STATE OF MAINE

DEPARTMENT OF ENVIRONMENTAL PROTECTION

BOARD OF ENVIRONMENTAL PROTECTION

	IN THE MATTER OF
NORDIC AQUAFARMS, INC.	:APPLICATIONS FOR AIR EMISSION,
Belfast and Northport	:SITE LOCATION OF DEVELOPMENT,
Waldo County, Maine	:NATURAL RESOURCES PROTECTION
	:ACT, and MAIN POLLUTANT
	:DISCHARGE ELIMINATION SYSTEM
	:(MEPDES)/WASTE DISCHARGE
A-1146-71-A-N	:LICENSE
L-28319-26-A-N	:
L-28319-TG-B-N	:
L-28319-4E-C-N	:
L-28319-L6-D-N	:
L-28319-TW-E-N	:
W-009200-6F-A-N	:
ME0002771	

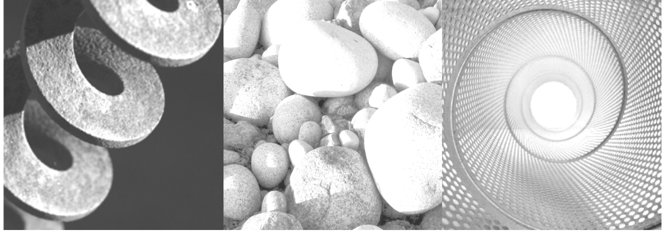
Assessment of the Nordic Aquafarms Permit to Satisfy Clean Water Act Requirements

TESTIMONY/EXHIBIT: NVC/UPSTREAM 2

TESTIMONY OF: GEI

December 13, 2019

DATE:



Consulting
Engineers and
Scientists

Testimony to the Maine DEP
Water Supply and Dam Evaluation

Proposed Nordic Aquafarms, Belfast Maine

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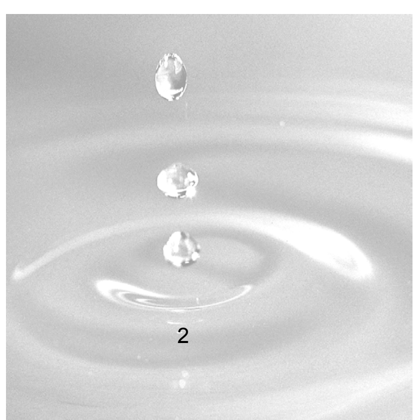
December 13, 2019
Project 1900162



Testimony of GEI Consultants, Inc.

Introduction

Upstream Watch retained GEI Consultants to conduct an evaluation of available information regarding the water supply for the proposed Nordic Aquafarms project in Belfast, Maine. This evaluation included a review of the two dams along the Little River adjacent to, and upstream and downstream from, the proposed Nordic site. Our evaluation was performed to understand the potential for adverse environmental impacts and risks to public safety caused by GEI's understanding of the construction or operation of the Nordic facility.

GEI's detailed assessment is presented in our December 2019 report to Upstream Watch and is included as Attachment 1 of this testimony. The following narrative summarizes our findings and conclusions and is representative of the testimony that will be presented by GEI at the proposed hearing before the Maine Department of Environmental Protection (DEP) the week of February 10, 2020. Mr. Frederick Johnson will be GEI's spokesperson at the hearing. Mr. Johnson's corporate resume and the resumes of the key GEI staff assisting Mr. Johnson are included as Attachment 2.

Summary of Findings and Opinion

Nordic's proposed land-based salmon farm will be constructed on approximately 50 acres adjacent to, and west of the Little River. The Little River has two impoundments of 48 acres (upper reservoir #1) and 37 acres (lower reservoir #2) created by two dams, which were originally constructed over 100 years old. The lower dam was reconstructed in 1944 after a catastrophic failure.

The farm will produce Atlantic salmon from eggs to market size using land-based recirculating tanks housed in and supported by approximately 800,000 square feet of new buildings. Because the native soils are unsuitable to support the building loads, the native soil must be removed and replaced with controlled structural fill. Approximately 19 acres will be excavated to depths of 8 to 20 feet.

Once constructed, the Nordic facility will require up to 1,200 gallons per minute (GPM) of fresh water. The proposed fresh water would come from three sources;

- Four on-site bedrock wells drilled to 500 feet are estimated to provide 455 GPM.
- 250 GPM will be extracted from Reservoir number 2 adjacent to the site.

- The City of Belfast has committed to provide up to 500 GPM from municipal wells located in a separate watershed.

Based on GEI's review of the Nordic Aquafarms April 2019 ME DEP Bureau of Land and Water Quality Application for Development and background documents reviewed as part of our December 2019 report, we offer the following observations concerns and opinions regarding Nordic's plans to develop a salmon farm on the Belfast Little River property.

The integrity of the existing Little River dams is critical to the successful development and operations of Nordic Aquafarms.

A failure of either one or both Little River dams would impact the proposed Nordic operation in several ways including;

- Loss of the lower reservoir and a source of up to 250 GPM of necessary fresh water needed to operate.

- Significant soil erosion could occur. Depending on the magnitude of the breach the sediment may encroach on the Nordic operation. More significantly, the transfer of sediment to Belfast Bay would impair water quality and could preclude Nordic from discharging wastewater to the bay.

- The loss of the dams may make the Nordic facility more susceptible to flooding.

- The loss of either of the reservoirs would alter the current groundwater flow regime for which Nordic's engineers determined the efficacy of the anticipated 455 GPM water supply from bedrock wells installed on site.

- A catastrophic dam failure could impact US Route 1 directly downstream. Route 1 is a major thoroughfare and its' loss would cause significant transportation issues for Nordic and the Belfast region

Little River Upper and Lower Dams lack critical stability and dam failure analyses to fully understand the risk and threat that the dams present.

Both dams were originally constructed over 100 years ago to create surface water reservoirs for the City of Belfast and are owned and operated by the Belfast Water District. In 1980 the use of the reservoirs for water supply was ended. Since that time the dams have fallen into disrepair. Several inspections over the years by the United States Army Corps of Engineers (USACE) and Maine Emergency Management Agency (MEMA) document several potential structural and operational deficiencies. In our assessment we understand that the Belfast Water District has decided not to spend funds to either maintain or rehabilitate the dams. Continued neglect will lead to further deterioration and eventual failure of the dams.

To help mitigate safety concerns and reduce the risk of failure because of Upper Dam's poor condition, MEMA recommended the pool elevation in Upper Dam be lowered based on their 2015 inspection. It is unclear whether the agreed upon lowered reservoir level is 6 ft below the spillway sill or 6 ft below the 18-inch outlet (14.7 ft below the spillway sill). Regardless, it appears there are no calculations to support that the stability of the dam is adequate at the elevation of the lowered reservoir. Furthermore, during a visit about two years ago GEI observed the outlets were blocked and water was flowing over the spillway. Clearly the dam was and is not being maintained to mitigate the risk.

In 1943, Lower Dam failed and US Route 1 was washed out downstream. The dam was rebuilt in 1944. This history is illustrative of the actual risk posed by the dams.

The Nordic development will disrupt approximately 6 acres with excavations up to 20 feet deep. This amount of intrusive subsurface construction has the potential to impact the dams. Construction activities such as driving piles and dynamic compaction of soils may cause vibrations at the dams. At a minimum, proposed construction methods should be evaluated to assess potential impacts to the dams during the planning process.

It is understood that Nordic has an option to purchase Lower Dam from Belfast, but that purchase is speculative. Nordic's existing site analysis is predicated upon the effective operation and maintenance of the dams. However, our evaluation shows there is no such commitment to maintain, rehabilitate or remove the dams.

In consideration of the condition of the dams and the potential hazards posed to Nordic by their failure, we believe that any permit issued by the State of Maine be conditioned by a definitive commitment to repair or remove the dams prior to Nordic operating at the site.

The proposed ground water supply sources may have adverse environmental effects to the environment.

Nordic and their engineers have conducted on-site evaluation of potential groundwater supplies that included drilling of test wells and conducting 72-hour pump tests. These tests conclude that up to 455 GPM of groundwater is proposed to be extracted from four bedrock wells finished approximately 500 feet below the site. Additionally, the aquifer testing demonstrates that the pumping of these wells will cause salt water intrusion from Belfast Bay.

In ME DEP Chapter 375; "No Adverse Environmental Effect Standards of the Site Location Development Act", sections 7 and 8 specifically prohibit any adverse effects to groundwater quality. Salt water intrusion is one of the adverse effects considered by the Act. The Nordic application for development does not address the consequences of the anticipated saltwater intrusion.

It is recommended that no permit be issued until the potential adverse environmental effects from the groundwater extraction and the resulting saltwater intrusion be fully addressed by the applicant.

Conclusion

The Nordic Aquafarms site analysis is dependent upon the current function of Little River dams regarding surface water flow, storage and its impact to the groundwater regime. Unless repaired and maintained, these dams will not survive to maintain current assumptions. Approval of the project without consideration of the efficacy, responsibility and future configuration of the hydrologic regime is irresponsible. The fate of the dams must be determined along with assignment of responsibility and funding for their revitalization or removal.

The demonstrated and eventual salt water intrusion from on-site pumping of groundwater is an adverse effect under Maine law. The permit should not be issued until the full impact of this adverse effect is understood to the satisfaction of the Maine DEP.

I certify that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete.

Respectfully Submitted:

Frederick W. Johnson
Sr. Vice President/Principal
GEI Consultants, Inc.

12/16/19

SUSAN E. WHITE
NOTARY PUBLIC
MY COMMISSION EXPIRES OCT 31, 2021

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Attachment 1

Water Supply and Dam Evaluation

Belfast, Maine

Consulting
Engineers and
Scientists

Water Supply and Dam Evaluation

Belfast, Maine

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Protected by attorney-client, work product, and self-evaluative privileges. The contents of this writing should be discussed only with counsel, and no distribution or public disclosure should be made of this document, its contents, or its subject matter.

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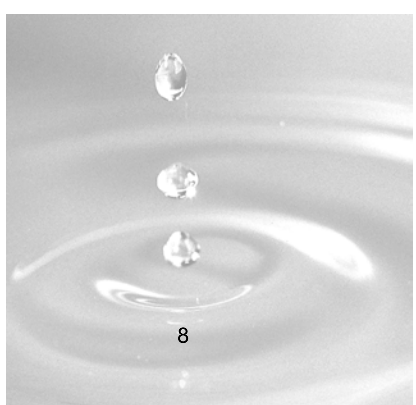
December 2019
Project 1900162



Lissa Robinson, P.E.
Senior Civil Engineer and Hydrogeologist

Frederick W. Johnson, LEP
Sr. Vice President/Principal

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GMW/LCR/FWJ:bdp

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Executive Summary

Upstream Watch retained GEI Consultants, Inc. to perform a preliminary evaluation of the Belfast Water District Water Supply as a potential water source for the proposed Nordic Aquafarms project. GEI's work also included a review of readily available information regarding the Little River Upper and Lower Dams from the perspective of their value and risks in-place and with removal. GEI's preliminary evaluation was performed to understand the potential for adverse environmental effects from development of the proposed project relative to surface and ground water resources, dam safety, and overall potential to adversely impact the fish farm operations.

