Appendix D:

Lake Waukewan Notice of Decision –
Final Operating Level

In re: Lake Waukewan Center Harbor, Meredith and New Hampton, NH	**NOTICE OF DECISION FINAL OPERATING LEVEL**

Summary of Decision

The Department of Environmental Services (DES) has completed a Lake Level Investigation into the control of the outlet of Lake Waukewan. The Lake Level Investigation was conducted under the authority of RSA 482:79 and in accordance with Administrative Rule Env-Wr 700 Lake Level Determinations. The Lake Level Investigation included research into topics relevant to the control of the outlet, collaboration with experts, collection of information and opinion from affected parties and other interests, several public forums to gather testimony, analysis of data, and numerous field assessments.

Based on the findings and conclusions of this Lake Level Investigation, as documented in this Notice of Decision, DES has determined that a summer recreational level of 540.0 feet on Lake Waukewan is protective of the ecology of both Lake Waukewan and Lake Winona and strikes a proper balance among the many factors that DES must consider including balancing the interests of those whose use and enjoyment of the lakes are affected by high lake levels, and those whose use and enjoyment are affected by low levels. To protect the habitat and property along the shoreline of both lakes, DES is requiring that the operations of the dam be timely and aggressive so that Lake Waukewan is maintained at as consistent an elevation as possible.

Also, because of the limited discharge capacity of the dam, DES has determined that a fall/winter drawdown is necessary to reduce the frequency and extent of flooding of the shoreline during the high runoff period in the spring, and has determined that the drawdown elevation will be to elevation 538.5 feet. The drawdown will begin on Columbus Day of each year with the goal of refilling Lake Waukewan to its summer level of 540.0 feet by May 15th of each year.

Background

The Lake Waukewan Dam regulates a watershed area of approximately 13 square miles and

impounds a water body of nearly 930 acres. In addition, dam operations and water levels in Lake Waukewan influence the water levels of the 21-acre Snake River wetland, as well as Lake Winona, a 148-acre lake located in the upper portion of the watershed.

Subsequent to a significant rain event in August of 2008, a shorefront resident of Lake Waukewan contacted DES with concerns associated with the high level resulting from the August 2008 event, as well as of persistently high lake levels that had been maintained for prior years. That contact was followed by phone calls to DES from other residents of Lakes Waukewan and Winona, all referring to long-term high lake levels and associated damage to shorelines, shoreline vegetation and shoreline structures. In addition, DES received a letter dated September 30, 2008 from the Lake Winona Improvement Association (LWIA) stating that the water level of Lake Winona has become an increasingly serious concern. According to the letter, the members of LWIA consist of the majority of the approximately 120 lakefront property owners on Lake Winona. The letter stated that the high water level of Lake Winona had become "an increasingly serious concern" and was producing "many adverse impacts throughout the watershed" including:

- "Loss of beach frontage"
- "Structural damage to stone retaining walls, docks, boathouses and beaches"
- "Difficulty placing and maintaining seasonal docks"
- "Damage to the waterfront buffer, including loss of mature trees, saplings, shrubs and ground cover"
- "Loss of property value and useable land to newly 'created' wetlands"
- "Potential negative impact on water quality due to increased silt and nutrients entering the lake"
- "The deterrent to loon nesting around the lake since nesting sites are now usually flooded"
- "Potential increased health risk of mosquito borne diseases (including Triple-E) when standing water that remains after flooding provides additional breeding areas"
- "Ongoing high water conditions [that] compromise the storm water retention capacity of Lake Waukewan, the Snake River, Lake Winona and their associated marshes' ability to mitigate the effects of major storms like the recent flooding rains of August 7, 2008."

The letter stated that the Association voted unanimously "to request that DES investigate and oversee an evaluation of Winona/Waukewan lake levels."

After these complaints were received, DES performed an initial review of its files and held conversations with the owner of the Lake Waukewan Dam (Dam No. 155.01), Hampshire Hospitality Holdings, Inc. (HHH), and representatives from the Town of Meredith. According to information received by DES, the owner and the Town of Meredith were acting jointly in making operating decisions for the dam.

The dam on Lake Waukewan has existed, in one form or another, since the early 1800's. The ability of the dam to discharge water is limited by constrictions associated with its outlet works,

which consist of a penstock, a canal, and a surge tower. Over time, modifications have been made to the outlet works, which have decreased the discharge capacity of the dam. In addition, historical maps indicate that there was an additional outlet to the lake in the area of Corliss Brook, an area now occupied by the Town of Meredith's water treatment facility. Elimination of this spillway has decreased the discharge capacity of the dam even further.

The ownership and management of the dam has been the responsibility of HHH since approximately 1983. Under previous ownership and management, the stored lake waters were used to power and/or to provide water to several manufacturing operations that have occupied the site. Current operations of the dam are performed for lake level management and aesthetics. The dam and its stone-lined discharge flume are located in the midst of a public marketplace/restaurant/hotel complex, and the visual and audible effects of the moving water through the discharge flume provide an enjoyable atmosphere.

Based on the information discovered in its initial file review, as well as information gathered from shorefront property owners, the dam owner and the dam operators, DES determined that a formal Lake Level Investigation should be initiated in accordance with RSA 482:79, Investigation of Levels of Inland Public Waters. Under this statute:

> "The department may, upon its own motion or at the request of the attorney general or upon complaint of not less than 10 owners of property on any inland public water in the state, make a preliminary investigation of conditions affecting the use and enjoyment of any such public water whenever it shall be of the opinion that such investigation would be in the public interest. If, as a result of any such preliminary investigation, it shall appear to the department that the management and control of any outlet of any such public water and the connected instrumentalities are carried on or used in such manner that the value of shore property above or riparian rights below such outlet or the enjoyment of such water by the public is seriously and adversely affected, it may make further investigation with a view to ascertaining the respective rights of all interested parties, including the public. If, as a result of such further investigation after public hearing, the department shall be of the opinion that such management and control is lawful, but that changes in the manner of the exercise of the right of management and control would be of benefit to others without undue injury to the owner of the outlet, it shall direct such changes as in its opinion would be of benefit to the public and private interests concerned."

This Lake Level Investigation was performed in accordance with this statute and in accordance with Administrative Rule Env-Wr 700 Lake Level Determinations.

During the course of the Lake Level Investigation, after recognizing that the proceeding would be a lengthy one, DES determined that establishing an interim operation plan was appropriate to address some of the early findings. The interim operation plan was established in DES's *Notice of Decision Interim Operating Level Lake Waukewan* dated April 12, 2010.

Included in the early findings was information on the historical operation of the dam. Documentation, including maps and reports, indicate that when the dam was owned and operated by the manufacturing facility, the dam was operated to maintain a target lake level at elevation 539.0 feet during the summer, and then draw down the lake level approximately 1½ to 2 feet in the winter to provide storage to reduce the chance of flooding during the spring when inflow to the lake was high due to snowmelt and rain runoff. However, similar records produced after 1983, document a lake level of 540.0 feet under current ownership of the dam, but data indicate that the lake level had been maintained higher than that in recent years, with no seasonal drawdown.

The interim plan, as modified, set an operating level for Lake Waukewan, which was midway between these two past operating levels, at elevation 539.5 feet for the 2010 recreational season and a fall drawdown to elevation 538.5 feet beginning on Columbus Day 2010 and lasting through the spring of 2011. Operation under this interim plan provided the time necessary to gather and examine the additional data needed for a more complete Lake Level Investigation.

For the purpose of the investigation, DES has defined the period of past management and control of the outlet as for the 78 years from 1904 to 1982 (pre-1983) and the period of current management and control of the outlet as for the 26 years from 1983 to 2009 (post-1983). The levels maintained during 2010 were established in the Notice of Decision, issued on April 12, 2010, that set the interim operating plan. The potential summer operating levels evaluated as part of this evaluation range between 539.0 feet (pre-1983 management) and 540.4 feet (recent management). Based on water level data collected during the course of this investigation, Lake Winona is typically 0.2 to 0.5 feet (2.5 to 6 inches) higher than Lake Waukewan under average meteorological conditions. However, beaver dams on the Snake River can cause differences in the elevations of Lake Waukewan and Lake Winona to be greater than 6 inches.

The results of the Lake Level Investigation are provided in the subsequent sections of this decision.

Investigation

Preliminary Investigation Phase

Dam Operations

Based on a review of the available information, DES determined that a change in management and control of the outlet had occurred subsequent to 1983 in conjunction with a change in ownership of the dam. The purpose of the dam prior to 1983 was primarily for mill/industrial use and secondarily the maintenance of the level of Lake Waukewan. After the change in ownership the purpose of the dam operations was to maintain the level of Lake Waukewan and provide a waterfall in the Mill Falls complex for aesthetic purposes. Although a dam controlling the outlet of Lake Waukewan has

been located near the site of the present dam since the early 1800s, limited information was available concerning the specifics of the dam and/or water levels prior to a 1904 court decree establishing water rights for the Lake Waukewan Dam.

