing wetland habitats. However, immediately below the dam there is a large wetland complex that could reduce the effectiveness of any flow released from Socha Dam by temporarily storing it. Insufficient information is available to determine the amount of water that could be stored by the wetland areas and the resulting impacts on any flow management actions.

Potential for Dam Management to Support Instream Flow Requirements

Factors favoring the consideration of the Socha Dam for the storage and release of water for flow management on the Designated Lamprey River are limited. The dam is located in the headwaters of the North Branch River, which is a major tributary to the Designated Lamprey River and would provide minor relief during periods of low flow.

Limiting factors include: the private ownership of the dam; the need to retrofit the dam to allow for controlled releases; the presence of a large wetland complex immediately downstream which could potentially temporarily store water released from the dam; and the small volume of water potentially available for flow management.

Dam Management Activity

Due to the significant limiting factors associated with this dam, no dam management activity is required at this time.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Socha Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: Ms. Marie Socha
Address: 547 Londonderry Turnpike, Auburn, NH 03032-1602
Phone: 603-627-8993
Email: Not available

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 - Socha Dam Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**6.0**
Freeboard (ft)	**1.5**
Type of spillway controls or outlet works	**None**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**30**
Drainage area (sq. miles)	**4.35**
Maximum storage (ac-ft)	**90**
Normal or permanent storage (ac-ft)	**45**
Total discharge capacity (cfs)	**437**
Maximum unoperated discharge (cfs)	**437**
Design storm discharge (cfs)	**1,139**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**NA**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #037.03.

Note:

NA – not available from NH Dams Data Sheet.

DAM MANAGEMENT PLAN

Thurston Pond Dam (State ID #061.18)

Figure 1 – Thurston Pond Dam, photos taken October 2, 2007.

Introduction

Thurston Pond Dam (lat. 43° 08’ 22”, long. -71° 17’ 59”) is located in Deerfield, New Hampshire, on an unnamed tributary to Hartford Brook, which is a tributary to the Lamprey River, approximately 30 miles upstream of the start of the Lamprey Designated River. The dam is owned by the Town of Deerfield and managed by the Deerfield Water Commission (see contact information). The dam is active and its use is for recreation.

Dam Design

The dam was constructed in 1772 and permitted in 1999. The dam consists of an earth embankment and a stone outlet structure. A large beaver dam blocks the outlet structure and controls the water level in the pond (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04 on the characteristics of the dam is summarized in Table 1.

Protected Flow, Flowage Rights or Contractual Obligations

According to the owner, there are no flowage requirements or rights.

Riparian Property Obligations or Agreements

According to the owner, there are no riparian property obligations or agreements.

Water Quality Requirements or Limits

According to the owner there, are no water quality requirements or limits.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Thurston Pond Dam is 43 acre-feet (ac-ft), while its permanent storage volume is 6 ac-ft, for a difference of 37 ac-ft (1.6 million cu. ft. or 12 million gallons). When compared with the other dams in this Water Management Planning Area, the permanent storage volume of Thurston Pond Dam falls is small. In addition, its drainage area, 1.27 square miles is also small, which would limit recharge to the pond during periods of below normal precipitation.

Potential Impacts of Storage and Release of Relief Flows

Upstream of the dam and within the impoundment are extensive mapped wetlands. The inundation of this area by the storage and release of water for flow management could affect the existing wetlands. There are several mapped riparian wetland areas downstream of the dam, which could attenuate any flow released from Thurston Pond Dam by storing water temporarily and reduce the effectiveness of the release. Insufficient information is available to quantify the resulting impacts on any flow management actions.

Potential for Dam Management to Meet Instream Flow Requirements

The potential for using Thurston Pond Dam for flow management on the Lamprey Designated River is considered low due to the following: its long distance (30 miles) upstream of the start of the Lamprey Designated River; its small permanent storage volume and contributing drainage area;, the lack of a functioning outlet structure that will allow for the controlled release of water from the dam; the presence of wetlands bordering the impoundment that would be impacted by the storage and subsequent withdrawal of water; and the potential storage effects of wetlands below the dam.