Nordic Aquafarms is proposing a land-based salmon farm on more than 50 acres of land in Belfast, Maine. The project is proposed for the production of Atlantic salmon from eggs to market size using a land-based recirculating tank system. The proposed project area would include about 30 acres of land known as the "Little River Property" owned by the Belfast Water District.

Little River Upper and Lower Dams

Our review of the Little River Upper and Lower Dams indicated the dams lack critical stability and dam failure analyses to fully understand the risk and threat that the dams present. The dams are in poor condition and continue to degrade, are unlikely to meet current engineering dam guidelines, lack the infrastructure to lower the reservoirs in the event of an emergency, are at potential risk of failure, and, in the event the dams were to fail, and in the absence of analyses, they appear to present an unacceptable threat to downstream life and/or property.

Nordic's Proposed Water Supply Capacity

The intent of GEI's water supply capacity review was to understand the proposed project water use and to evaluate potential impacts to the groundwater and surface water systems which may result due to water use by Nordic Aquafarms.

Once constructed, the Nordic facility will require up to 1,200 gallons per minute (GPM) of fresh water. The proposed fresh water would come from three sources;

- Four on-site bedrock wells drilled to 500 feet are estimated to provide 455 GPM.
- 250 GPM will be extracted from Reservoir number 2 adjacent to the site.

- The City of Belfast has committed to provide up to 500 GPM from municipal wells located in a separate watershed.

We found that the Belfast Water District aquifer system appears to be capable of providing the quantity of water requested by Nordic Aquafarms.

The extraction of water from the adjacent Little River would withdraw all surface water allowed pursuant to current Maine regulations. However, the surface water extraction calculations were conducted assuming the presence of the dams and the lower reservoir. As this report summarizes, the Little River dams are potentially high risk, in poor condition and not maintained. Accordingly, their future failure is near certain without intervention. The future of the dams is not adequately considered in the Nordic application.

Nordic and their engineers have conducted on-site evaluation of potential groundwater supplies that included drilling of test wells and conducting 72-hour pump tests. These tests conclude that up to 455 GPM of groundwater is proposed to be extracted from four bedrock wells finished approximately 500 feet below the site. Additionally, the aquifer testing demonstrates that the pumping of these wells will cause salt water intrusion from Belfast Bay.

In ME DEP Chapter 375; “No Adverse Environmental Effect Standards of the Site Location Development Act”, sections 7 and 8 specifically prohibit any adverse effects to groundwater quality. Salt water intrusion is one of the adverse effects considered by the Act. The Nordic application for development does not address the consequences of the anticipated saltwater intrusion.

Potential Environmental Contaminant Considerations

During our review of material, we also identified potential environmental considerations that warrant additional investigation such as the nutrient load in the surface water runoff and discharge water from the Nordic operation, and the potential for contaminants (metals, PCBs, PFASs, etc.) in the sediments behind the dam(s). If failure occurred at these dams, the sediments would likely be mobilized.

1. Introduction

Upstream Watch retained GEI Consultants, Inc. to perform a preliminary evaluation of proposed groundwater extraction from the Belfast Water District Water Supply and/or extraction from new wells as a potential water source for the proposed Nordic Aquafarms project.

Additionally, GEI conducted a preliminary evaluation of two existing dams on the Little River that flows along the western boundary of the proposed Nordic Aquafarms project.

1.1 Project Understanding

Nordic Aquafarms is proposing a land-based salmon farm on more than 50 acres of land in Belfast, Maine. The project is proposed for the production of Atlantic salmon from eggs to market size using a land-based recirculating tank system. The proposed project area would include about 30 acres of land known as the "Little River Property" owned by the Belfast Water District. A purchase agreement between the Belfast Water District, Nordic Aquafarms, Inc., and the City of Belfast dated January 30, 2018 provides a property description. The proposed project area would also include 12 acres of property that surrounds the Lower Reservoir, which is impounded by Lower Dam. This 12-acre property includes a 250-ft-wide strip of land containing walking trails. Collectively, these parcels will be referred to as the Project Site.

The agreement indicates that Lower Dam would continue to be owned by the Belfast Water District for two years from the date of closing with the option for Nordic Aquafarms to purchase the dam within the two-year period for $1. The upper dam is upstream of the Project Site and is also owned by the Belfast Water District.

The project is proposed to be served by water from three sources; purchased from the Belfast Water District, pumped from the adjacent lower reservoir and extracted from bedrock wells. .

Most of the water will be used to constantly supply clean water to the fish tanks. A certain amount of contaminated water from the fish tanks will be generated daily. The quantity of the discharge is assumed to be the majority of the 72,000 GPD minus any relatively small amounts lost due to evaporation, spillage, and/or discharge to the sanitary sewer. Water treatment is proposed to manage feces, feed particles, and dissolved nutrients before discharging wastewater into Belfast Bay, located about 600 ft east of the proposed project. From there, wastewater is proposed to be piped into, diffused, and diluted into Belfast Bay. GEI did not review wastewater treatment or disposal as part of this evaluation.

1.2 Scope of Work

Upstream Watch retained GEI to perform a preliminary evaluation of the Belfast Water District Water Supply as a potential water source for the proposed Nordic Aquafarms project. The GEI work scope also includes a review of readily available information regarding the Little River Upper and Lower Dams from the perspective of their value and risks in-place and with removal. GEI's preliminary evaluation was performed to understand the potential for adverse environmental effects from development of the proposed project relative to surface and ground water resources, dam safety, and overall potential to adversely impact the fish farm operations.

2. Upper and Lower Dams

2.1 General

The Belfast Water District was established in 1887. Based on the 1979 U.S. Army Corps of Engineers (USACE) Phase 1 Inspection Report for Little River Lower Dam (Lower Dam), Lower Dam was originally constructed circa 1887 to impound Belfast Reservoir No. 1. The Lower Dam later failed during a flood event in 1943 and was rebuilt in 1944. The National Inventory of Dams (NID) indicates Little River Upper Dam (Upper Dam) was constructed circa 1910/1913 to impound Belfast Reservoir No. 2. In 1950, two water supply wells were installed in Belfast, and by 1980, the reservoirs were no longer used by the Belfast Water District for water supply. The locations of the Upper and Lower Dams are shown in the attached Fig. 1.

The State of Maine Dam Safety Program is administered by the Maine Department of Defense, Veterans, and Emergency Management. The program includes inspection of the dam and reservoir for hazard classification, reviewing the design and construction of new and reconstructed dams, assisting dam owners with development of Emergency Action Plans (EAP), and taking all necessary actions in emergency situations of probable dam failure to protect life and property.

Background documents for this report were obtained via email communication with Ms. Tara Ayotte at Maine Emergency Management Agency (MEMA) and from a site visit to the Belfast Water District office. A complete list of documents reviewed by GEI is included in the References section of this report. The primary documents relied upon include the following:

- Tony Fletcher's (MEMA) email correspondence to Keith Pooler, Belfast Water District, Re: #31, Upper Dam, Belfast – Condition Assessment based on a Site Inspection of 10/9/15.

- A Brief History of the Belfast Water District 1887 to Present compiled by Nancy Smith in 2003. http://www.belfastwater.org/history.htm.

- Phase 1 Inspection Report for Little River Upper Dam, National Dam Inspection Program, by the USACE dated November 1979.

- Phase 1 Inspection Report for Little River Lower Dam, National Dam Inspection Program, by the USACE dated November 1979.

- Inspection of Upper Reservoir Dam by MBP Consulting, report dated April 1998.

- Evaluation of Little River Upper and Lower Dams by Wright-Pierce dated April 1999.
- May 16, 2019 Nordic Aquafarms Application for Development to the ME DEP Bureau of Land and Water Quality.
- Hydrogeologic Investigation Report prepared for Nordic Aquafarms by Ransom Consulting, Inc. dated April 2019.

Upper Dam

Upper Dam is NID No. ME00289, State Number 5091, and Maine Emergency Management Agency (MEMA) ID No. 031. Upper Dam is located approximately 2,200 ft upstream of Belfast Reservoir No. 1 on the Little River. The dam impounds Belfast Reservoir No. 2, which has a maximum storage capacity of about 850 acre-ft and a surface area of about 48 acres. The dam is run-of-the-river with a reported hydraulic height of 30 ft.

The dam is a 216-ft-long concrete gravity dam with a central 114-ft-long, slightly arched, ogee spillway. The dam crest is 3 ft wide with a vertical upstream face and downstream face sloped at 1H:12V. The dam crest is at El. 64.9 ft, and the spillway sill is at El. 59.0 ft. Elevations are reported as NGVD.

There is a concrete training wall at the right (south) abutment and an intake tower on the left (north) abutment. There are three inlet valve operators at the intake structure, and 6-inch and 8-inch outlet pipes. The invert elevations of the outlet pipes are reported as El. 38.7 ft for the 6-inch pipe and El. 35.5 ft for the 8-inch pipe; however, on the drawing (Fig. 1 attached to this report), they appear to be switched and the elevations do not match (USACE 1979b). The third valve operator is for the 36-inch-diameter outlet in the bottom of the spillway located to the right of the intake structure, which can be used to drain the reservoir. There is additionally an 18-inch steel outlet through the north abutment with an upstream slide gate, which was replaced in 2000 (Wright-Pierce 1999).

There are bedrock outcroppings downstream of the dam, and the dam is at least partially founded on rock. On the right side of the dam, there is a concrete training wall that extends downstream with earth fill behind the wall. There is concrete stair apron on the right downstream side of the spillway, likely to protect the underlying rock from erosion (USACE 1979b). The Upper Dam is shown in Fig. 2 of this report.

Lower Dam

Lower Dam is NID No. ME00288, State Number 5090, and MEMA ID No. 030. The Lower Dam is located on Little River approximately 700 ft up from the confluence with the Atlantic Ocean on the boundary of the Towns of Belfast and Northport, Maine. The dam is run-of-the-river with a reported hydraulic height of 30 ft. The reservoir has a maximum storage capacity of 615 acre-ft and a surface area of 37 acres.

The dam is about 126 ft long, with a 91-ft-long ogee spillway. The ogee spillway is concrete with a smooth, slightly sloping apron, which then discharges over an 11-ft-high dry-stone-masonry wall.

A pump station and filter house are built integrally with the left (north) abutment and are no longer in service. The left abutment has an upstream concrete faced, dry-stone-masonry training wall. The intake structure on the left side of the spillway is dry-stone-masonry encased in concrete on the top, upstream face, and riverside face. Downstream of the intake structure is a dry-stone-masonry training wall that is partially faced with concrete. The intake gate is of unknown size and is reportedly inoperable. There are also two 8-inch-diameter water supply intakes; the locations of which are unknown (USACE 1979a).

The right (south) abutment consists of a concrete wall. The wall originally extended the length of the spillway downstream, then turned at a 90-degree angle right (south) towards the abutment, and then extended approximately 15 ft further downstream. The downstream 15 ft of the wall were removed in 1988/1989 and replaced with a modular block concrete wall extending about 104 ft downstream from the end of the spillway. The wall was extended due to erosion of the right downstream bank, which was reported to have threatened the integrity of the dam (USACE 1992).

The top of the right abutment is at El. 30.5 ft (NGVD), and the top of the right abutment is noted as El. 30.3 ft. The spillway sill is at El. 25.0 ft (USACE 1979a). The Lower Dam is shown in Fig. 3 of this report.

2.2 Dam History

Our understanding of the history, including the construction, modifications, and brief summary of inspections, is described in the following sections.