A review of DES files for the Lake Waukewan Dam (See Appendix A) indicated pre-1983 management was to maintain a normal elevation of 539.0 feet with a winter drawdown of 15 to 22 inches. A Superior Court decree issued in 1904 requires full opening of a low level gate in the dam when lake levels reach 540.7 feet, but does not provide specific maximum or minimum water levels. Moreover, the low level gate has since been abandoned and is no longer available to discharge water from the dam.

Discussions with HHH and the Town of Meredith Water Department indicated that recent management for Lake Waukewan was to maintain a normal level of at least 540.0 feet or higher with no winter drawdown. The operator indicated that, up until July 7, 2009, the level of the lake was determined using, as a benchmark, a "cold joint" on the slope of the Town of Meredith boat ramp. The cold joint has an elevation of 540.32 feet. After July 7, 2009, the level of the lake was determined by measuring from a bolt installed in a vertical wall near the boat ramp. The elevation of this benchmark is 540.85 feet. Though the data from the Meredith Water Department on water levels for Lake Waukewan for the years 2008 and 2009 were not continuous and complete, the data available indicate that water levels averaged 540.4 feet with a minimum of 539.8 feet and a maximum of 542.3 feet for this period. This information supports a finding that a difference existed between pre-1983 and post-1983 management and control of the outlet of Lake Waukewan.

Effects of Operations on Use and Enjoyment of Shore Property on Lake Wakewan and Lake Winona

Based upon the 1904 decree, the flowage rights of the dam owner extend to at least an elevation of 540.7 feet. The range of normal water levels under consideration for this lake level investigation range from the past level of 539.0 feet to the current level range of 540 to 540.4 feet, which are below the elevation of 540.7 feet. However, post-1983 management practices of the outlet that would be consistent with elevations on the higher end of this range (539.8 to 540.4 feet) make it more than likely that the 540.7 foot elevation has been exceeded.

The frequency and duration of exceeding the 540.7 foot elevation during both the pre and post-1983 management and control of the outlet is not known. However, high water events were documented in 1900, 1936, 1938, 1973, 1978, 2006, 2007 2008 and 2009. Based on interpolation of the limited lake elevation data available for 2008 through 2009, the elevation of 540.7 feet was exceeded on at least 90 days (12%) during this period, and was likely exceeded at other times during the 26 years of the post-1983 management and control of the outlet. This frequency of exceedence generally supports the public comment that higher water levels have persisted in recent years.

The information provided in the September 30, 2008 LWIA letter, conversations with several shore property owners on both Lakes Winona and Waukewan and reconnaissance by DES personnel indicated that these high water levels were causing damage to shorelines, shoreline vegetation and shoreline structures, thereby affecting the use and enjoyment of some shore property.

Effects of Operations on Riparian or Littoral Rights Downstream of Outlet

The Lake Waukewan Dam discharges through a short channel, approximately 200 feet long, directly into Lake Winnipesaukee, with no apparent riparian rights beyond those of the dam owner. The discharge from Lake Waukewan is a small percentage of the total inflow into Lake Winnipesaukee, and no significant impact to littoral rights on Lake Winnipesaukee would be expected from any potential discharge of water from the Lake Waukewan Dam. As such, no effects to riparian or littoral rights below the outlet were indicated by either the pre or post-1983 management and control of the outlet.

Public Access and Public Recreation

The waters of Lakes Waukewan and Winona above the outlet are accessible to the public by public boat ramps, one on each lake. There were no indications that the post-1983 management and control of the outlet was impacting public use of the boats ramps. The public boat ramp on Lake Waukewan, owned by the Town of Meredith, was in a state of disrepair at the outset of the investigation, but was repaired in 2010. The ramp at Winona Lake is largely unimproved, and is composed of a gravel parking area that slopes gently into the lake immediately upstream of the Winona Road culvert at the southern end of the lake. Given the shallowness of the lake in this area and the narrowness of the channel that connects the ramp area to the main lake, higher lake levels made its use more convenient for larger boats. In addition, the Town of Meredith owns a public beach on Lake Waukewan at the toe of a tall retaining wall on the lakeside of Waukewan Street. Based on an elevation survey performed by DES, when lake levels reach approximately elevation 541.5 feet, the beach is inundated and the water is at the toe of the retaining wall.

Access to the waters above or below the outlet does not appear to be impacted with post-1983 management, nor is there information in the file, from abutter comment or the public testimony that indicated pre-1983 difficulties with access to the lakes. Further, the waters above the outlet are suitable for navigation and recreation under both the current and past management and control regimes of the outlet. The waters below the outlet, between the Lake Waukewan Dam and the west side of route 3, are not considered navigable.

Aquatic and Land Based Habitat

No information was discovered indicating that aquatic or land based habitat was harmed

by pre-1983 management and control of the outlet. Further, it does not appear that aquatic habitat is being impacted by post-1983 management and control of the outlet. However, land based habitat does appear to have been harmed by the differences associated with pre- and post-1983 management and control of the outlet as some trees and other vegetation have perished or are suffering from erosion of the shoreline and other effects associated with elevated water levels and more frequent flooding.

Based upon the preliminary investigation, DES determined that management and control of the outlet has caused some adverse effects that interfere with the use and enjoyment of littoral property or public waters. These effects include erosion damage to shorelines, harm to land-based vegetation and habitat and reductions in the size of public recreation areas. In addition, due in part to the reduced discharge capacity of the dam since the 1904 Court Decree was issued, the post-1983 management and control of the outlet increases the duration and frequency at which littoral property is flooded, beyond that allowed in the 1904 decree. As a result of these determinations, DES undertook further investigations, including public hearings, in accordance with RSA 482:79.

Further Investigation Phase

Initial Public Input

To obtain public input on the management and control of Lake Waukewan, DES conducted two public forums in September 2009 for property owners, lake users and members of the general public: one on September 28 in Center Harbor, and the other on September 29 in Meredith. At the September 28 meeting in Center Harbor, a show of hands at the beginning of the meeting indicated that 16 people (37%) favored the higher lake levels under the post-1983 management of the dam, but 27 people (63%) favored establishing lower lake levels. According to DES notes of the meeting, of the people who spoke, 3 (18%) were in favor of the higher lake levels under the post-1983 management of the dam, and 14 (82%) were in favor of establishing lower water levels. At the September 29 public forum in Meredith, of the people who spoke, 9 (41%) favored the higher lake levels under the post-1983 management of the dam, 7 (32%) favored establishing lower water levels and 6 (27%) did not express a clear preference. A large majority was in favor of a fall/winter draw down to provide additional storage for spring runoff and potential flood reduction.

In addition to these two public forums, DES conducted a survey in 2009 to obtain more public opinion on preferred water levels and management protocols from a wider population than were able to attend the public forums. DES issued a press release announcing the survey on October 23, 2009, and surveys were available on the DES webpage and distributed by the LWIA and the Waukewan Shore Owners Association (WSOA) to their memberships. Many respondents provided additional information on the surveys in an effort to explain their interests and to qualify the basis of their responses.

One hundred and twenty (120) of the surveys were completed (approximately 35% of the total number of shorefront properties on Lakes Waukewan and Winona). Of those responding, 72 (60%) preferred a constant lake level through the summer months and 24 (20%) preferred a lake level which gradually declines over the summer months. Of those preferring a constant lake level, 51 (71%) favored a summer lake level of 540.0 feet, 12 (17%) favored a summer level of 539.0 feet, and the remainder preferred a summer lake level at an elevation between 539.0 feet and 540.0 feet. Regarding a fall drawdown, of those responding, 91 (76%) favored a fall drawdown. Of those respondents that favored a drawdown, 27 (31%) preferred a fall drawdown level of 539.0 feet, 22 (25%) preferred a drawdown level of 538.5 feet, 16 (18%) preferred a drawdown level of 538.0, 5 (6%) preferred a drawdown level of 537.5 feet, and 17 (20%) preferred a drawdown level of 537.0 feet.

Establishment of Interim Operating Level for 2010

Based on the information collected since the beginning of the Lake Level Investigation in September 2008 through the winter of 2010, DES determined that establishing an interim operation plan was appropriate to further study the effects of the level of Lake Waukewan on the shoreline of Waukewan, Lake Winona and the Snake River. The interim operation plan was established in DES's *Notice of Decision Interim Operating Level - Lake Waukewan* dated April 12, 2010, and the basis of the interim operation plan is included in that Decision.