Dam Management Activity

Since the potential for its use for flow management on the Lamprey Designated River is considered low, no dam management activity is required at this time.

Schedule for Dam Management Plan Implementation

Since no dam management activity is currently required for Thurston Pond Dam, there is no implementation schedule.

Estimated Cost of the Implementation of the Dam Management Plan

Since no dam management activity is currently required, there are no costs.

Dam Owner and Contact Information

Owner: Town of Deerfield
Address: P.O. Box 159, Deerfield, NH 03037

Contact: Mr. John Dubiansky, Chairman, Deerfield Water Commission
Phone: 603-463-8811
Email: None provided

Conversion Factors for Volume and Flow Units			
1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	cfs =	448.86	gpm
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

Table 1 – Thurston Pond Dam Characteristics.

Elevation (ft) of recreation pool or height relative to lowest spillway	**NA**
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**NA**
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**NA**
Height of the dam (ft) from toe to the highest point on the dam	**9**
Freeboard (ft)	**1**
Type of spillway controls or outlet works	**None**
Dimensions of spillway controls or outlet works	**NA**
Surface area (ac) of impoundment at maximum impoundment	**13.5**
Drainage area (sq. miles)	**1.27**
Maximum storage (ac-ft)	**43**
Normal or permanent storage (ac-ft)	**6**
Total discharge capacity (cfs)	**230**
Maximum unoperated discharge (cfs)	**230**
Design storm discharge (cfs)	**230**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**NA**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #061.18.
Note:

NA – not available from NH Dams Data Sheet.

DAM MANAGEMENT PLAN

Wiswall Dam (State Dam ID #071.04)

Figure 1 – Wiswall Dam, photo taken May 13, 2013.

Introduction

Wiswall Dam (lat. 43° 06’ 14”, long. -70° 57’ 48”) is located on the Lamprey River, immediately downstream of the Wiswall Road bridge crossing in Durham, New Hampshire. The dam is located on the Lamprey Designated River and is approximately three miles upstream of the end of the Designated River. This dam is owned by the Town of Durham (see contact information), is active, and its primary use is identified as recreation. However, it was evaluated for removal in recent years and retained chiefly for its role is to impound the Wiswall Reservoir, which is one of the water supplies for the University of New Hampshire/Town of Durham Water System (UDWS). The UDWS maintains a pump station upstream of the dam which was constructed in 1970 for the purpose of withdrawing drinking water.

Dam Design

The dam was constructed in 1911. The dam consists of a concrete structure, and has a gated spillway, which can be manually used to regulate water levels in the Wiswall Reservoir (Figure 1). Details on the design and operation of the dam were obtained from the records of the Department of Environmental Services (DES) Dam Bureau and from the dam owner. The information required by Env-Wq 1906.04

describing the characteristics of the dam is summarized in Table 1. A final decision to install a fish ladder and flow structure for outlet migration at the dam was made in 2008. Construction began during the summer of 2011 and completed in late 2011. The construction and repairs on Wiswall Dam adds several functioning mechanisms for managing stream flow. The fish ladder has an operable weir gate and an outlet structure that includes stoplogs on the opposite side of the dam to provide for downstream fish migration. The repairs include replacement of the two low level gate structures.

Minimum Flow, Flowage Rights or Contractual Obligations

The conditions of 401 Water Quality Certification #2001-001 apply to management of this dam in concert with the operation of UDWS's Lamprey River water withdrawal (Water User ID #20066-S02.) A specific right to the use of waters from the Lamprey River was granted to the Town of Durham by the New Hampshire legislature in Chapter 332 of the Laws of 1965. Under this law Durham was granted the right to divert waters from the Lamprey River and it has flowage rights in the Town of Lee to the extent necessary to maintain the dam at Wiswall Falls. The Town of Durham has identified Wiswall Reservoir as one of UDWS's primary drinking water sources. The installation of manual staff gages near the Wiswall Dam and an instrumented water level transducer near the UDWS's pump station was completed in 2011 to record real-time stage elevation and transmit real-time data to the UDWS Water Treatment Plant operator.