Upper Dam

1910/1913 Dam was constructed (NID).

1954 Spillway flashboards washed out in Hurricane Edna, replaced with 3-ft concrete cap (MBP, 1998).

1979 USACE performs Phase 1 Inspection (USACE, 1979b). Dam was noted as small, Significant hazard, and in fair condition. The main items of concern were the large ratio of height to width, vegetation and erosion at the earthen abutments, cracking and spalling of the concrete surfaces, and the condition of the intake tower. The report indicated the test flood (or design flood) is 50% of the Probable Maximum Flood (PMF). The spillway can only pass 44% of the design flood without overtopping the earthen abutments. There were no design or construction records for the dam. The report indicated that additional investigations are needed to assess the stability of the dam, and it was recommended that an engineer be retained to analyze stability and design remedial measures, if necessary.

1980 Reservoir no longer used for Belfast water supply (Smith, 2003).

1987 Stone masonry section of right (south) downstream training wall added (MBP, 1998).

1991 Dam surface cracks filled with "gunite" and upper portion of upstream face coated with waterproof seal (MBP, 1998).

1997 MPB Consulting performed an inspection of Upper Dam and considered the dam to be in fair to poor condition (MPB, 1998). The main items of concern included the lack of downstream apron at the tallest section of the spillway, inadequate hydraulic capacity of the intake structure, and leakage through the abandoned outlet (i.e., 18-inch outlet) in the north abutment.

2000 Wright-Pierce evaluated the dam in 1999 (Wright-Pierce, 1999). In 2000, the recommended improvements from the Wright-Pierce report were constructed, which included: control tower repaired, baskets placed on inlets to protect from debris blockage, 18-inch clay pipe in north abutment replaced with 18-inch steel pipe which was pressure grouted, upstream slide gate on 18-inch outlet repaired and significant silt on upstream side of dam removed, deteriorated concrete on north abutment and concrete tower repaired, reservoir was completed drained and topographic map of reservoir made, 36-inch pipe was successfully opened and used to drain the reservoir. A written O&M manual and EAP was prepared (Wright-Pierce, 2000). We note that the concrete apron recommended by MPB was not constructed.

2005 In a memo dated March 3, 2005, Mr. Tony Fletcher (Maine State Dam Inspector) recommended that Upper Dam be reclassified as High hazard due to the potential for loss of life at the house located downstream of the Route 1 bridge downstream of Lower Dam in the event of a breach of Upper Dam.

2010 Reservoir drawn down for reconstruction of the Herrick Road bridge downstream of the Upper Dam (Ciomei, 2011).

2011 Inspection performed by Mr. Nicholas Ciomei of MEMA (Ciomei, 2011). Mr. Ciomei noted that the spillway was spilling during the inspection, but that it appeared that some of the surface gunite had eroded off the spillway downstream face exposing the original concrete. He recommended the structure be re-inspected when there is no flow over the spillway. He also noted that Mr. Fletcher could easily remove some concrete chips from the right abutment and general cracking and spalling of the abutments. Mr. Ciomei confirmed the dam is a Significant hazard and stated that the dam is well maintained.

2015 Various emails between Belfast Water District and MEMA in August indicate that MEMA recommended performing core samples of the dam and pumping out the pool located at the downstream toe of the dam to observe conditions at the toe. Belfast Water District notes that these actions will cost money, and that they do not have the appropriate pumping equipment to complete toe dewatering. The Belfast Water District and MEMA appear to agree to keep the reservoir at the level of the 15-inch outlet pipe (we note that this is assumed to be the 18-inch outlet pipe approximately 14.7 ft below the spillway sill based on drawing in 1979 Phase 1 Inspection Report).

2015 Tony Fletcher (MEMA) performed an inspection on October 9. Mr. Fletcher concluded that the dam was in poor condition, was unsafe, needed extensive repair, and recommended the reservoir be drained to keep water load off the dam until an engineering analysis is performed and the dam is repaired.

[Subsequent to this memo, it was reported by the Belfast Water District to GEI on February 4, 2019 that the Belfast Water District agreed to keep the water level approximately 6 ft below the spillway sill, if possible; however, sometimes the outlet pipes get clogged by debris.]

2017 Mr. Fred Johnson (GEI) visited Upper Dam on December 13 and observed water flowing over the top of the spillway sill (see Photos 1 and 2 in Appendix A).

2019 Ms. Gillian Williams (GEI) visited the site on February 4. The reservoir appeared to be approximately 6 ft below the spillway sill at the time of the site visit. Ice was observed against the upstream face of the dam.

Lower Dam

1887 Dam was originally constructed (USACE, 1979a). Construction included the pump house on the north abutment with two turbines and an auxiliary steam pump (Smith, 2003).

1943 On October 17, 1943 after two days of heavy rain, an additional 4.5 inches of rain fell, which caused 10-ft granite blocks to fall off the Lower Dam. Reportedly, the water level was 5.5 ft above the spillway sill. The weakened dam then failed. The Route 1 bridge downstream of Lower Dam was destroyed, and the pump house flooded with the windows and doors washed out (Smith, 2003).

1944 Dam was rebuilt for $50,000 (Smith, 2003).

1979 USACE performs Phase 1 Inspection (USACE, 1979a). Dam was considered Significant hazard, which was considered to probably not cause loss of life but significant damage and loss of the reservoir and water supply to Belfast. Dam was noted as being in fair condition. Erosion of the upstream and downstream training walls was noted as being a concern for the project. The gate valves for the intake were not operational (i.e., there is no easy way to drain the reservoir). The report indicated there were no design or construction records, as well as no formal operation and maintenance procedures for the project. The Test Flood (or Design Flood) was considered to be 50% of the PMF.

1980 Reservoir no longer used for Belfast water supply (Smith, 2003).

1988-1989 Erosion protection project (i.e., construction of right embankment modular concrete wall extending 104 ft downstream of the end of the spillway) was constructed by the USACE for $150,000 (Smith, 2003).

1989 The Belfast Water District completed erosion repairs to the left (north) downstream bank (Wright-Pierce, 1999).

1991 Repairs made to the concrete surface of the dam (Wright-Pierce, 1999).

1999 Wright-Pierce performed an evaluation of the Lower Dam (Wright-Pierce, 1999). Wright-Pierce noted that the intake gate is still non-functional. Small trees were present along the upstream and downstream sides of the dam. Sedimentation behind the dam was unknown. Wright-Pierce did not evaluate stability of the Lower Dam because stability “has not been an issue.” Wright-Pierce recommended that an operation and maintenance plan and EAP be prepared for the dam, fences installed to limit public access, repair of the intake structure so the reservoir level can be controlled by the Belfast Water District, and an investigation as to the amount of sediment on the upstream side of the dam be made. Other than the EAP and O&M Manual, it is unknown whether these improvements were made by the Belfast Water District.

2011 Inspection performed by Mr. Nicholas Ciomei of MEMA (Ciomei, 2011). Mr. Ciomei stated that there was cracking and spalling on the concrete abutments, including one large crack in the right abutment where it meets the spillway. There was some shifting and settling of the training wall, up to 2 inches. The left abutment surface was noted as uneven and "appears to have settled and/or is losing some of the material through leaks." The downstream toe of the dam wasn't inspected due to flow over the spillway. Overall, the dam was considered to be well maintained.

2019 Ms. Gillian Williams (GEI) visited the site on February 4.

2.3 Hazard Classification

For the purpose of this report, the dam hazard classifications and definitions of the State of Maine are adopted. We note that there are differences in hazard classifications and definitions among the various regulatory authorities, e.g., the USACE, the Federal Energy Regulatory Commission (FERC), and MEMA. The fact that these differences exist should be kept in mind when reviewing other reports.

The hazard classifications are defined in Chapter 24: Dam Safety, Section 1111 Definitions, of Title 37-B: Defense, Veterans and Emergency Management, of the Maine Revised Statutes. The hazard classifications are not reflective of the condition of the dam but of the possible consequences in the event of a dam breach. The hazard classifications are as follows:

A. "High hazard potential dam" means a dam assigned the high hazard potential classification where failure or mis-operation will probably cause loss of human life.

B. "Low hazard potential dam" means a dam assigned the low hazard potential classification where failure or mis-operation results in no probable loss of human life and low economic and environmental losses. Losses are principally limited to the owner's property.

C. "Significant hazard potential dam" means a dam assigned the significant hazard potential classification where failure or mis-operation results in no probable loss of human life but can cause major economic loss, environmental damage or disruption of lifeline facilities or affect other concerns. Significant hazard potential dams are often located in predominantly rural or agricultural areas but could be located in areas with population and significant infrastructure.

Upper Dam

The following hazard classifications and/or consequences of dam breach were discussed in the available reports:

- The Phase 1 Inspection report (USACE, 1979b) indicates the potential for loss of one life (dam tender at the Lower Dam), loss of the water supply, and downstream property damage.

- The 1999 Wright-Pierce report indicates that a breach of the Upper Dam could damage or possibly destroy the Herrick Road Bridge, overtop the Lower Dam, damage or possibly breach the Lower Dam, and cause damage to the Water District offices at the Lower Dam, which could cause loss of life. A loss of the lower dam adds additional risk of damage, including a loss of the downstream Route 1 bridge. The loss of the Route 1 bridge has potential for loss of life.

- The 2005 memo by Tony Fletcher notes the potential for loss of life at the house located downstream of the Route 1 bridge downstream of Lower Dam.

- Excerpts from the EAP revised in September 2017 suggests that a breach could damage Herrick Road bridge, overtop the Lower Dam, possibly damage the Lower Dam and adjacent Water District facilities, and possibly cause loss of life.

Based on the potential consequences, as summarized in the various documents by others, and the MEMA hazard categories, it is our opinion that Upper Dam should be classified as High Hazard due to the potential for loss of life in the Water District offices located at Lower Dam and/or loss of life at the house located downstream of the Route 1 bridge and any traffic on the bridge.

Lower Dam

The following hazard classifications and/or consequences of dam breach were discussed in the available reports:

- The Phase 1 Inspection report (USACE, 1979a) indicates the potential for loss of the water supply and property damage.

- The 1999 Wright-Pierce evaluation suggests that a breach of the Lower Dam could result in damages to the Route 1 bridge and possibly to the historic structure located downstream of the bridge. A breach of the Lower Dam resulting from a breach of the Upper Dam during the 50% PMF could result in significant overtopping of the Route 1 bridge, possibly destroying it. However, the depth of overtopping of the Route 1 bridge is unclear in the Wright-Pierce report.

It is our opinion that the hazard classification for the Lower Dam cannot be determined without a formal evaluation of the consequences of failure. Consideration should be given as to whether significant overtopping of the Route 1 bridge would occur and whether overtopping would endanger public safety.

2.4 GEI Site Observations

On February 4, 2019, Ms. Gillian Williams visited the Upper and Lower Dams. Weather conditions at the time of the site visit were about 50 degrees F and sunny; however, snow and ice were covering many of the dam features, which limited visibility. It was not possible to approach many of the dam features due to fencing and safety hazards (i.e., steep slopes and ice and snow conditions), so observations are generally limited to observations from a distance away from the dams.