The interim plan set an operating level for Lake Waukewan for the 2010 recreational season, at elevation 539.5 feet, which was midway between the two documented target elevations of 539.0 feet (pre-1983 management) and 540.0 feet (post-1983 management). The interim plan also called for a fall drawdown to elevation 538.0 feet beginning on November 1, 2010. During implementation of this interim plan, concerns were expressed on the depth of the drawdown. In addition, the New Hampshire Fish and Game Department stated a preference that any drawdown be performed earlier to avoid potential impacts to amphibians and other organisms that burrow and begin to hibernate in shallow areas in the fall and could be vulnerable if these areas are exposed to predators and freezing temperatures due to a later drawdown. In consideration of these concerns, DES determined that a modification to the April 2010 Notice of Decision was warranted, and modified the interim plan to start the drawdown of Lake Waukewan on Columbus Day, the date on which drawdowns begin on most of the lakes in New Hampshire on which annual drawdowns are conducted, and to raise the target drawdown level to 538.5 feet.

During the 2010 recreational season, hydrologic conditions were much dryer than normal. From April through September, rainfall in Belknap County was over five inches below normal. As a result, the level of Lake Waukewan and Lake Winona was correspondingly lower than would be expected during more normal hydrologic conditions under the same dam management plan.

Site Visits

Multiple visual surveys of the watershed, both by boat and land, were conducted to observe Lake Waukewan, Lake Winona, the Snake River wetland, numerous private and public properties, and other areas surrounding these water bodies under various lake level conditions (see dates of surveys conducted by boat, below). Particular attention was paid to how varying water levels affected public and private uses, including access to water bodies, boating and swimming activities, and to determine how shorefront property, such as homes, docks, rafts, retaining walls and landscaped areas may be affected. DES observed and photographed effects to shorelines, shoreline vegetation and shoreline structures from higher and lower water levels. The extent of impacts to root systems of shoreline vegetation and impairments to shorefront structures like docks, retaining walls and beaches were also observed, as was the extent to which the emergence of previously submerged lake bottom and other shallow areas made some recreational activities and water access from some private properties more difficult at the 2010 interim level of 539.5 feet.

The dates of some of the boat surveys and water levels corresponding to them are noted below:

Date of Boat Survey	Area Surveyed	Water Elevations (feet)	
		Waukewan	Winona
9/23/08	Winona, Snake River and the Waukewan Road area	540.5 (est.)	N/A
10/5/09	Waukewan and Winona	540.35	540.65
5/25/10	Waukewan	539.51	N/A
6/14/10	Waukewan and Winona	539.55	540.12
7/29/10	Waukewan	539.70	N/A
9/24/10	Waukewan and Winona	539.19	539.26
10/29/10	Snake River	538.96	539.71

Additional Public Input

During implementation of the 2010 interim operation plan, two additional public forums, held on July 1 and August 17, 2010, were conducted for DES to receive testimony from property owners, lake users and members of the general public on the effects of the interim operation plan on the use and enjoyment of Lake Waukewan and Lake Winona. Also, DES conducted a second survey of lakeshore property owners, and received several targeted opinion surveys from groups of shoreline property owners. In addition, much information on the effects of lake levels was supplied to DES through letter, e-mail and by telephone. This public input is summarized below

The July 1, 2010 public forum was sponsored by Executive Councilor Raymond Burton in Meredith to gather input on the 2010 interim lake level of 539.5 feet for Lake Waukewan and the corresponding slightly higher level for Lake Winona. A total of 155 people signed in for the meeting with 41 (26%) supporting the 539.5 foot level, 81 (52%) not supporting the 539.5 foot level, 2 (<1%) supporting both and 35 (22%) not indicating any opinion on the sign-up sheet. Of the 54 people who spoke, 29 (54%) preferred a higher water level, 20 (37%) preferred a lower water level and 5 (9%) did not indicate a clear preference.

The August 17, 2010 public forum was conducted in Meredith to allow DES and other resource agencies to present findings and information on various investigation topics and to gather information from property owners and users regarding their experiences with the 2010 interim lake level of 539.5 feet for Lake Waukewan and the corresponding slightly higher level for Lake Winona. A total of 130 people signed in for the meeting. Of the 40 people who spoke, 21 (52.5%) preferred a higher water level, 17 (42.5%) preferred a lower water level and 2 (5%) did not indicate a clear preference.

The 2010 survey conducted by DES was completed by 93 people (representing approximately 26% of the shorefront properties on Lakes Waukewan and Winona). Of those responding, 16 (17%) had made adjustments to their docks, and 45 (48%) expected to. Of those responding, 60 (65%) indicated that some activities were negatively impacted by the 2010 summer operating level of 539.5 feet. Regarding the drawdown to approximately elevation 538.6 feet that occurred from December 1, 2009 through March 15, 2010, 40 (43%) indicated they experienced no noticeable effects, while 28 (30%) experienced benefits and 18 (19%) reported that damage was experienced.

In addition to these DES-sponsored opportunities to obtain public input for the lake level investigation, DES received public input from a number of other sources. These other sources are described below:

- A petition was provided to DES on June 1, 2010 requesting that the water level of Lake Winona be raised in increments (two) of 6 inches at a time, followed by a two week evaluation period. The petition suggested that the level be raised in one 6 inch increment and then, if no issues existed, raised another 6 inches and evaluated further. DES considered the proposal but elected to have the owner of the Lake Waukewan Dam continue to follow to interim operation plan that called for a water level of 539.5 feet. This petition included 77 signatures representing 40 properties (approximately 36% of the total number of properties on Lake Winona).

- DES attended the June 26, 2010 meeting of the LWIA at which an informal poll of those present was made. The question asked for an opinion of Winona Lake levels in comparison to the elevation of the lake on that day (540.0 feet). The corresponding level at Lake Waukewan on that same day was 539.60 feet.

Of the 24 respondents, 18 (75%) favored a level that was between 3 inches lower or higher (or a range of 539.75 to 540.25 feet), while 6 (25%) favored a level that was at least 3 inches higher (540.25 feet or higher).

- A petition completed by residents in support of lower water levels for Lakes Waukewan and Winona was provided to DES at the July 1, 2010 public meeting. This petition was signed by 72 people (approximately 20% of the shorefront properties on Lakes Waukewan and Winona).

- A survey conducted by property owners on Lake Winona was submitted to DES. The locally-sponsored 2010 Lake Winona survey was completed by 101 people (representing approximately 91% of the properties located on Lake Winona). Of those responding, 63 (65%) preferred a higher lake level for Lake Winona than that experienced during the 2010 recreational season as provided by the interim operation plan. The average lake levels for the 2010 recreational season, June through September, were 539.5 and 539.7 feet for Lakes Waukewan and Winona, respectively. This survey also reported that 54 (61%) property owners believed that over the past 30 years the operation of the dam had caused a serious and adverse effect on their property and that 59 (60%) were not in favor of a fall drawdown. It should be noted that the hydrologic conditions were much dryer than normal for the majority of the 2010 recreational season and the level of Lake Winona was correspondingly lower than would be expected during more normal hydrologic conditions under the same dam management plan. It is unclear if those who believed that over the past 30 years the operation of the dam had a serious and adverse effect on their property were referring to the 2010 interim level of 539.5 feet, which was lower than post-1983 management, or to higher water/flooding events from previous years. In addition, the condition of the beaver dam on the Snake River heavily influences lake levels on Lake Winona. DES understands that work to keep a section of the beaver dam cleared to allow more flow was conducted during 2010 and that several beavers were also trapped.

- A survey conducted by property owners on Lake Waukewan was submitted to DES. The locally-sponsored 2010 Lake Waukewan survey was completed by 103 people (representing approximately 39% of the shorefront properties located on Lake Waukewan) and received by DES in December 2010. Of those responding, 101 (98%) preferred a higher level than that experienced during the 2010 recreational season (539.5 feet, average). This survey also reported that 80 (78%) of property owners believed that over the past 30 years the operation of the dam had not had a serious and adverse effect on their property and that 67 (65%) were in favor of a fall draw down.

- Petitions for Lake Waukewan and Lake Winona/Waukewan were received by

DES in December 2010. The Lake Waukewan Petition expressed dissatisfaction with the Interim Operating Level of 539.5 feet and asked for the lake level to be restored to 540 feet or higher. This petition was signed by 119 people, all of whom appeared to have homes on Lake Waukewan (approximately 45% of the shorefront properties). The Lake Winona/Waukewan Petition was worded the same and was signed by 123 people representing about 74 properties (67% of the Lake Winona properties) all of which appeared to be located on Lake Winona.

- DES received numerous letters, e-mails and telephone calls concerning water levels and other issues on both lakes and in the Snake River wetland, primarily from many of the same people who spoke at the public forums and completed the various surveys and petitions. The content and opinions expressed in these communications were similar to the oral testimony provided at the public meetings, the responses to the surveys, and the information contained in the various petitions. All of the written descriptions described above are included in the file for this matter.