Riparian Property Obligations or Agreements

Chapter 332 of the Laws of 1965 dictates that the use of water by the Town of Durham cannot lower the water level upstream from the so-called Hook Island Falls in Lee or result in the breaching of the Hook Island Falls.

Assessment of Potential Water Availability

DES Dam Bureau files show the maximum storage volume for Wiswall Dam is 500 acre-feet (ac-ft), while its permanent storage volume is 360 ac-ft. Durham Public Works estimated the volume in gallons in the top 18 inches of the Wiswall Reservoir as:

0 to 6" -	7,137,266 gallons	= 954,052 cubic feet	= 21.9 acre-ft
0 to 12" -	12,142,211 gallons	= 1,623,290 cubic feet	= 37.3 acre-ft
0 to 18" -	17,037,153 gallons	= 2,277,390 cubic feet	= 52.3 acre-ft

The drainage area upstream of the dam is 183 square miles, which provides considerable runoff potential for refilling the Wiswall Reservoir following a rain event.

Potential Impacts of Storage and Relief Flows

Use of the Wiswall Reservoir for providing relief flows was evaluated with respect to other existing uses. The Wiswall Dam and Reservoir provide for recreation in addition to water supply storage. Boating, fishing and swimming are commonly observed recreational activities in the Wiswall Reservoir. If Wiswall Reservoir were used as a source of water for a downstream flow relief pulse, lowering of the water level should have little impact on the recreational activities unless the water level is lowered by several feet.

There are mapped wetlands within the Wiswall Reservoir and they could be impacted by either rapid declines in water levels or by prolonged or recurrent periods of below normal water levels.

As previously mentioned, the Wiswall Reservoir is used as a water supply by UDWS. Releasing water from this dam would affect the storage available to the UDWS. As a result, this Dam Management Plan must be coordinated with the Water Use Plan developed for the UDWS withdrawal from the Wiswall Reservoir (#20066-S02).

Potential for Dam Management to Meet Instream Flow Requirements

The overall potential for this dam for flow management of the Lamprey Designated River is considered to be low due to its location, upstream of only the last three miles of the Designated River. A relief pulse release from the Wiswall Reservoir would also result in loss of storage affecting its use as a water supply source for UDWS. Releases from the dam for the protection of instream flows would reduce the water available for use as source of water for UDWS without improving flow conditions in the upper parts of the Designated River.

Wiswall Dam has a potential to impact protected flows needed to maintain stream flow downstream. The volume of the impoundment creates a potential for attenuation of a relief flow release such that the target flow may not be met. Depending on the magnitude of the required relief flow and the reservoir stage elevation relative to the dam's spillway crest at a given time, the dam may need to be operated under this Dam Management Plan to attain the desired downstream relief flow.

Dam Management Activity

Dam management activities are expected to occur on a frequency from as little as none per year to one or more events per bioperiod in five of the six bioperiods. The Spring Flood bioperiod will not be managed under the Lamprey Dam Management Plan.

Because the dam impounds Wiswall Reservoir, this Dam Management Plan is integrally tied to the use of Wiswall Reservoir by UDWS as a water supply. This water supply (Water User ID 20066-S02) has conditions described under the UDWS Water Use Plan for the Lamprey River withdrawal. The Dam Management Plan activities in this sub-plan must be implemented in concert with the UDWS Water Use Plan. The general components of the dam management activities include:

1. At all times, when the flow at the USGS Lamprey near Newmarket gage is less than 16 cfs, the Town of Durham will operate the dam to ensure that downstream flow is maintained at a discharge effectively equal to inflow to the greatest extent practicable. Operation of outflow using stoplogs may include use of modified stoplogs calibrated to release of partial flows as alternatives to removing/replacing whole stoplog increments. Modifying stoplogs may be accomplished by means of notching or boring the stoplogs. Coordination with the UNH/Durham Water System may be required to meet this objective.