Upper Dam

The dam was first observed from the Herrick Road bridge located about 200 ft downstream of the dam. The 18-inch and the upper outlet (higher of the 6-inch or 8-inch outlet pipes) were discharging flow at the time of the visit (Photos 3 and 4). Water was ponded at the downstream toe, so the foundation conditions at the downstream toe were not able to be observed. Bedrock outcroppings were observed on the left downstream side of the dam. Prevalent alligator cracking with some efflorescence was observed on the downstream side of the left abutment.

The horizontal construction joint for the 3-ft concrete cap was observed on the spillway (Photo 3). In the photos taken during a GEI site visit in December 2017, the flow is disturbed at the cap construction joint, indicating either leakage through the joint or an offset in the downstream face (Photos 1 and 2). A large section of the surficial gunite has been eroded off the downstream face of the spillway below the concrete cap, exposing the original concrete beneath (Photo 4). Other areas of the gunite spillway surface have spalled, and there is significant cracking of the gunite.

The stepped apron at the right downstream side of the spillway was covered in snow and not able to be observed with any detail (Photo 13). There was some yellowish discoloration of the ice along the contact between the spillway and lower two apron steps. Ground conditions at the right downstream embankment were not able to be observed due to the snow cover. The downstream training walls on the right side were observed from a distance but difficult to see due to the ground conditions and being unable to approach the walls (Photos 12 and 13).

The reservoir was estimated to be approximately 6 ft below the spillway sill (Photo 5). The reservoir was ice-covered, and there was ice against the dam. The upstream left abutment and intake tower had prevalent cracking with efflorescence and spalling/loss of the gunite surfacing (Photos 6 and 7). There was no obvious misalignment of the crest (Photos 8 and 9). The upstream right abutment retaining wall was observed to have spalling and cracking in the gunite surface (Photos 10 and 11). There also appeared to be a failing gunite repair that was separating about ½-inch off the face of the wall (Photo 11).

Lower Dam

The Lower Dam was spilling a couple of inches over the spillway on the day of the site visit (Photos 14 and 15). The reservoir was ice covered to the top of the spillway (Photos 16 and 18). The intake that is understood to be inoperable was observed on the upstream side of the left abutment (Photo 17). As observed from the left abutment, the right abutment wall facing the spillway had cracking with efflorescence about halfway up the wall (Photos 15 and 18). The efflorescence is typically indicative of seepage having occurred through the cracks. Some vegetation was observed at the downstream toe of the right abutment wall where the wall turns 90 degrees towards the right abutment before turning back downstream. Weep holes were observed in the right downstream training wall located a couple of feet from the top of the wall (Photo 18).

The left downstream abutment consists of a masonry wall with concrete infilling (Photo 19). The wall appears to be in fair condition with some cracking in the concrete. Much of the downstream left dry masonry training walls were obscured by the water level, but there were no obvious signs of distress to the wall (Photos 20 and 21). As observed from the right abutment, the left abutment concrete wall facing the spillway was observed to have cracking with some efflorescence (Photos 21 and 22). The concrete facing on a section of the left abutment upstream training wall appears to have failed (Photo 23).

GEI talked briefly with Mr. Keith Pooler, Belfast Water District, during the site visit on February 4, 2019 and during a follow-up phone call. From this discussion, we understand the Water District has decided not to spend money on engineering analyses or maintenance/repair of the dams. Following the 2015 MEMA inspection in which Mr. Tony Fletcher recommended these items be performed, the Water District agreed to keep the water level in the Upper Dam reservoir approximately 6 ft below spillway crest. However, sometimes the outlets clog with debris and the reservoir level is higher (as evidenced by water spilling over the spillway crest during GEI's December 2017 site visit). Mr. Pooler indicated that the Water District annually exercises the gates on all four of the outlets at the Upper Dam and the 10-inch-diameter outlet at the Lower Dam.

2.5 Conclusions

A summary of our conclusions based on our review of available documents and site visit are summarized below:

- From our limited observations, we agree with the assessment by Mr. Tony Fletcher, MEMA, from 2015 that the Upper Dam appears to be in poor condition with cracking, spalling, and loss of surficial concrete. Additionally, there are no stability analyses for the dam, and the stability of the dam under the applicable loading conditions (normal pool, normal pool + ice, flood conditions, and seismic conditions) are unknown. The dam was constructed circa 1910/1913, and there are no detailed design and construction documentation. The dam is not likely to meet current engineering guidelines.

- We understand the Belfast Water District has decided to not spend funds on maintaining or rehabilitating either dam. Continued neglect will lead to seepage issues, vegetation encroachment leading to limited flow capacity, continued cracking and deterioration of the concrete, and other factors that will lead directly to eventual failure of the dams.

- Stability analyses for both dams could not be located by GEI and do not appear to exist based on the USACE 1979 Phase 1 Inspections for both dams. The stability of both dams should be calculated for the applicable loading conditions (normal pool, normal pool + ice, flood conditions, and seismic conditions). Stability calculations should consider sediment levels in the reservoirs and the downstream toe conditions, which are currently unknown for both dams. Sliding stability calculations should consider the bedrock conditions at the dams. Fill conditions at the abutments and the condition of the concrete at both dams are unknown. Explorations, such as borings drilled from the spillway crest and abutments, as previously recommended by others, may be needed for both dams.

- The reservoir at the Upper Dam is currently lowered due to safety concerns by MEMA based on their 2015 inspection of Upper Dam. GEI is unclear whether the agreed upon lowered reservoir level is approximately 6 ft below the spillway sill or the level of the 18-inch outlet (14.7 ft below the spillway sill). Regardless, it appears there are no calculations to support that the stability of the dam is adequate at the elevation of the lowered reservoir. It is also noted that the reservoir was spilling during GEI's December 2017 site visit.

- The intake located at the Lower Dam left abutment appears to be inoperable, which limits the Water District's ability to lower the reservoir pool in the case of an emergency. The Water District indicated they annually exercise a 10-inch diameter outlet at the Lower Dam.

- It appears from a review of the available documents that the Upper Dam should be considered High hazard due to the potential for loss of life at the Water District office and/or house downstream of the Route 1 bridge in the event of a dam failure. In the event of breach of both the Upper and Lower Dams during the 50% PMF event, the Wright-Pierce 1999 report indicated the Route 1 bridge could be significantly overtopped and possibly destroyed. Significant overtopping of the Route 1 bridge would jeopardize public safety.

- The 1979 USACE Phase 1 Inspections indicate that the non-overflow sections of both dams would be overtopped during a flood event less than the Test Flood (i.e., design flood of 50% PMF). Overtopping of the earthen abutments at either dam would likely lead to a failure of the dams.

- Even if further engineering studies on hazard classification determine that loss of life is not likely in the event of a failure of the dams, a failure of a Significant or Low hazard dam could result in:

    - Significant erosion of the riverbanks downstream of the dams.

    - Sediment that accumulated upstream of the dams, if any, washing downstream and causing detrimental effects on wildlife and fish habitats (including sediment washing into the confluence with the Atlantic Ocean).

    - Disruption to the general public in the event of damage to the Herrick Road and/or Route 1 bridges.

    - Economic and property damages.

- The above consequences of continued dam neglect and eventual failure would be significantly exacerbated by the development of Nordic Aquafarms between the two dams. Such additional potential impacts would include:

    - The existing use of the Little River waterway may be significantly altered due to recreational land loss and potential impacts to groundwater extraction in the watershed.

    - A dam failure would cause significant soil erosion with subsequent transfer of sediment downstream, including the bay.

    - A breach of either or both dams would significantly alter existing habitat both up and down stream. Wetlands would be lost upstream. Instream habitat would be changed with altered stream flow. Ecosystems in the bay would be impacted by a significant influx of sediment and the resulting degradation of water quality within the bay.

- The new development would be susceptible to flooding in the event of a dam breach. Flooding could be disruptive to the fish farm operations including the operational and engineering controls that prevent and/or treat discharge of contaminants to the bay.

3. Water Supply Evaluation

3.1 General

In their May 2019 application for development to the Maine Department of Environmental Protection Bureau of Land and Water Quality Nordic Aquafarms identified the need for up to 1,200 gallons per minute to operate the proposed fish farm. They propose to get this water from three sources; on-site groundwater, surface water from the adjacent lower reservoir and purchase from the Belfast water district.

GEI reviewed the application and supporting materials to understand the proposed project water use and to evaluate potential impacts to the groundwater and surface water systems which may result from use by Nordic Aquafarms of the three proposed water sources. Specifically, water use by Nordic Aquafarms may result in degradation of available quantity and water quality in both the groundwater and the surface water.

3.2 Background

A total of 1,200 Gallons Per Minute (GPM) is needed to operate the proposed Nordic Aquafarm. This quantity of water is proposed from the three sources as follows:

- Belfast Water District – 500 GPM
- Surface water withdrawal- 250 GPM
- Groundwater from proposed on-site bedrock wells- 455 GPM

The Belfast Water District entered an agreement with Nordic Aquafarms to purchase up to 262.8 million gallons per year (MGPY) or 72,000 GPD on average. Further, Belfast Water has committed to provide Nordic Aquafarms water at a rate up to 500GPM. Details of the agreement are summarized in a Public Statement from the Belfast Water District dated October 26, 2018.

Nordic plans to pump up to 250 GPM of water from the adjacent lower reservoir along the Little River. This withdrawal was estimated using an empirical calculation based upon the size of the surface water body (70 GPM) combined with the inflow rate (180 GPM) to the reservoir. These calculations were conducted pursuant to MEDEP Chapter 587.

The groundwater withdrawal of 455 GPM will come from a series of bedrock wells proposed to be drilled on the southern portion of the proposed Nordic Aquafarm project site. The 455 GPM withdrawal rate was estimated based upon the installation of several test wells and a series of four, 72-hour aquifer pump tests. These aquifer tests and information supporting the proposed groundwater withdrawal are presented in an April 18, 2019 Hydraulic Investigation Report prepared by Ransom Consulting, Inc. on behalf of Nordic.

3.3 Discussion of Potential Groundwater and Surface Water Impacts

3.3.1 Belfast Water District

An evaluation of the Belfast Water District water supply capacity and ability to serve Nordic Aquafarms was performed by Mr. Ricky Pershken of A.E. Hodsdon dated February 27, 2018.

As outlined in the Capacity Evaluation report, the City of Belfast obtains its water from the two wells within the Goose River Aquifer. These are capable of producing up to 1,750 gallons per minute (GPM) (when running alone) and have an estimated safe yield of up to 1,130 GPM (two wells operating together). The aquifer has been determined to have:

- Safe yield of 699 million gallons per year (MGY) or 1.9 million GPD.
- The current demand (2018) is 200 MGY or 548,000 GPD.
- Additional use of 14.6 MGY.
- Current reserve capacity of 484.4 MGY.

The Nordic Aquafarms is expected to use 262.9 MGY or 720,000 GPD. If water were obtained solely from BWD, the water use represents approximately 130% of the current municipal water use, more than doubling Belfast Water Districts' current supply. Regardless, the Belfast Water District would be left with an estimated 221.5 MGY of operation reserve, or nearly 32% of the total safe yield of 699 MGY.

A third well is in place within the well field but is not currently being pumped. Operation of this well could boost production to the system and provide additional reserve capacity, if ever developed.