Findings

DES, through its investigation, including document review, site visits and public input, makes the following findings regarding the lake levels of Lake Waukewan and Lake Winona.

Flowage Rights

Based on DES's review of deed and title information and the 1904 decree, DES finds that the upper limit of flowage extends at least to an elevation of 540.7 feet on Lake Waukewan, under the 1904 decree, which requires full opening of a low level gate in the dam when lake levels reach 540.7 feet. However, the flowage rights conferred by the 1904 decree may no longer be valid since modifications to the dam, which were constructed since the decree was issued, have reduced the discharge capacity of the dam, resulting in higher lake levels than would have been anticipated under the 1904 decree. These modifications include elimination of the low level gate referred to in the 1904 decree, and a reduction in the diameter of the penstock of the dam from 6 feet to 5 feet. Although modifications have been made to the surge tower to restore some of the lost discharge capacity, the modifications do not fully compensate for the loss.

Based upon interpolation of the limited lake level data for Lake Waukewan during the 2008-2009 period, DES estimates the elevation of 540.7 feet was exceeded for at least 90 days (12%) of the time during that period, and was likely exceeded at other times during the 26 years of the post-1983 management and control of the outlet.

Discharge Capacity of the Lake Waukewan Dam

The discharge capacity of this dam is very small in comparison to the size of its watershed, which drains into Lake Waukewan. Out of 1,273 dams in New Hampshire for which data are available, nearly 95% of them have a greater ratio of discharge capacity to watershed size. As a result, storm inflows cause greater and more prolonged rises in lake levels on Winona and Waukewan than would be expected in nearly 95% of the lakes in New Hampshire.

The maximum available discharge from the dam at various lake levels on Waukewan, with all stoplogs removed, is provided in the table below:

Elevation (feet)	**Maximum Available Discharge (cfs)**
539.0	93
539.5	125
539.9	153
540.0	155
540.4	166

For the location of Lake Waukewan, a 1-year rainfall event, which has a 100% chance of occurring each year, is 2.4 inches over 24 hours and results in a peak inflow into Lake Waukewan of 653 cubic feet per second (cfs). This inflow is nearly 4 times greater than the discharge capacity of the dam when the lake level is at 540.4 feet. Thus, rainfall events cause rises in lake levels, which remain high until the water can drain out through the dam over an extended period before the lake returns to pre-storm levels.

The modifications which have been made to the dam that have decreased its discharge capacity have also reduced the rate at which the lake can return to its starting level after periods of high inflow. The August 2008 flood increased the lake level by 1.8 feet and required 51 days to return to its starting level, due, in part, to this reduced capacity to drain the lake, as well as the additional rainfall received during that time.

The discharge capacity of the dam with the lake level at elevation 540.0 feet and all stoplogs removed, is equal to the inflow into the lake that would be expected from a rainfall of approximately 1.4 inches over a 24-hour period. According to weather data for the City of Concord, the region experienced a daily rainfall of this amount or greater 9 times in 2008, 5 times in 2009 and 6 times in 2010. At an elevation of 540.0 feet , all stoplogs would have to be immediately removed from the dam to prevent the lake level from rising during these relatively common rainfall events.

Dam Safety Requirements

Lake Waukewan Dam is classified as a high hazard dam, and, as such, must have sufficient discharge capacity to meet the discharge capacity requirement for high hazard dams specified in Env-Wr 303.11 (a)(3) of New Hampshire's Dam Safety Rules. Normally, high hazard dams must have sufficient discharge capacity to pass 250% of the 100-year flood with one foot of freeboard. However, DES has determined that, based upon the configuration and location of the dam, a failure of the dam would affect a very localized area of development and that the discharge capacity requirements for the dam, in consideration of the limited impacts on lives and property associated with a failure of the dam, could be reduced. As such, the discharge capacity requirement established for this dam is the 100-year flood, and the dam must be able to pass that flood with one foot of freeboard. DES performed a hydrologic assessment of the Lake Waukewan watershed, which modeled the effects of a 100-year precipitation event and the resulting runoff. The results of that assessment indicated that, unless a waiver is granted under New Hampshire's Dam Safety Rules, the maximum starting water level of Lake Waukewan could be no higher than 539.9 feet to accommodate the slightly greater than 2 foot rise caused by this flood and still provide for the required minimum of one foot of freeboard as measured from the top of the walls that line the canal near Main Street in downtown Meredith.

Riparian Rights Downstream of the Dam

Releases from the Lake Waukewan Dam have no effect on riparian rights that may or may not exist below the dam. The Lake Waukewan Dam discharges through a short channel, approximately 200 feet long, directly into Lake Winnipesaukee and no riparian rights beyond those of the dam owner were identified below the outlet of the Lake Waukewan Dam. No deeded rights or grants associated with any former Mill Dam Act were found or produced.

Public Access

Public access to Lake Waukewan is provided by a boat ramp owned by the Town of Meredith. Public access to Lake Winona is provided by a boat ramp owned by the Town of Center Harbor. No public access is provided or needed in the flume below the outlet that discharges into Lake Winnipesaukee. Access to the Lakes Waukewan and Winona impoundments via these ramps could be impacted by low lake levels, especially those seen at each ramp when the level of Lake Waukewan is maintained below 539.5 feet, based on reports of ramp users during the 2010 recreational season. Access conditions at both boat ramps will vary under varying lake levels, with elevations in the upper range providing additional depth for launching larger watercraft. However, neither the Town of Meredith nor the Town of Center Harbor expressed any concerns related to the 2010 interim operating water levels and boating access to the lakes with their boat ramps.

Fisheries

The New Hampshire Fish & Game Department (NH F&G) annually stocks Lake Waukewan with rainbow trout and Lake Winona with rainbow and brook trout. Other species found in the lakes include, among others, bass, pickerel and smelt. Fishing is a common activity on both Lakes Waukewan and Winona, in the Snake River wetland and below the outlet of Lake Waukewan. Based on testimony and information from NH F&G, no noticeable impacts to fishing in any of these areas would be expected for the range of normal lake levels experienced in the past at Lake Waukewan, including during pre-1983 management, post-1983 management and management under the interim operation plan.

Water Quality

Volunteers from both Lake Waukewan and Lake Winona participate in DES's Volunteer Lake Assessment Program (VLAP). Initiated in 1985, VLAP is a volunteer-driven lake sampling program to assist DES in evaluating water quality throughout the state. Volunteers on Lake Winona have been collecting data on that lake since 1986, and volunteers on Lake Waukewan have collected data on that lake since 1990. The data collected through the program show that the quality of the water in both lakes is very good.

For Lake Waukewan, the clarity is characterized as exceptional in the Interim Data Report for 2010, exceeding the median for all New Hampshire Lakes that are monitored, as well the median for similarly sized lakes in the state. The concentrations of Total Phosphorous in the upper layer of the lake are below the median concentration for all lakes in New Hampshire that are monitored, and generally below the median concentration for similarly sized lakes in the state. In addition, over the monitoring period the concentrations of Total Phosphorus in the upper layer have shown a decreasing trend. The concentrations of Chlorophyll-a have shown an increasing trend over the monitoring period, but are still below the median concentration for all lakes in New Hampshire that are monitored, and generally below the median concentration for similarly sized lakes in the state.

Similarly for Lake Winona, although clarity shows a slight decreasing trend over the monitoring period, the clarity is still characterized as exceptional in the Interim Data Report for 2010, exceeding the median for all New Hampshire Lakes that are monitored, as well the median for similarly sized lakes in the state. The concentrations of Chlorophyll-a have shown a decreasing trend over the monitoring period and are generally below the median concentration for all lakes in New Hampshire that are monitored, as well as the median concentration for similarly sized lakes in the state. The concentrations of Total Phosphorous in the upper layer of the lake also show a decreasing trend over the monitoring period, and are below the median concentration for all lakes in New Hampshire that are monitored, and consistent with the median concentration for similarly sized lakes in the state.

The continued high quality of the water in the lakes is dependent upon many factors, primary among them are the land use practices in the watershed area that drains into them. The greatest threat to water quality within the Lake Waukewan watershed is phosphorus, which is produced naturally by decaying vegetation and man-influenced causes related to sewage (treated or untreated) and lawn and ornamental plant fertilizers. In general terms, the annual phosphorus budget into surface waters comes from runoff (established tributary streams and overland flow from abutting land area) and groundwater infiltration and precipitation (rain and snow); the in-lake contribution is very small and somewhat static.