2. The Town of Durham will monitor and record flow and dam operational conditions and any other information necessary to determine relative outflow and inflow measurements whenever daily stream flow is equal or less than 16 cfs at the USGS gage Lamprey River Near Newmarket, NH, to the highest practicable accuracy. Flow measurements or height of the stage elevation relative to the spillway crest or other outlet structures will be measured on a frequency of at least once every hour until daily average stream flow exceeds 18 cfs from a natural storm event for

two consecutive days. The University's existing water level data recorder in Wiswall Reservoir has been identified as a means to make hourly measurements to calculate inflow. The logger records hourly water levels in Wiswall Reservoir. If the data logger fails, then Town of Durham will make manual measurements of water level at a minimum of once every four hours. The Town of Durham will also record the dam's current outflow structure conditions and any changes made to the gate position or other criteria defining the outflow. Measurements and results of calculations will be provided to DES upon request.

3. When protected flow conditions are not met and thereby result in catastrophic conditions, DES may release periodic relief flows from impoundments upstream of the Wiswall Reservoir. A relief flow release may start the day before flow conditions are expected to exceed the catastrophic conditions. When a relief flow release event is scheduled, DES will notify the Town of Durham contact identified in this document. The Town of Durham will provide an alternate or emergency contact person to the DES Instream Flow Program upon adoption of this plan. DES's notification will be by phone or email, or both, at least 72 hours in advance of the intended relief flow release. The Town of Durham will confirm receipt of this notification by phone or email within 24 hours unless the notification is received on a Friday or a weekend in which case the acknowledgment will be provide on the following Monday.

4. During a relief flow release conducted under the Lamprey Water Management Plan, the Town of Durham will operate the Wiswall Dam (i.e., open gates or remove stop logs in the Wiswall Dam, or other) to maintain outflow from the Wiswall Reservoir effectively equal to inflow.

5. The Town of Durham will maintain the dam's water release mechanism(s) to allow controlled releases of water in the flow ranges of the proposed relief pulses and of inflow rates. Operation of one or more of the dam's outlet structures will be necessary to pass a relief flow pulse if the Wiswall Reservoir stage elevation has been drawn down below the spillway crest. Operation may also be necessary to maintain flow if water withdrawals from storage are or have been occurring. Variability in daily stream flow discharge is expected. If during the relief flow release the Wiswall Reservoir stage elevation is below the spillway crest, operation of the dam outlet will be required and variable rates of discharge may be required. Consequently, operability of some mechanism for flow release must be assured during all but the Spring Flood bioperiod. If Wiswall Dam is passing outflow at least equal to inflow and UDWS is not withdrawing then no operational changes are necessary.

6. The Town of Durham will not at any time except relating to maintenance operations or in the case of a water emergency[11] cause the reservoir water level to fall below 18 inches below the spillway crest, or cause the water level to drop more than one inch per day. Coordination with the UNH/Durham Water System may be required to meet this objective.

7. Refilling of storage in the Wiswall Reservoir will meet the following conditions for downstream flow. No refilling will occur during a relief pulse or when flows are less than 18 cfs at the Lamprey Near Newmarket gage. Once daily average flows from natural recharge events are greater than 18 cfs for two days at the USGS Lamprey near Newmarket gage, storage equivalent to UDWS's withdrawal rate of 2.8 cfs may be used to refill the Wiswall Reservoir, or for water withdrawal, or a combination of the two.

[11] RSA 4:45 and RSA 483:9-c, IV

8. The Town will provide DES with standard operating procedures (SOP) for the operation of the dam under protected flow conditions. UDWS installed a water level gage in the Wiswall Reservoir to provide remote measurements of the reservoir level in order to manage withdrawals according to this plan. UDWS will also develop either a flow measurement at the outlet of the Wiswall Dam or use the USGS Lamprey River near Newmarket gage to provide accurate reservoir outflow data to manage withdrawals. The SOP will describe UDWS's methods for implementing accurate measurements of inflow to the Wiswall Reservoir to determine and meet conditions for Reservoir outflow management.

Schedule for Dam Management Plan Implementation

This Dam Management Plan will be put into practice immediately upon adoption of the Lamprey Water Management Plan.