The Goose River Aquifer is not located in the same watershed as the proposed Nordic site. All three wells in the Goose River Aquifer are relatively shallow at less than 60 ft. The water level in the wells is also shallow (generally less than 10 ft below ground surface). The wells are completed in a sand and gravel deposit related to an esker, and also within the Goose River drainage. The esker deposits may be discontinuous and separate on either side of the Goose River, but this has not been clearly identified through previous investigations. The available water in this aquifer appears to be significant, but the aquifer is likely constrained within the drainageway and the esker deposits, and with bedrock at the bottom of the channel. Pumping of the wells indicates connection between the individual wells and the river.

The existing information indicates there is a strong connection between the surface water (Goose River and surrounding wetlands) and the aquifer. Pumping of one or both wells causes drawdown in the other well, and the system stabilizes with drawdown of several feet within the aquifer.

Although the Goose River aquifer can provide the quantity of water requested by Nordic, high pumping rates are likely to cause drawdown of water within the surface water system. Drought conditions would increase the drawdown of the groundwater within the aquifer and exacerbate impact to the Goose River and surrounding wetlands.

3.3.2 Surface Water

The proposed Nordic development abuts the lower reservoir of the Belfast Water District. This reservoir was used as the Belfast water supply until circa 1980 when the Goose River Aquifer was used exclusively for water supply. Nordic proposes to pump 250 GPM from the lower reservoir as part of their required 1,200 GPM water supply.

The 250 GPM surface water pumping estimate is in Nordic's May 16, 2109 development application to the MEDEP. The estimate was derived from Maine DEP Chapter 587 regulations allowing a specified amount of water withdrawal based upon the surface area of the water combined with a portion of the base flow into the surface water. The details of the withdrawal estimates are presented in Ransom's April 2019 Hydrogeologic Investigation Report. According to this report the planned withdrawal of 250 GPM represents the entire baseline flow of the Little River into the lower reservoir.

The proposed pumping from the lower reservoir is not necessarily problematic, provided the conditions in the watershed remain the same. A significant factor to change the Little River watershed is the integrity of the two dams that create the reservoirs. As discussed in the beginning of this report both dams are significantly degraded and in need of significant repair or removal. A failure or removal of either of the dams could significantly impair Nordic's ability to withdrawal the needed 250 GPM for their operations.

In the Ransom report both dams were characterized as "run of the river" because of the bypass valves are left open. Even with the bypass open the dams still impound water. More importantly, during GEI's inspection the bypass valve was clogged with debris and the upper dam was flowing over the spillway and clogged with ice. Additionally, water was discharging from cracks in the dam. These conditions make the run of the river conditions only temporary dependent upon maintenance of dam. These dams continue to be classified as high hazard. Until they are removed or repaired, the dependence of them to support water delivery to the proposed Nordic operation is risky.

3.3.3 Groundwater

The April 2019 Ransom Hydrogeologic Investigation Report details a series of investigations that demonstrate that up to 455 GPM of sustained yield is possible from three bedrock wells under the proposed Nordic site. Specifically Ransom and its subcontractors conducted a series of four 72-hour pump tests in several configurations over a few seasons. This work informed the 455 GPM withdrawal estimate which is part of the needed 1,200 GPM for the Nordic operations. The Ransom studies show that the southern-most portion of the bedrock aquifer at the proposed Nordic site is relatively higher yielding. These tests also show some hydraulic connection to the surface water in the Little River and the lower reservoir and to Belfast Bay.

Similar to the surface water withdrawal the groundwater is somewhat connected to the lower reservoir. However, the report does not discuss the impact to bedrock groundwater yield in the event the reservoir was not there. Again, the ability to dependably obtain water from the site may be negatively impacted by a failure of one or both of the Belfast dams.

The hydrogeologic investigations involved pumping the bedrock aquifer at 100 GPM to 600 GPM over a 72-hour period. During these pump tests it was reported that salt water was eventually entrained in to the well(s). These data demonstrate that salt water intrusion from Belfast Bay would occur if the wells were developed. A salt water plume from the Bay extending under US Route 1 to the site is probable.

It is reported that the homes along US Route 1 are served by Belfast Water. Nonetheless, the groundwater under these homes, US Route I and any other properties between the site would be impaired with salt water. The Hydrogeologic Investigations acknowledges this possibility but does not estimate its' degree and extent or consequences to existing water quality.

In the ME DEP Chapter 375: "NO ADVERSE ENVIRONMENTAL EFFECT STANDARDS OF THE SITE LOCATION OF DEVELOPMENT ACT" sections 7 and 8 specifically prohibit any adverse effects to groundwater quality. In fact, section 8 states

> "In determining whether the proposed development will have an unreasonable adverse effect on ground water quantity, the Department shall consider all relevant evidence to that effect, such as evidence that:
>
> (1) The quantity of water to be taken from ground water sources will not substantially lower the found water table, cause salt water intrusion, cause undesirable changes in ground water flow patterns, or cause unacceptable ground subsidence."

The Nordic application for development and the supporting documentations does not adequately characterize of address the consequences of anticipated saltwater intrusion.

3.4 Potential Environmental Contaminant Considerations

Potential considerations related to environmental contamination include:

- What is the nutrient load in the discharge water from the Nordic operation? Increased nutrient load may lead to detriment of the water quality in the reservoir adjacent to the operation.

- The sediments behind the dam(s) have the potential to contain contaminants (metals, PCBs, etc.). Lowering of the water in the reservoirs due to a breach of one of the dams (due their advanced age and poor condition) or lowering of the water for any other reasons could expose these contaminants.

- The potential exists that per- and polyfluoroalkyl substances (PFAS) may be present in the groundwater and surface water due to the proximity of the airport to Little River and the two reservoirs.

- These PFAS compounds may also be present within the sediment of the reservoirs.

4. References

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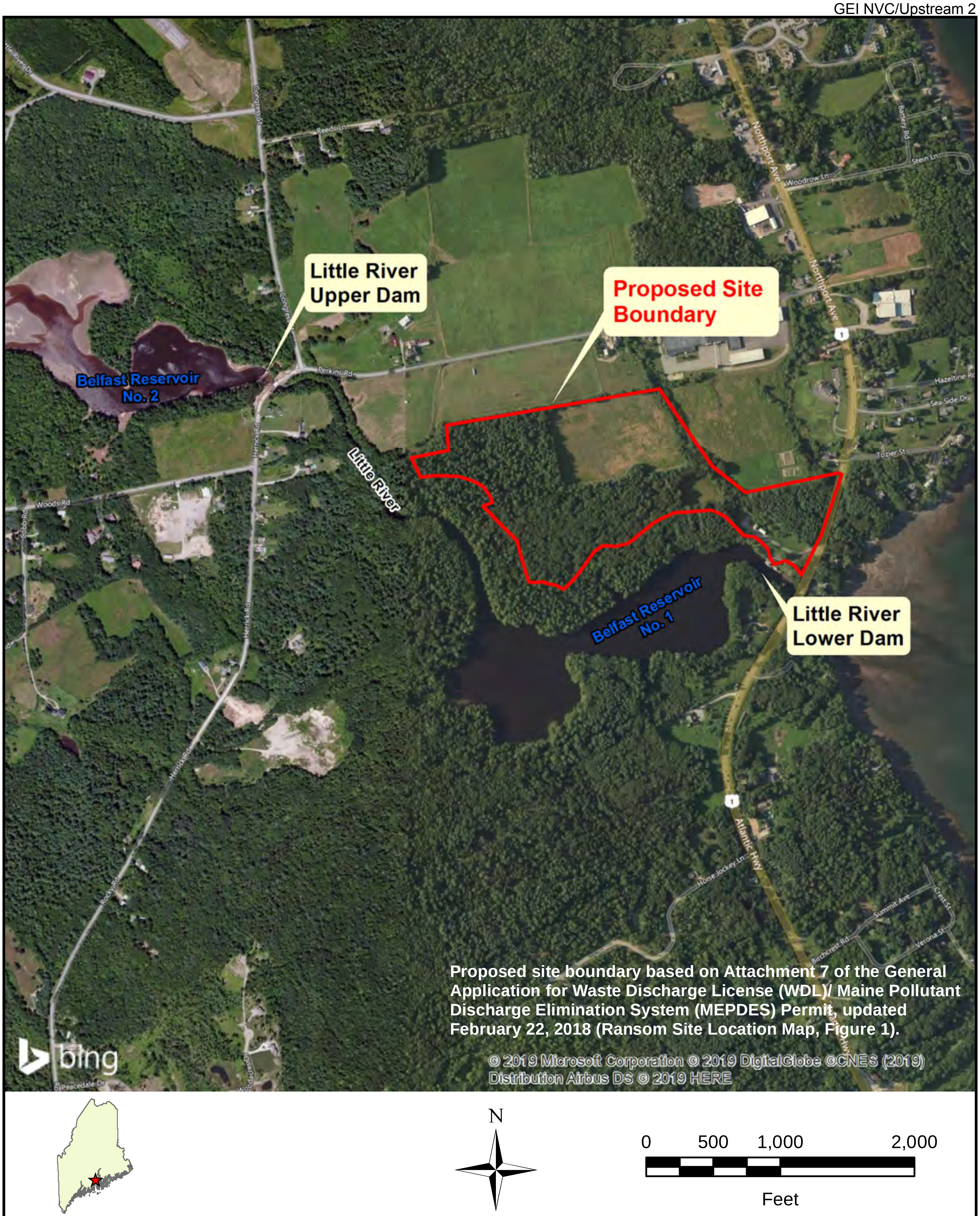

Water Supply and Dam Evaluation Belfast, Maine	GEI Consultants	AERIAL MAP
Upstream Watch Camden, Maine	Project 1900162	December 2019 Fig. 1