In terms of lake levels and how they might affect phosphorus loading, the contribution from groundwater is likely the one that is most controllable. Lower lake levels provide a deeper soil column surrounding the lakes to filter and retain phosphorus and other contaminants from sources such as septic tanks, leach fields and lawn/plant fertilizers. Though it is impossible to assess each and every septic system or cultivated property to determine what benefit may be derived from a reduction in lake level, data from public testimony and from study completed by the Waukewan Watershed Advisory Committee indicate that septic systems may be directly or potentially affected by the post-1983 management and control of the outlet. One resident present on Lake Winona since the 1950's reported at the July 1, 2010 public forum that high water levels related to the post-1983 management required a septic tank to be pumped on three occasions during 2009, but noted that the circumstance was unusual. A Septic Risk Analysis performed by the Waukewan Watershed Advisory Committee evaluated 112 septic systems within 250 feet Lake Waukewan in the Town of Meredith and categorized the risk these septic systems presented to water quality as follows: 40 systems (36%) as very high risk, primarily because no information was available on the systems: 13 systems (12%) as high risk because of their age, the slope of the lot or the proximity to water: 41 (36%) as moderate risk and 18 systems (16%) as low risk. Further, lower water levels allow the expansion of naturally vegetated shoreline buffer areas that may act to filter some of the overland runoff produced by the watershed.

Aquatic and Land Based Habitat

The health and density of land-based vegetation, which serves as part of the shoreline buffer zone and as habitat for both aquatic and shore-based land organisms, is likely to increase if the vegetation is not inundated for long periods of time by high lake levels. This is attributable to a reduction in wave action and resulting erosion of root systems of trees, brush and plant species along the shoreline.

As indicated in the report submitted to DES by the Loon Preservation Committee, loons have nested throughout the watershed with recorded activity on Lake Waukewan from the mid-1970's, on Lake Winona from the early 1980's, and adjacent to and within the Snake River watershed since 1996. The Loon Preservation Committee also provided an

assessment of the loons that indicated a change in water levels is not generally a negative issue, provided that the levels remain fairly constant during the nesting period.

Shoreline Health

High lake levels, such as those that occur during significant flooding or as a result of water level creep, negatively impact the shoreline and shoreline vegetation. Negative impacts can include erosion of soil causing loss of shoreline and increased sedimentation in the lake, with associated reduction in water quality and the potential of silting-in of the lake bottom in susceptible areas. Loss of shoreline further reduces available growing area for vegetation. Undermining and saturation of shoreline can also lead to the loss of trees by toppling or drowning. Loss of shoreline vegetation and trees reduces the buffer surrounding the lakes and subsequently reduces potential filtration of runoff with associated reduction in water quality.

Drinking and Non-potable Residential Water Source

Lake Waukewan is the source of water for the water treatment and supply facility of the Town of Meredith, which is located at the southern end of Lake Waukewan. Some shorefront property owners on both Lakes Waukewan and Winona also draw water from the lakes for residential use. Based on communications with the Town of Meredith and the DES Drinking Water and Groundwater Bureau, no significant effect on the quality or quantity of raw water for treatment or non-potable residential use would be expected for the range of normal lake levels experienced in the past at Lake Waukewan, including during pre-1983 management, post-1983 management and management under the interim operation plan. However, during the public forums, at least one resident reported that, during management under the interim operations plan in 2010, the water available in his well was reduced and insufficient to meet his needs.

Boating

Motorized and non-motorized boating activity is extensive on both lakes. As with access at each of the public boat ramps, varying water levels will change lake depths in locations that are typically used for boating. Such changes will affect the type and extent of boating activities in these areas. Boating in the Snake River wetland is generally done by non-motorized craft. There is no navigation in the stream below the outlet of Lake Waukewan.

From a boater's perspective, higher water levels allow for more convenient access at the public ramps at both lakes, especially for larger boats. Further, many owners of shoreline property that surrounds both lakes have constructed and are maintaining docks that were set to operate most efficiently at the water levels that have been seen during the post-1983 management and control of the outlet. There is also a belief that higher levels will reduce the number of navigational hazards (rocks/ledge/pond bottom) that come into play when

navigating the lake or when tied up to docks; however, it is also possible that lower levels may make several existing hazards more prominent and avoidable. According to the New Hampshire Department of Safety, they received no formal requests to mark navigational hazards under the interim 2010 lake levels for Lake Waukewan and Winona. They also stated, in a letter dated December 17, 2010, "We have determined that the current (references the 2010 interim level of 539.5 feet) impoundment levels of Lake Waukewan and Winona created no negative effect on safety."

Based on DES's experience navigating the entire shoreline of both lakes multiple times during 2010 when lake levels were being maintained in accordance with the interim operations plan, operating the lake at lower levels can still afford users the ability to access either lake to recreate, but would require adjustments to the changed conditions. However, at lower water levels it would be necessary for some shorefront owners to adjust docks to accommodate their boats/watercraft in response to levels that differ from those maintained under the post-1983 management. Further, there are areas on both lakes that are naturally shallow, so lower levels may limit recreation in areas previously more accessible or make accessing some individual shorefront properties difficult. The lower water levels under the pre-1983 management of the lake could limit access to some shorefront properties on both lakes. However, boating activities at high lake levels may have negative impacts related to damages or erosion at developed or natural shorelines caused by wakes and waves, which can amount to several inches of run-up at shoreline areas.

Swimming

Swimming is a popular activity at both lakes. Swimming does not occur in the stream located directly below the outlet of Lake Waukewan. Generalizations about the ease or convenience of performing this activity under different lake levels are difficult to make, as shoreline properties and the water depths adjacent to them vary greatly. Under higher levels like those maintained under the post-1983 management and control of the outlet, many shorefront owners have become used to swimming and diving from existing docks, swimming platforms, boats or exposed rocks consistent with these levels. At lower lake levels, swimming activities can still continue, but owners may need to adjust dock and raft locations and re-learn the conditions at their traditional locations so that swimming convenience and safety are maintained.

Another component of the swimming issue relates to the usability of the Meredith Town Beach. Under the post-1983 management, only a relatively narrow strip of sandy beach is available for the Town's residents to use. At levels like those seen during pre-1983 management of the outlet and the interim operations period, a larger area of beach is made available, allowing for a higher number of residents to use the facility. Regardless, the beach remains usable and accessible under a wide range of levels. At a level of 540.0 feet, the width of the beach varies from approximately 14 feet at one end to approximately 24 feet at the other end. At a level of 539.5 feet, the width of the beach

increases approximately 9 feet, to approximately 23 feet at one end and approximately 33 feet at the other end. However, based on an elevation survey performed by DES, when lake levels reach approximately elevation 541.5 feet the beach is inundated and the water is at the toe of the retaining wall. In its letter of December 20, 2010, the Town of Meredith stated that lake levels will not impact the beach (or its other facilities) unless a substantial lowering of the lake, well below levels currently maintained, were to occur.

Other Recreation

Other types of recreation include water skiing, snowmobiling, ice fishing and skating, though none of these occur in the stream located directly below the outlet of Lake Waukewan. Like boating, higher levels may put navigational hazards farther below the surface and make them less likely to affect water skiing. However, lower levels may expose additional potential water skiing hazards to sight so that they may be avoided altogether. Levels lower than those experienced under post-1983 management may require users to acquaint themselves with the changed conditions. For the winter recreation activities, neither lower nor higher levels would impact their success or safety.

Fall/Winter Drawdown

A fall/winter drawdown has been performed in the past at Lake Waukewan to provide flood storage for spring snowmelt and rains. The drawdown under pre-1983 management was 15 to 22 inches from the normal operating level of 539, resulting in a fall/winter lake level of 537.2 to 537.75. There are no indications that a fall/winter drawdown was performed under post-1983 management of the dam, despite the fact that the New Hampshire Water Resources Board in December 1983 recommended to the Town of Meredith that all stoplogs from the dam should be removed during the non-recreational months (see Appendix A).

Fall/Winter drawdowns are conducted at many lakes in New Hampshire to protect the shoreline from erosion due to high water, reduce the adverse effects of winter ice on the shoreline and shorefront structures, and provide water storage capacity to mitigate flooding. Because of the lack of vegetation and wet soil conditions that are typical in the month of April, the amount of runoff that occurs that month is on average 10 times higher than the amount of runoff that occurs in August and September, for the same amount of rainfall. Drawdowns are helpful to avoid flooding of the shoreline during the high runoff months of March and April. The lack of a fall drawdown between the fall of 1936 and the spring of 1936 was cited as a contributing factor for the damaging flooding which occurred in the Town of Meredith that year, according to the 1936 WRB Flood Report for Meredith.