Estimated Cost of the Implementation of the Dam Management Plan

As discussed and included in the UDWS Lamprey River withdrawal's Water Use Plan, the estimated cost of the installation of the gages for water level and flow monitoring range from $10,000 to $30,000 depending upon the equipment used and the type of installation.

The actions associated with the implementation of the Dam Management Plan for Wiswall Dam include operation of the dam's outlet structures; and monitoring, recording and reporting of water levels, dam release configuration, and flow measurements. Management will be required during relief flow pulse releases and when flows fall below 16 cfs. These latter management activities will be reduced or eliminated by operation of UDWS's other water sources when flows are low as has been UDWS's practice. However, management operations may be required when low flows persist and water withdrawals are made from Wiswall Reservoir's storage to maintain outflow at effectively equal to inflow.

These actions are expected to be performed by Town personnel, however, the town may chose to subcontract the work to consultants or contractors. The estimated annual costs associated with this work will be dependent upon the number of personnel involved; and either the degree of automation of the system or the number of site visits required to perform the necessary flow management actions; plus travel time and mileage. The estimated cost for monitoring, recording and reporting of water levels, dam release configuration and flow measurements for one relief flow event is $2,000 to $5,000 depending on labor rate and hours expended. The total cost involved will be dependent upon the number of relief flow events. Most years will require no management. During the 1960s drought, six management events would have been conducted during the worst year. The majority of durations below 18 cfs lasted less than 10 days.

Dam Owner and Contact Information

Owner: Town of Durham
Address: Public Works Department, 100 Stone Quarry Drive, Durham, NH 03824
Contact: Mr. David Cedarholm, P.E.
Phone: 603-868-5578
Email: dcedarholm@ci.durham.nh.us

Conversion Factors for Volume and Flow Units

1	cubic foot =	7.481	gallons
1	gallon =	0.1337	cubic feet
1	acre-foot =	43,560	cubic feet
1	acre-foot =	325,872	gallons
1	cfs =	448.86	gpm
1	cfs =	646,358.4	gpd
1	cfs =	0.65	MGD
1	gpm =	0.002227866	cfs
1	gpd =	0.00000154713	cfs
1	MGD =	1.5471	cfs

References:

Env-Wq 1900 Rules for the Protection of Instream Flow on Designated Rivers, effective 5/29/03.

Email from David Cedarholm, Town Engineer, Durham to Wayne Ives, NH Instream Flow Specialist, June 29, 2010.

Preliminary Dam Engineering Report, Wiswall Dam, Durham, New Hampshire. Prepared for Department of Public Works, Town of Durham. Prepared by Stephens Associates Consulting Engineers, LLC. Dated December 1, 2006.

Table 1 – Wiswall Dam Characteristics

Elevation (ft) of recreation pool or height relative to lowest spillway	**56.5***
Elevation (ft) of additional spillway crest(s) or height relative to the lowest spillway	**56***
Elevation (ft) of streambed at the dam centerline or the height relative to the lowest spillway	**41***
Height of the dam (ft) from toe to the highest point on the dam	**18**
Freeboard (ft)	**5**
Type of spillway controls or outlet works	**2 Gates Stoplog bay**, Fish ladder gate****
Dimensions of spillway controls or outlet works	**Gates =5 ft x 6 ft* Stoplog Bay = 5 ft x 5 ft Fish ladder gate = 4 ft x 5ft**
Surface area (ac) of impoundment at maximum impoundment	**30**
Drainage area (sq. miles)	**183**
Maximum storage (ac-ft)	**500**
Normal or permanent storage (ac-ft)	**360**
Total discharge capacity (cfs)	**6238**
Maximum unoperated discharge (cfs)	**5216**
Design storm discharge (cfs)	**8210**
Estimated 50-year flood flow (cfs)	**NA**
Estimated 100-year flood flow (cfs)	**8210**

Source of information: DES Dam Bureau, NH Dams Data Sheet for Dam #071.04.
*- Information from Stephens and Associates (2006)
**-Added in 2011

NA – not available from NH Dams Data Sheet.