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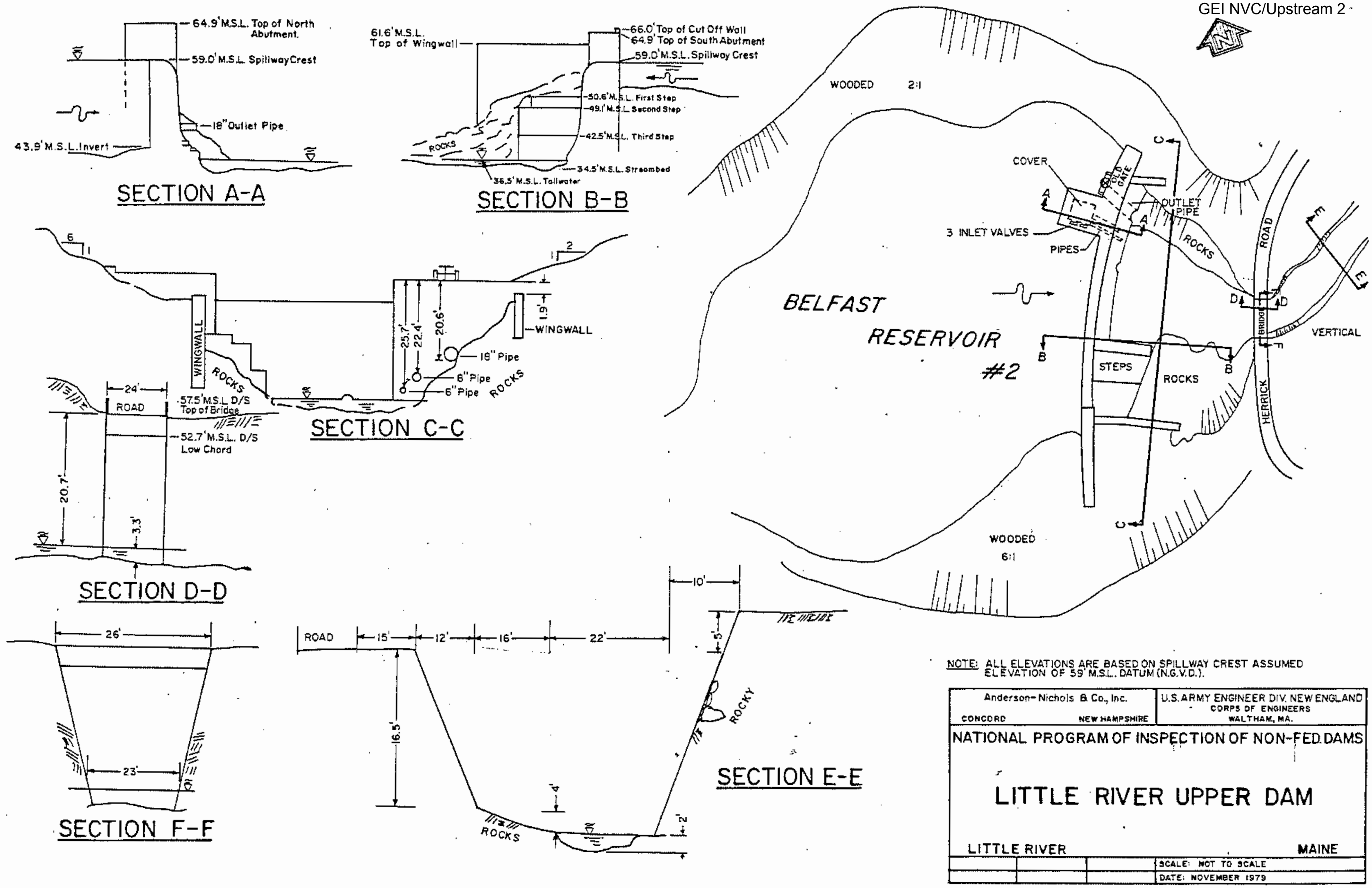
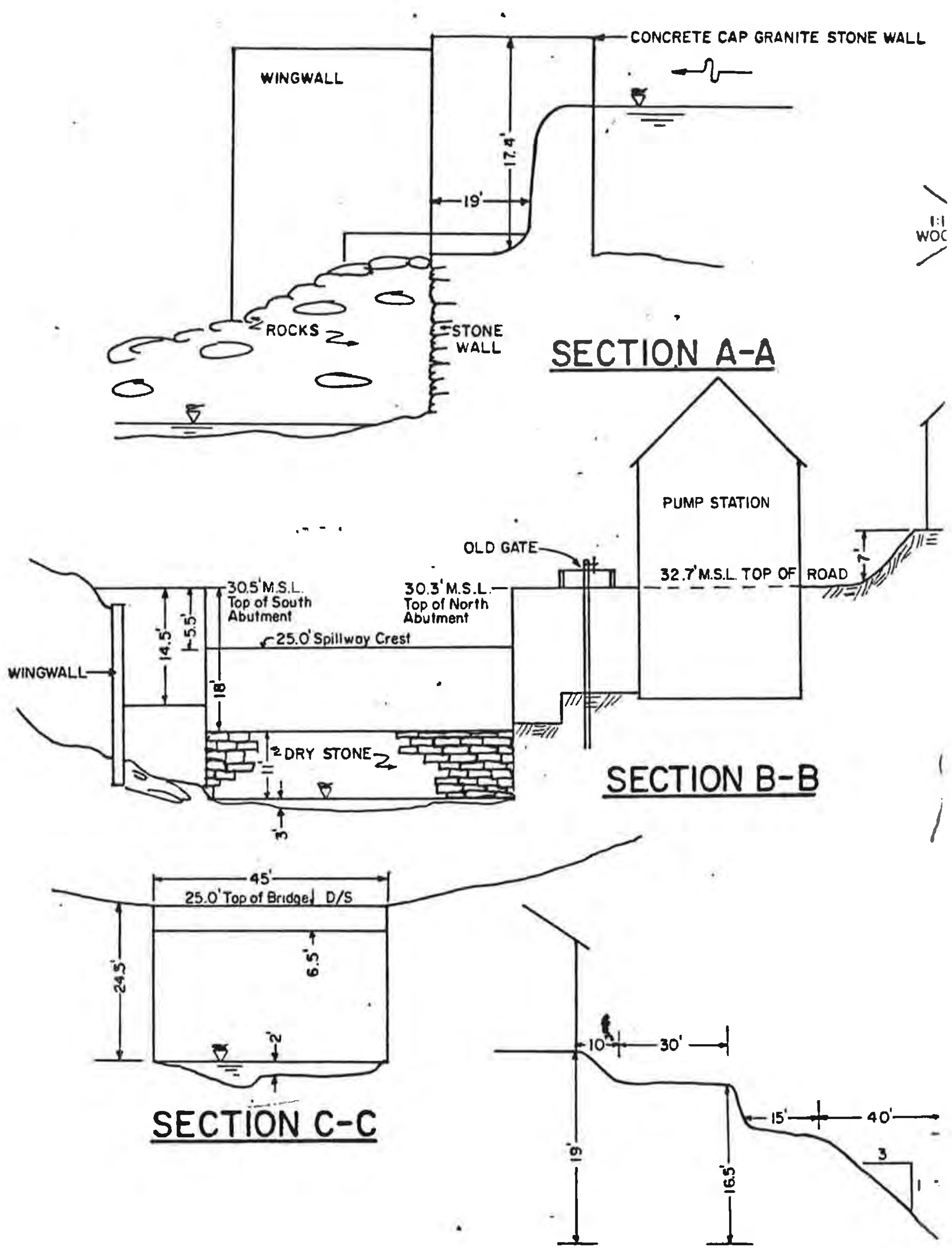
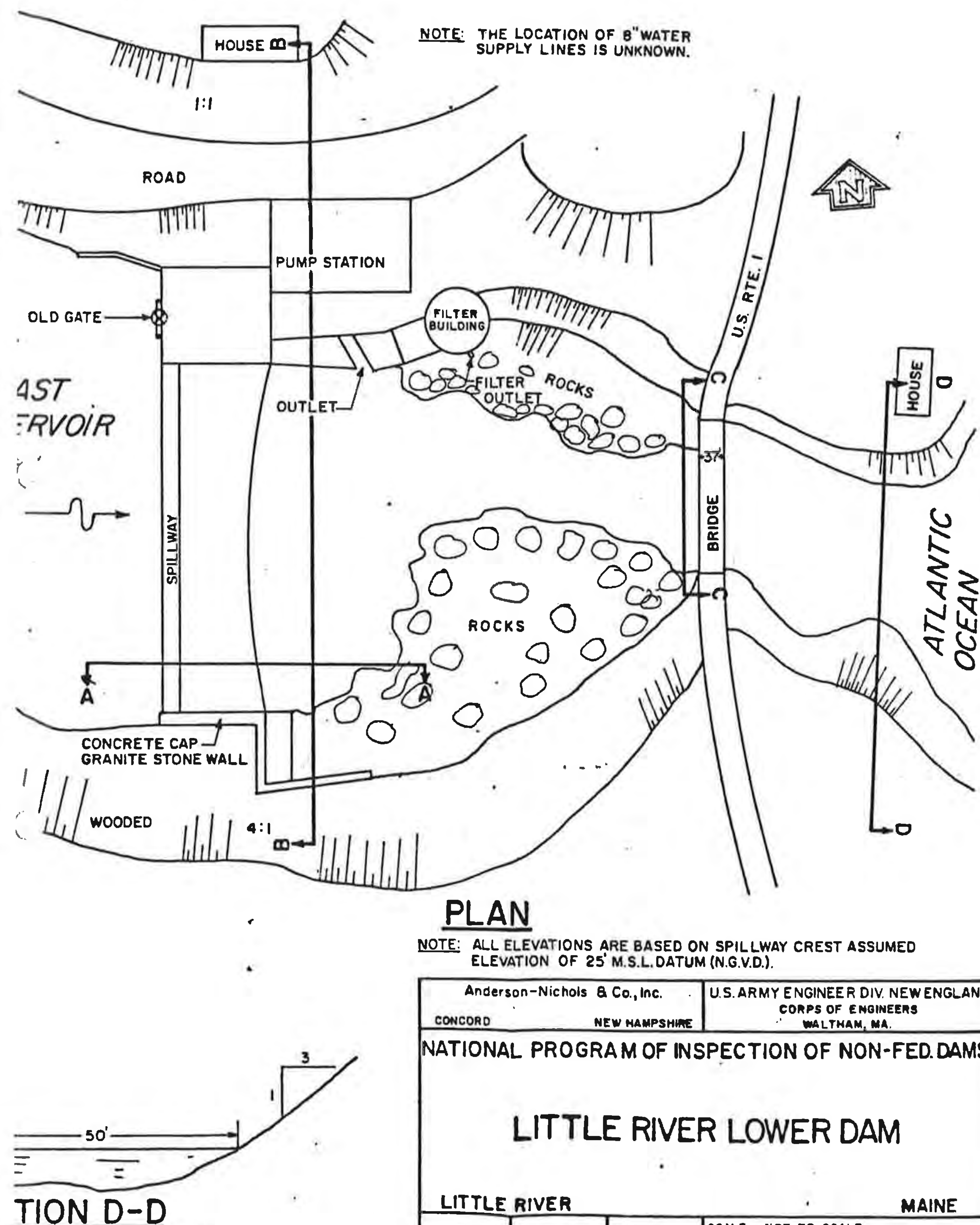


Fig. 2
Source: USACE 1979b





Anderson-Nichols & Co., Inc.
CONCORD NEW HAMPSHIRE

U.S. ARMY ENGINEER DIV. NEW ENGLAND
CORPS OF ENGINEERS
WALTHAM, MA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

LITTLE RIVER LOWER DAM

LITTLE RIVER MAINE

SCALE NOT TO SCALE
DATE: NOVEMBER 1979

FIGURE B-1

Fig. 3 (USACE 1979a)

Appendix A

Site Visit Photographs – February 4, 2019

Photo No. 1 – Upper Dam - Site visit in December 2017. Note water over spillway.


Photo No. 2 – Upper Dam - Site visit in December 2017. Note water over spillway.

Photo No. 3 – Upper Dam – Downstream face. Note 18” and 8” outlets flowing.

Photo No. 4 – Upper Dam – Downstream side of left abutment and spillway. Note cracks in abutment and loss of surficial concrete on spillway.

Photo No. 5 – Upper Dam – Upstream face. Note reservoir approximately 6’ below spillway sill.

Photo No. 6 – Upper Dam – Upstream side of left abutment. Note 18” gate stem and cracking and spalling concrete.

Photo No. 7 – Upper Dam – Upstream side of left abutment and spillway. Note ice against spillway face.

Photo No. 8 – Upper Dam – Dam crest, looking right.

Photo No. 9 – Upper Dam – Spillway sill, looking left.

Photo No. 10 – Upper Dam – Upstream side of right abutment retaining wall. Note spalling concrete.

Photo No. 11 – Upper Dam – Right abutment retaining wall, looking right. Note cracking and failing concrete repairs.