A fall/winter lake level drawdown was directed by DES for the 2009/2010 period based on past practice, requests from the public during the period of initial public input, and engineering evaluations associated with the hydrology of the contributing watershed and

hydraulic capabilities of the dam as performed by DES. The average lake level for Lake Waukewan for the 2009 summer period was 540.4 feet and the fall/winter drawdown target was 539.0 feet. The drawdown was started about October 29 and the target level was generally reached on December 27, 2010. Subsequent snow melt and rainfall resulted in the level rising above the target near the end of January 2010. The water level dropped to 538.64 feet by February 24 and rose to 540.47 feet by April 2 as the result of rainfall and snow melt that occurred in the period. This 1.8 foot increase in the level of Lake Waukewan occurred with a nearly maximum discharge from the dam and would have resulted in an elevation of 542.2 feet with associated shoreline flooding if Lake Waukewan had been maintained at the 540.4 feet summer level over the winter.

A 2010/2011 fall/winter drawdown from 539.5 to 538.0 feet was included in the 2010 interim operation plan for Lake Waukewan. Based on input from NH F&G and the public, the target drawdown level was revised to 538.5 feet prior to implementation in the fall of 2010. The 2010 drawdown began on October 12 and the target level of 538.5 feet was generally reached on December 30, 2010. Subsequent operations by the dam owner increased the level to about 539 feet for about 2 months. The target level was re-attained on February, 27, 2011, but rainfall and snowmelt in the months of March and April 2011 caused the lake level to rise to approximately 540.7 feet even with all of the stoplogs removed from the surge tower.

The Lake Waukewan Dam, because it discharges directly into Lake Winnipesaukee, is able to be operated in such a way as to cease all discharge without risk to ecological or riparian concerns to downstream areas. This ability to retain all of the inflow from its watershed will greatly enhance the ability of dam operations to return the lake level to its recreational level during all but the most extreme meteorological conditions.

Conclusions

DES concludes that the goal of the pre-1983 management of the Lake Waukewan Dam in Meredith, NH was to maintain a summer level of 539.0 feet and draw the lake down 15 to 22 inches in the winter. After 1983, documents indicate that the Lake Waukewan Dam was operated to maintain a summer level one foot higher, at an elevation of 540.0 feet. However, in recent years the level of Lake Waukewan has been maintained even higher, at elevations of approximately 540.4 feet. This higher elevation, combined with the rapid increases in the lake levels during storm events due to a combination of high inflow and the limited discharge capacity of the dam, has caused flooding of shoreline property and fluctuations in water levels that has damaged shoreline vegetation, and affected the use and enjoyment of Lake Waukewan and Lake Winona by some owners of property on the lake and the public. Further, based on the response of a significant portion of the public to the interim operating level of 539.5 during the summer recreational months of 2010, DES concludes that low lake levels also affect the use and enjoyment of Lake Waukewan and Lake Winona by other owners of property on the lake and the public, primarily by impairment of their recreational activities including boating and swimming.

In the 26-year period from 1983 through 2009, before implementation of the interim operating level of 539.5 feet in 2010, the Lake Waukewan Dam was operated to maintain a level of approximately 540.0 feet, and in that period, shoreline structures were built to accommodate that level. In addition, during this period, the shoreline has largely adapted to a level of approximately 540.0 feet, although erosion and shoreline damage can occur with higher and fluctuating lake levels, as has been experienced in recent years.

Based on its findings described in the previous section, DES has determined that a summer recreational level of 540.0 feet on Lake Waukewan is protective of the ecology of both Lake Waukewan and Lake Winona and strikes a proper balance between those whose use and enjoyment of the lakes are affected by high lake levels, and those whose use and enjoyment are affected by low levels. However, to protect the habitat and property along the shoreline of both lakes, operations of the dam must be timely and aggressive so that the water level in Lake Waukewan is maintained at as consistent an elevation as possible.

Also, because of the limited discharge capacity of the dam, DES has determined that a fall/winter drawdown is necessary to reduce the frequency and extent of flooding of the shoreline during the high runoff period, and has determined that the drawdown elevation shall be to elevation 538.5 feet. The drawdown will begin on Columbus Day of each year, which is typical of many of the dams in New Hampshire at which drawdowns are conducted, with the goal of refilling Lake Waukewan to its summer level of 540.0 feet by May 15th of each year. This 1.5-foot drawdown will provide storage in Lake Waukewan and Winona to store 2.26 inches of runoff from the Waukewan watershed.

Anticipating that the discharge capacity of the dam will not be increased by HHH, the owner, the establishment of elevation 540.0 feet as the summer recreational level for Lake Waukewan will require a waiver of the freeboard requirements specified in Env-Wr 303.11 (a) of New Hampshire's Dam Safety Rules. That waiver can be granted in accordance with PART Env-Wr 202 of New Hampshire's Dam Safety Rules.

Decision

Based upon the complete record of the investigation as well as the determinations derived from that record, DES hereby directs the dam owner, Hampshire Hospitality Holdings, Inc., to manage the outlet of Lake Waukewan (Lake Waukewan Dam) as follows:

Summer Recreation Level

The summer recreational level of Lake Waukewan shall be maintained at elevation 540.0 feet as measured on the level gage installed in the canal upstream of the intake for the dam. For the purposes of this decision, the summer recreational season is defined as extending from May 15th to Columbus Day of each year.

In order to achieve and maintain this summer recreational level, the dam owner shall operate the

dam in a timely fashion and as aggressively as necessary. Accordingly, the owner must:

For levels below 540.0 feet:
Cease purposeful dam discharges beyond those that will cause neither a lowering nor a rise in the lake levels when the lake falls below the summer recreational level; and

For levels above 540.0 feet:
Make whatever operations are necessary, including removal of all stoplogs, to return the lake to the summer recreational level, at which point discharges should be made that will cause neither a lowering nor a rise in the lake level.

Fall/Winter Drawdown Level and Spring Refill

The fall/winter level of Lake Waukewan shall be maintained at elevation 538.5 feet as measured on the level gage installed in the canal upstream of the intake for the dam. For the purposes of this decision, the fall/winter drawdown period is defined as beginning on Columbus Day and extending to May 15th of the following year. Beginning on or promptly after Columbus Day, the dam owner shall remove stoplogs in a manner and at a rate necessary to achieve the winter level as quickly as possible. Further, there is a spring refill period during late April and early May that is defined as the period of transition from the winter level to the summer recreational level. The rate at which stoplogs are added to refill Lake Waukewan to the summer recreational level should be determined based upon such factors as the depth of snow within the watershed and on prevalent meteorological conditions. However, the dam owner should operate the dam to achieve the summer recreational level by May 15th.

In order to achieve and maintain this winter level, the dam owner shall operate the dam in a timely fashion and as aggressively as necessary. Accordingly, the owner must:

For levels below 538.5 feet:
Cease purposeful dam discharges beyond those that will cause neither a lowering nor a rise in the lake levels when the lake falls below the target level; and

For levels above 538.5 feet:
Make whatever operations are reasonable or necessary to return the lake to the target level, at which point discharges should be made that will cause neither a lowering nor a rise in the lake level.

During the spring refill period:
Make whatever operations are reasonable or necessary to return the lake to the summer recreational level in as gradual a manner as possible, at which point discharges should be made that will maintain the summer recreational level.

To monitor compliance with this decision, DES directs the dam owner to maintain an operational log, which documents each operation made to the outlet, including the date of the operation, the number of stoplogs in each stoplog bay of the surge tower before and after the operation, and the lake level at the time of each operation. For a period of two years from the date of this decision,

the dam owner shall provide to DES, within 7 days following the last day of each month, the log for the month just ended. The dam owner shall also provide the log to DES, at all such other times as requested by DES.

Appeals

This decision may be appealed to the New Hampshire Water Council ("Water Council") by filing an appeal to the Water Council that meets the requirements specified in the Procedural Rules of the Water Council, Env-WC 200, within 30 days of the date of this decision. Copies of the rules are available from the DES Public Information and Permitting Unit at (603) 271-2975 or at http://des.nh.gov/organization/commissioner/pip/index.htm.

Date: April 29, 2011

James W. Gallagher, Jr.