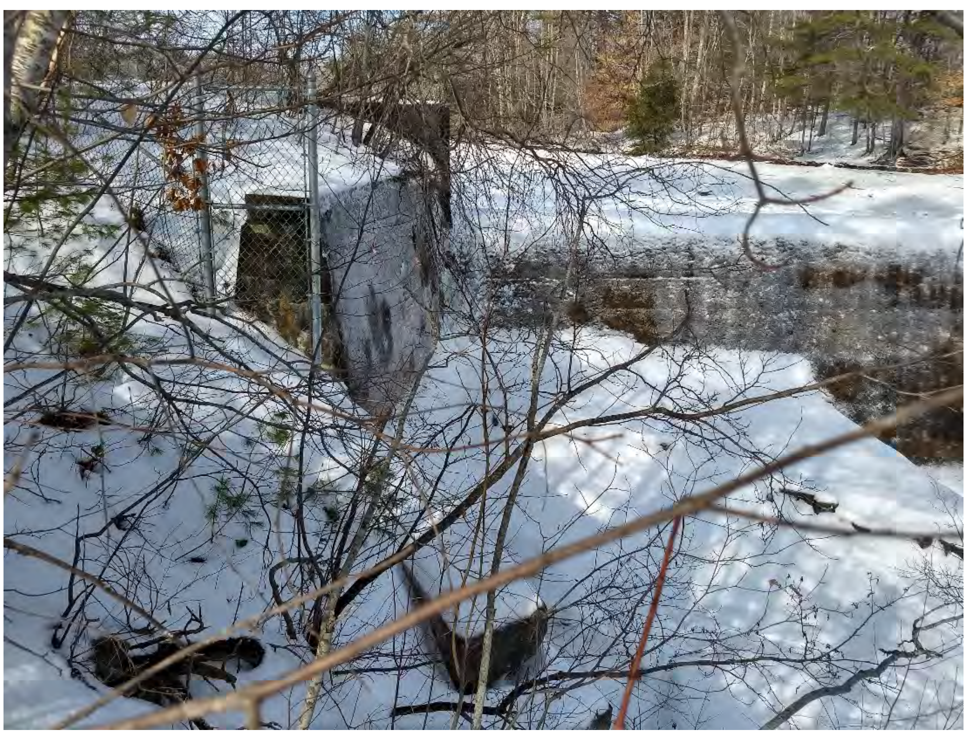


Photo No. 12 – Upper Dam – Right downstream side of spillway and downstream training wall.

Photo No. 13 – Upper Dam – Downstream side of dam. Note right abutment training wall and concrete apron.

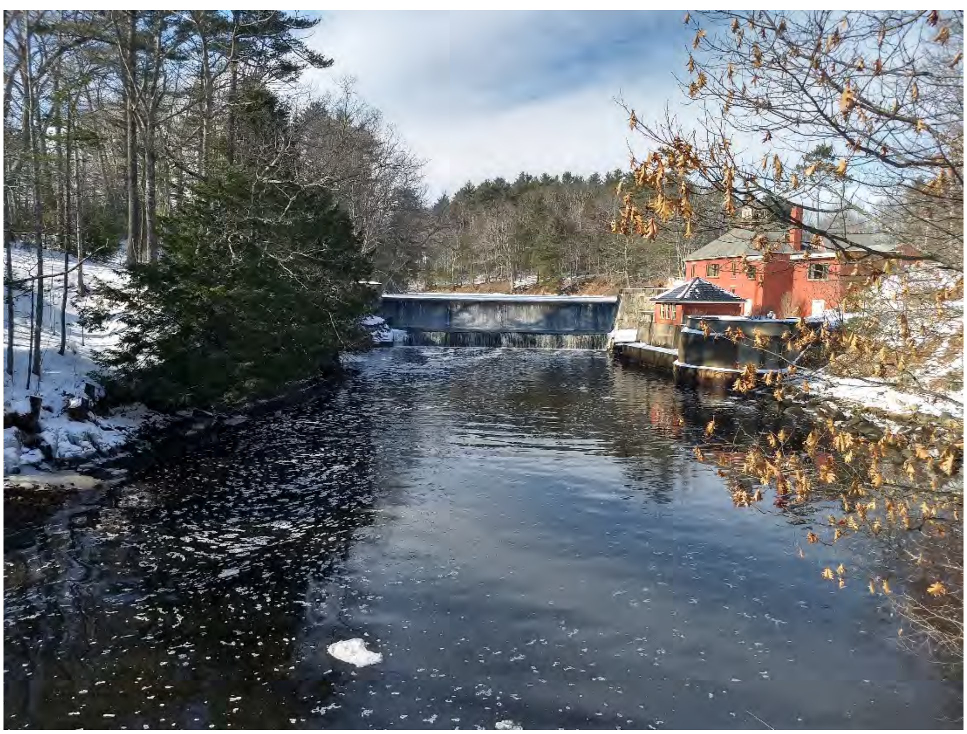


Photo No. 14 – Lower Dam – Downstream side of spillway, looking upstream.

Photo No. 15 – Lower Dam – Downstream side of spillway. Note spilling by a couple of inches, vegetation on right downstream toe.

Photo No. 16 – Lower Dam – Upstream side of Left Abutment, looking downstream.

Photo No. 17 – Lower Dam – Intake on left abutment.

Photo No. 18 – Lower Dam – looking right. Note cracking with efflorescence on right abutment.

Photo No. 19 – Lower Dam – Downstream side of left abutment.

Photo No. 20 – Lower Dam – Downstream masonry training wall on left side.

Photo No. 21 – Lower Dam – looking towards left abutment. Note cracking with efflorescence on left abutment.

Photo No. 22 – Lower Dam – Upstream side of right abutment.

Photo No. 23 – Lower Dam – Upstream left abutment training wall. Note section where concrete facing appears to have failed.

Attachment 2

Key Staff Resumes

Frederick Wain Johnson, LEP
Regional Manager/Senior Vice President

Frederick Johnson is the Manager of GEI's eastern Region operations. He joined GEI after spending 12 years as a Director of Environmental Programs with United Technologies Corporation's (UTC's) Corporate and Pratt & Whitney Division's environment, health and safety departments.

In that capacity, Mr. Johnson had extensive experience dealing with senior corporate management relative to legal, financial, public relations, technology development, and ethical issues relating to corporate environmental programs. Mr. Johnson helped establish and was responsible for the oversight of nearly $800 million of remediation liability that had been expended or reserved. Mr. Johnson had direct responsibility for the technical, financial, and project management of a portfolio of over 300 matters with residual environmental liabilities. In addition to the remediation responsibilities, he directed the corporation's environmental programs relative to compliance, pollution prevention, management systems, auditing, and due diligence.

Prior to his time with UTC, Mr. Johnson spent eight years in environmental consulting, three years with government regulatory agencies, and three years with the Appalachian Mountain Club, a non-profit environmental conservation and education organization. He has been a project geologist on a number of state and federal Superfund sites, including the first federal emergency response action at the Brodhead Creek manufactured gas plant (MGP) site in Pennsylvania. He has managed numerous hydrogeologic investigations and site remediation projects for a variety of clients and has conducted environmental due diligence assessments throughout the United States and the world.

Since joining GEI, Mr. Johnson has been the project manager or principal-in-charge on a variety of diverse projects including; complex remediation/redevelopments, environmental compliance management assessments, flood control system assessments and recertification and litigation support. Much of Mr. Johnson's experience is associated with the acquisition and divestiture of small and large manufacturing assets where he had to assess risks and present them to management in a timely manner to facilitate a transaction.

As a former industry executive and client, Mr. Johnson understands what is needed to accomplish a client's ultimate objective and protect their interests. He has been challenged by providing high level review of numerous matters without getting lost in technical details, while maintaining technical competency to be able to understand the details in case they become relevant.

Mr. Johnson regularly provides expert services for several prominent law firms and industries.

EDUCATION
M.S., Engineering Science, Rensselaer Polytech Institute
B.A., Environmental Earth Science, Eastern Connecticut State University

EXPERIENCE IN THE INDUSTRY
37 years

EXPERIENCE WITH GEI
15 year(s)

REGISTRATIONS AND LICENSES
Licensed Environmental Professional, CT No. 366
Registered Sanitarian, CT No. 325

PROJECT EXPERIENCE

Environmental Due Diligence Assessments, Various Clients. Working in consulting and at UTC, involved in numerous environmental due diligence projects. Experience ranges from conducting the field work and writing reports, to working with the acquisition team to integrate the environmental issues into the transaction. Developed the corporate policy for UTC on acquisitions and divestitures. Managed the due diligence for the first industrial joint venture in St. Petersburg, Russia. Been part of the UTC executive acquisition team for numerous potential acquisitions, including UTC's successful $2-billion acquisition of the Sundstrand Corporation. While at GEI Mr. Johnson has managed numerous acquisition or divestiture projects ranging from relatively small commercial properties to significant industrial facilities.

Environmental Management Systems/ISO 14000, Various Clients, Various Sites. As the Director of Environmental Programs at UTC's Pratt & Whitney division, led the effort to refine the management system to conform with requirements for ISO 14001 registrations. Pratt & Whitney received a commendation from Underwriters Laboratories for ISO 14001 "umbrella" registration for five major sites and the corporate function in September 2000. During the early 1990s, served as a key contributor to the development and implementation of an Environmental Health and Safety management system across UTC's worldwide operations. Policies and procedures were developed that defined the corporation's standard of care in various environmental media for almost 250 manufacturing operations worldwide. Technical training, resource evaluations, and auditing were conducted to implement and provide assurance that there was compliance with the management system.

Litigation Support/Insurance Recovery, Various Clients, Various Sites. Spent over 10 years providing technical support to the plaintiff in one of the country's largest cost recovery claims against insurance policies for environmental impairment. This complex case involved numerous sites, multiple insurers, differing policies and both first- and third-party claims. Responsible for supporting the case in many ways, including reviewing cost estimates, prioritization of claims, providing testimony, and preparation of expert witness testimony. In the third-party recovery portion of these suits, served as the representative for the plaintiff in a six-week jury trial in federal court. The jury verdict was overwhelmingly supportive of the plaintiff's claims against the insurance policies. While at GEI, Mr. Johnson has been an expert witness in several matters for clients including; General Motors, Union Carbide, Pfizer, Pepsi Bottling, and U.S. Fire Insurance. Most of this litigation has been for the defendant and involve allocation of responsibility for environmental contamination.

Permitting and Closure of Waste Handling Facilities, Various Clients, Various Sites, CT. Extensive experience with permitting, closure and corrective action under the Resource Conservation and Recovery Act (RCRA). Worked for the Connecticut Department of Environmental Protection (CTDEP) as an analyst in the RCRA closure and permitting unit. Written and supervised several RCRA closures. Involved in a leading industry group that participated in the drafting and review of the EPA's proposed regulations and administrative reforms for RCRA corrective action. Responsible for site remediation of several facilities which were subject to RCRA corrective action orders and/or permit conditions. Negotiated with the regulatory agencies and managed the site remediation under these programs. Mr. Johnson is currently the Project Manager on a major RCRA Corrective Action Site that is being conducted under the first "Stewardship" permit issued in Region I EPA.