James W. Gallagher, Jr., P.E.
Chief Water Resources Engineer
Department of Environmental Services

APPENDIX A

APPENDIX A

DES conducted a file review of data, documents, drawings and photographs related to the structural configuration of the dam, historic lake level, and management of the outlet of Lake Waukewan, operating criteria and physical potential of the dam structure. A list of the relevant information reviewed is provided below:

- 1927 - United States Geologic Survey (USGS) topographic map shows a lake level of 539 feet for Lake Waukewan and 540 for Lake Winona.
- 1926 – 1936 quarterly lake levels for Lake Waukewan from Meredith Linen Mills indicate an average lake level of 538 feet during this 10-year period with a maximum elevation of 542.2 feet and a minimum elevation of 534.2 feet. 75 percent of the quarterly lake level measurements over this 10-year period were at or below elevation 539.2 feet and 25 percent of the quarterly measurements were at or below elevation 536.5 feet.
- March 20, 1933 – Letter from dam owner/operator, Meredith Linen Mills, reporting highest water level (542.2 feet) in past 60 years – elevation 542.2 feet.
- April 1936 – New Hampshire Water Resource Board (NHWRB, predecessor agency to DES) "Report on Flood Conditions at Meredith Caused by High Water in Lake Waukewan" reported that the lake level increased 3.9 feet over 13 days starting at 539.5 feet and peaking at 543.4 feet. This report also indicated that the normal fall/winter drawdown was to an elevation of 535.7 to 536.7 feet. Further, it noted that the lake had not been lowered for that winter and that the flooding would likely not have occurred if the normal fall/winter drawdown had been performed.
- July 28, 1937 - Copy of Army Engineer Corps sketch of uncertain date which shows former dam upstream of Main Street.
- 1940 - USGS topographic map shows a lake level of 539 feet for Lake Waukewan and 540 feet for Lake Winona.
- September 24, 1953 – Aerial photograph of Lake Waukewan shows large area of exposed sand for town beach and at location adjacent to current boat ramp, and exposed rocks off of northeast point west of canal inlet. The area of beach and rocks shown exposed in this photograph is significantly greater than any seen during this evaluation and seems to indicate a lake level below 538.5 feet
- 1954 – Drawing indicates elevations of dam components, which generally agree with 2009 surveyed elevations, showing a lake level of 540.35 feet.
- 1956 - USGS topographic map shows a lake level of 539 feet for Lake Waukewan and 540 feet for Lake Winona.
- November 1, 1965 – Aerial photograph of Lake Waukewan shows large area of exposed sand for town beach and at location adjacent to current boat ramp, and exposed rocks off of northeast point west of canal inlet. The area of beach and rocks shown exposed in this photograph indicates a lake level below elevation 538.5 feet.
- 1968 Navigation chart shows a lake level of 539 feet for Lake Waukewan and 540 feet for Lake Winona.

- August 15, 1975 – NHWRB inspection photo indicates water level in canal is at elevation 539.4 feet. Penstock to turbine has been blocked.
- September 2, 1975 – NHWRB inspection memo indicates full pond is 539 feet. Flooding in 1973 caused a rise of about 3 feet in the level of Lake Waukewan (est. 542 feet + with a starting elevation of 539 feet) and flooded low areas near the lake. Other damages included undermining the culvert at Railroad Ave. on Corliss Brook, overtopping the headwall at end of canal (2009 surveyed elevation of 542.17 feet on right side which also agrees with the reported peak elevation of 542 feet +) and flooding under dry-cleaning shop on Main Street. Water did not wash over Main St.; however, excessive settlement of Main St. over the penstock occurred. High flows from the surge tower overshot the opposite flume wall and washed out a parking area and a portion of Dover St. The wall opposite the surge tower outlet was raised after this event along with adding concrete to the inside of the surge tower and permanently blocking the low level outlet.
- September 5, 1975 – NHWRB inspection letter to Amatex (dam owner) requesting meeting to evaluate lost discharge capacity from the un-permitted blocking of the low level outlet.
- November 11, 1975 – Calculations and options from Amatex for gate and surge tower repair/modification indicate existing conditions and elevations were in agreement with the 1936 report. Elevations of 538.7 and 540.7 feet were provided for the permanent crest and the top of the stoplogs, respectively.
- December 31, 1975 – Note on March 12, 1976 letter from NHWRB to Amatex indicates that a new gate was installed upstream of the surge tower on this date.
- December 19, 1977 – Inspection photos indicate an estimated water level in the surge tower of 538.4 feet with a lake level in the canal estimated at 539.8 feet. The elevation difference appears to be related to the large volume of debris shown blocking the trash rack for the penstock inlet. Based on an interview with the dam operator, Mr. Hodges, NHWRB was advised that the turbine had been shut down since the late 1950's when the shaft broke. The gate repair and the lowering of the permanent crest by 18 inches had both been completed.
- December 22, 1977 – NHWRB letter to Amatex advising them to clear the debris at the trash rack and that the dam be operated with all stoplogs removed during the non-recreational months and through the spring runoff period so as to provide some storage capacity during times of large inflow. The NHWRB stated that this recommendation was consistent with the court order of March 1904, which charged the owner of the facility with maintaining certain levels so as to reduce flooding conditions on the lake.
- December 22, 1977 – NHWRB letter to the Town of Meredith advising them that Amatex is the dam owner and discussing modifications made by others in the Corliss Brook area including illegal fill.
- June 6, 1978 – Army Corps of Engineers Phase I inspection Report indicates the level of Lake Waukewan rose to 542 during a 1978 flood. Report also stated that only 4 rows of stoplogs existed, resulting in a maximum elevation of the stoplogs of 539.7 feet with a permanent crest of 537.2 feet. At the time of the inspection, 2 rows of stoplogs were in place with about 6 inches of flow, resulting in a water level in the surge tower of 539.1

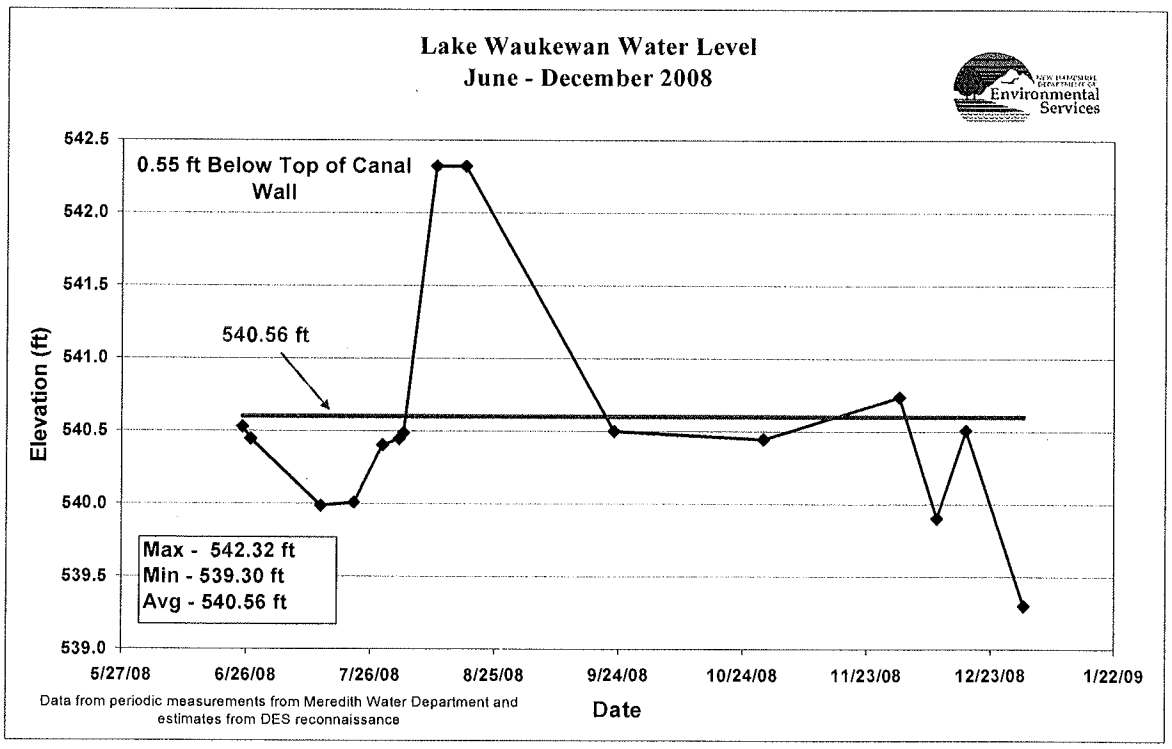
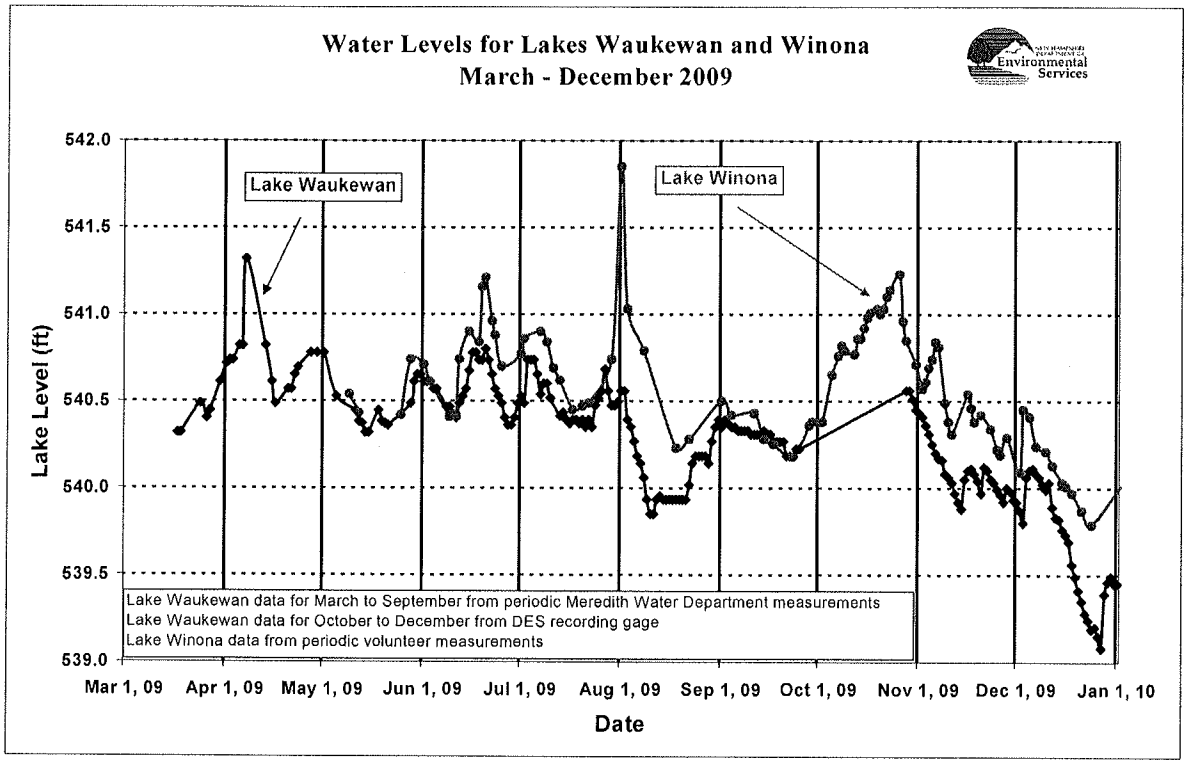
feet. The lake level was surveyed at 539.6 feet. The report indicates that the normal lake level is 539 with a 15 to 22 inch fall drawdown corresponding to 3 rows of stoplogs during the summer and 0 to 1 row in the winter.

- July 30, 1979 – Photos show turbine being removed.
- March 24, 1981 – Inspection of dewatered penstock revealed holes and thin areas in steel penstock; concrete in box culvert under Main St. in good condition.
- July 24, 1981 – Operating Procedure plan provided to NHWRB by Amatex indicates that normal lake level for Lake Waukewan is 539 feet ± with a 15 to 22 inch late fall/winter drawdown by stoplog removal.
- May 18, 1982 – Water level in surge tower estimated at 539.1 feet based on inspection photographs.
- August 10, 1982 - Water level in surge tower estimated at 539.7 feet based on inspection photographs.
- October 5, 1982 - Letter to NHWRB from NCM Engineers (NCM) with discharge calculations for the surge tower based upon a top of surge tower elevation of 543.28 feet and a permanent crest of 537.18 feet (crest has already been lowered 1.5 feet).
- October 14, 1982 – NHWRB letter to Amatex approving the repair of steel penstock that leads from the canal to the surge tower in conjunction with an additional 5-inch lowering of the permanent crest of the surge tower.
- March 3, 1983 - Water level in surge tower estimated to be 3.4 feet below top of concrete, (539.9 feet) based on inspection photographs.
- June 3, 1983 – Letter from Amatex to NHWRB indicating that penstock work and 6-inch lowering of permanent crest along with the addition of 3 wood stoplogs had been completed in January of 1983. This work should have resulted in a permanent crest elevation of 536.68 feet based on the elevation provided by NCM in October 5, 1982 calculations. The elevation surveyed by DES in 2009 indicates a permanent crest elevation of 537.32 feet, thereby raising doubt that this work was performed correctly or at all.
- December 6, 1983 – Letter from the NHWRB to the Town of Meredith Engineer responding to the Town's inquiry about any existing conditions or limitations regarding water rights or the outlet structure for the Lake Waukewan Dam. The basis for the Town's inquiry was their interest in acquiring the dam from the new owner of the Amatex property. In its response, the NHWRB provided a copy of the latest inspection report, as well as the 1904 Court Order, which NHWRB stated charges the owner of the facility with maintaining certain levels so as to reduce flooding on the lake. The letter also contains the recommendation that the structure be operated with all stoplogs out for non-recreational months and through the spring run-off period so as to provide some storage capacity during times of large inflow.
- June 5, 1984 - Water level in surge tower estimated to be 2.6 feet below top of concrete (540.7 feet) based on inspection photographs.
- July 9, 1985 - Water level estimated to be at elevation 539.8 feet in the surge tower and 540.2 feet in the canal based on inspection photographs.

- July 22, 1985 – Drawing from inspection indicates that the water level in the surge tower is 2.5 feet plus 4 inches below the top of the dam (540.5 feet).
- December 12, 1985 – Letter from the Meredith Planning Board to the NHWRB asking for information on the mean high water level for five lakes in the town, including Lake Waukewan, and stating that information in the Town's files indicates an elevation of 539 feet for Lake Waukewan.
- 1986 – a publicly available navigation chart indicates a lake level of 539 feet for Lake Waukewan.
- 1987 – USGS topographic map indicates lake level of 540 feet for both Lakes Winona and Waukewan.
- January 7, 1988 – Letter to DES (successor agency to NHWRB) from Mill Falls stating that personnel from both Meredith Bay Corp and the Town of Meredith monitor the dam and the dam is controlled by adding or removing stoplogs to maintain as consistent a level as possible.
- May 23, 1988 - Water level in surge tower estimated to be 3.3 feet below top of concrete (540.0 feet) with a canal water level estimate of 540.5 feet (because of debris) based on inspection photographs.
- October 30, 1989 - Water level in surge tower estimated to be 3.25 feet below top of concrete (540.07 feet) based on inspection notes. Water level in canal estimated to be 540.5 feet, with debris previously noted removed, based on inspection photographs.
- March 15, 1991 - Water level in surge tower estimated to be 540.4 feet, about 4 inches over stoplog bay III with 4 stoplogs and an estimated water level in the canal of 540.5 feet based on inspection photographs.
- June 28, 1996 - Water level in surge tower estimated to be 539.7 feet based on inspection photographs.
- 1998 – Aerial photograph of Lake Waukewan shows a smaller area of exposed sand at the town beach. The exposed sand adjacent to the boat ramp is not shown and the Town of Meredith water treatment plant is shown in the area of the Corliss Brook outlet.
- 1999 – Wetlands permit issued to the Town of Meredith to repair the stone canal walls. All photos prior to repair show rubble walls only slightly higher than the wingwall of the trash rack on the right side. Photos after reconstruction show rubble wall with a single row of cut granite about 2 feet tall on top of right wall. Top of right wall is now about 2 feet higher than before repair.
- November 1, 2001 - Water level estimated to be 539.0 feet in surge tower and 539.2 in canal.
- January 2, 2002 - Water level estimated to be 539.5 in surge tower and 539.8 with ice in the canal based on inspection photographs.
- September 24, 2004 - Water level estimated to be 540.2 in surge tower and 540.3 in canal with debris blocking trash rack based on inspection photographs.
- June 22, 2005 – Scuba inspection indicates 5-foot interior diameter for repaired steel penstock upstream of surge tower.
- June 22, 2005 – Waukewan Watershed Advisory Committee states that the minimum elevation of the watershed is 540. Assumption is that this is the level of the Lake

Waukewan at its outlet. This report also indicates a 12 to 15 inch annual fluctuation in lake level for Lake Waukewan with a spring drawdown for flood control.

- October 26, 2005 – Flood inspection for the October flood 2005 event indicates 3 feet of water over the sill with all stoplogs removed (540.32) and this is the highest flow this month according to employee.
- June 6, 2006 - Flood inspection for the May flood 2006 event estimates the canal water level was 3 feet below the upstream canal walls (541.8) and water level at surge tower was 3 feet below top of concrete (540.3).
- June 13, 2006 - Based on inspection photographs, water level in surge tower estimated to be 3.4 feet below top of concrete (539.9) with a canal water level estimate of 540.2 with debris.
- April, 2007 – April 2007 flood survey was completed by the owner and indicated a maximum water level 12 inches below the spillway walls (542.32).
- May 4, 2007 –Flood inspection after the April 2007 flood event indicates a water level of 540.3 in the surge tower and an estimated level in the canal of 540.9 with significant debris at trash rack.
- June 19, 2007 - Based on inspection photographs, water level in surge tower estimated to be 539.9, and water level in the canal estimated to be 540.2 with debris blocking trash rack.
- 2008 Lake Level Chart



- 2009 Lake Level Chart