Remediation Technology, Various Clients, Various Sites. As part of the development of the site remediation programs at UTC, identified critical gaps in technology that were impeding site cleanup. Through collaboration with Canadian and United States universities and internal research associates secured funding and project management resources to advance technologies in the areas of in-situ oxidation of dense non-aqueous phase liquids (DNAPLs), oxidation of organic substances in air and water, waste streams, treatment of arsenic in water using zero valent iron, and advanced field techniques to characterize DNAPL distribution in soils. Through this work at least three patents were obtained and all technologies were field-tested.

Superfund and Site Remediation, Various Clients, Various Sites, ME. Experienced in all aspects of site remediation ranging from project geologist conducting field studies to manager of all aspects of remediation and administration for $30 million, sole-PRP Winthrop Landfill Superfund Site in Maine. Direct line responsibility for the administration of over $15 million in remediation spending annually. Oversight responsibility for all of UTC's remediation spending of over $50 million annually. This involved extensive involvement with the financial management and third party auditors to develop and support reserve accounting pursuant to Securities and Exchange Commission standards and guidance. Invited lecturer at numerous forums on experience and expertise in remediation program management. These include The Information Network for Superfund Settlements, The Connecticut Bar Association, the United States Environmental Protection Agency (EPA), universities and law schools, and various business associations.

PREVIOUS PROJECT EXPERIENCE

Environmental Due Diligence Assessments, Various Clients, St. Petersburg. Working in consulting and at UTC, involved in numerous environmental due diligence projects. Experience ranges from conducting the field work and writing reports, to working with the acquisition team to integrate the environmental issues into the transaction. Developed the corporate policy for UTC on acquisitions and divestitures. Managed the due diligence for the first industrial joint venture in St. Petersburg, Russia. Been part of the UTC executive acquisition team for numerous potential acquisitions, including UTC's successful $2-billion acquisition of the Sundstrand Corporation.

Environmental Management Systems/ISO 14000, Various Clients, Various Sites. As the Director of Environmental Programs at UTC's Pratt & Whitney division, led the effort to refine the management system to conform with requirements for ISO 14001 registrations. Pratt & Whitney received a commendation from Underwriters Laboratories for ISO 14001 "umbrella" registration for five major sites and the corporate function in September 2000. During the early 1990s, served as a key contributor to the development and implementation of an Environmental Health and Safety management system across UTC's worldwide operations. Policies and procedures were developed that defined the corporation's standard of care in various environmental media for almost 250 manufacturing operations worldwide. Technical training, resource evaluations, and auditing were conducted to implement and provide assurance that there was compliance with the management system.

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AWARDS

Park Brownfield Redevelopment, *"Developers Showcase Blue Ribbon Award 2007",* The Real Estate Exchange Connecticut Real Estate Awards resume

Elizabeth C. Robinson, P.E., C.G.
Senior Civil Engineer, Hydrologist, Land Planner

Background

Ms. Robinson is a Senior Civil Engineer, Hydrologist, and Land Planner at GEI Consultants, Inc. with 30 years of consulting experience. Lissa has worked across the country providing expertise in civil and water resource engineering with particular emphasis in the areas of surface water and ground water hydrology, and hydraulic engineering.

Her work as a scientist, project manager, and land planner has helped guide industrial facilities, manufacturing companies, and municipal, state, and federal organizations with investigation, licensing, permitting, remediation and redevelopment of sites. She has worked extensively with clients to evaluate the effects of flooding and inundation, and the resiliency of structures, systems, processes, and equipment to impacts such as riverine flooding, erosion and sediment transport, extreme precipitation, sea level rise, storm surge, and wave run-up.

Ms. Robinson has provided Expert Witness/Litigation Support where she has evaluated claims, prepared expert opinions, given depositions, and provided trial testimony. This support assisted attorneys and clients in evaluating and interpreting third-party expert evidence and opinions.

In addition to her hydrologic and hydraulic analysis for the hydropower industry, Lissa also has experience in coastal engineering in the areas of wave generation and propagation analysis, shoreline protection, and coastal zone impacts. She has performed investigations of flood heights, wave climate analysis, and wave run-up and erosion studies.

PROJECT EXPERIENCE

HYDROLOGIC AND HYDRAULIC ANALYSIS

Hydraulic Model and Scour Analysis, Framingham, Massachusetts. Analyzed river channel hydraulics, and sediment mobilization for a range of flow conditions. Project included development of hydraulic model, calibration to observed flow conditions, simulation for a range of flows, and comparison with published thresholds of sediment transport. Purpose of the work was to quantify the potential for contaminated sediment mobilization at depth.

Hydraulic Model, Structure Remediation, Ohio River, Ohio. Developed 2-dimensional hydraulic model to evaluate flow characteristics associated with remediation of structure at FERC licensed hydroelectric generation addition to pre-existing USACE lock and dam. Work was conducted under both USACE and FERC regulatory requirements. Project included preparation of Temporary Emergency Action Plan for construction activities.

Jet Plow Evaluation, multiple locations, Confidential Clients, Maine, New Hampshire, Massachusetts, Connecticut. Evaluation of the impacts of jet plow cable installation practices on contaminant and sediment mobilization in coastal and riverine setting. Work included research on the impact of grain size, tides and currents on sediment redistribution and the potential for re-distribution of buried hazardous constituents to surface sediments.

EDUCATION
M.S., Community Planning and Development, University of Southern Maine - Muskie School of Public Service

Post Graduate Studies, Geology, University of Southern Maine

Post Graduate Studies, Engineering Hydrology, Imperial College, London, England

B.S., Civil Engineering, Tufts University

EXPERIENCE IN THE INDUSTRY
30 years

EXPERIENCE WITH GEI
7 years

REGISTRATIONS AND LICENSES
Professional Engineer, ME No. 6839
Professional Engineer, NH No. 14286
Professional Engineer, VT No. 0100451
Certified Geologist, ME No. 341

TRAINING
Computational Fluid Dynamics (CFD) Workshop with Flow-3D
Risk Informed Decision Making Level 2, FERC Division of Dam Safety
ASDSO Hydrologic Modeling Using Geospatial Information
ASDSO Loss of Life Consequences for Dam Failure Scenario
ASDSO Legal Responsibilities of Dam Owners, Operators, and Regulators
Erosion and Deposition Modeling with RiverFLO-2D
Princeton Training in Ground Water Pollution & Hydrology
NWWA Ground Water Geochemistry
40-Hour OSHA Hazardous Materials Training
Professional Liability Education Training
Harvard Negotiation Training
ASFE Institute for Professional Practice

PROFESSIONAL ASSOCIATIONS
Geological Society of Maine

GEI Consultants

Dam Failure Analyses, Multiple Dams, Confidential Client, California. Conducted hypothetical fair weather and PMF failure and flood wave routing for more than 60 dams using HEC-RAS and GIS. Models included both 1-dimensional and 2-dimensional unsteady flow analysis. The evaluations were performed in accordance with FERC Engineering Guidelines and included multiple downstream dam failures and sensitivity analyses of breach parameters and Manning's n-values. Work included the preparation of inundation maps and final reports.

NHDES, Alton Dam and Milton Three Ponds Dam, multiple towns, New Hampshire. Hydrologic and hydraulic (H&H) analyses to estimate the inflow design floods HEC-HMS and hydraulic modeling of hypothetical dam failure to evaluate inundation boundaries resulting from modeled gate operations and changes in reservoir elevation.

FirstLight, Northfield Mountain Pumped Storage Project, Northfield, Massachusetts. Hydraulic modeling of hypothetical dam failure to evaluate inundation boundaries resulting from modeled gate operations and change in reservoir elevation.

<u>COASTAL WATER RESOURCE MODELING AND MONITORING</u>

Tidal Restoration Feasibility. West Branch Pleasant River, Addison, Maine. Designed and implemented a program to evaluate issues surrounding the reintroduction of tidal flow to the West Branch Pleasant River. Evaluated hydraulic flow conditions and water elevation data to assess impacts on existing and proposed tide gates. Evaluated the potential impact on water supply wells, septic systems, roads, and culverts. Study included an assessment of well location, depth and water quality testing to relate to historic and proposed tidal influence.

Town-wide Water Resource Evaluations, multiple municipalities, Maine. Performed town-wide evaluations of water resources. Studies included water resource inventories, an evaluation of resource threats, and recommendations for the future protection of water resources. Studies were performed in the following Maine towns: Bar Harbor, Blue Hill, Islesboro, Long Island, Owls Head, South Bristol, Vinalhaven, and Westport.

Beach Erosion Potential, Lobster Cove, York Sewer District, York, Maine. Evaluated shoreline retreat at proposed sewer district pumping station. Analysis included the compilation of maps showing historic shorelines and tide levels, aerial photograph interpretation of shoreline trends, seismic refraction survey to assess the bedrock surface and its role in slowing potential shoreline retreat, shoreline mapping to evaluate land cover proximal to the project. Evaluation provided information on the rate of landward migration of the beach berm.

Wave Runup and Rates of Erosion, Stone's Point, Cushing, ME. Evaluation of shoreline erosion and recommendations for shoreline protection of coastal property. Work included vertical and horizontal survey of shoreline to document existing conditions, compilation of tidal data, flood elevation assessment, wave climate analysis, grain size analysis of bank material, and slope stability analysis to assess the need for bank stabilization. Assisted in obtaining approvals for the implementation of shoreline protection.

<u>FLOOD INVESTIGATION AND MITIGATION</u>

FEMA Flood Map Appeal, Commercial Property, Worcester County, Massachusetts. Developed hydraulic model and preparation of supporting materials for FEMA flood map appeal for large commercial property in Worcester County, MA. Project involved compilation of detailed terrain in the area of interest and a refinement of hydraulic model that subdivided watershed into smaller units. Deliverable was the completed model and a refined 1% annual chance flood inundation area.

Expert Witness, Rainfall Runoff and Flood Investigation, Massachusetts. Evaluated storm event and flood inundation at commercial property that caused damage to site infrastructure and property. Provided sworn statement of findings as part of proceedings.

Stormwater Management Analysis, Woburn, Massachusetts. Developed 2-dimensional hydraulic model to evaluate onsite ponding and flooding, and offsite runoff from a range of precipitation events. Work was performed to evaluate onsite capacity for detaining stormwater in existing containment systems and to evaluate containment under proposed modifications.

Gillian M. Williams, P.E.
Geotechnical Engineer/Project Manager

Ms. Williams is a geotechnical engineer with 13 years of experience including dam inspections, seepage and stability analyses, internal filter/drainage design, settlement analyses, retaining wall design, subsurface investigations, and preparation of geotechnical reports. She has performed construction observation for dam and canal rehabilitation projects. She has participated in numerous FERC Part 12D inspections and PFMA review sessions with an approved Independent Consultant. Ms. Williams is proficient in AutoCAD Civil 3D, GeoStudio, PLAXIS 2D and 3D, Snailz, Microsoft Word, and Microsoft Excel.

EDUCATION
M.S., Civil Engineering, Colorado School of Mines
B.S., Civil Engineering, Union College

EXPERIENCE IN THE INDUSTRY
13 years

EXPERIENCE WITH GEI
10 years

REGISTRATIONS AND LICENSES
Professional Engineer, CO No. 44917
Professional Engineer, ME No. PE15473

CERTIFICATIONS
OSHA 10 Hr Construction Safety

PROFESSIONAL ASSOCIATIONS
WTS, Member

PROJECT EXPERIENCE

East Norfolk Development Drilling Program Plan, Brookfield Renewable, Norfolk, NY. Project Manager. Reviewed existing information to determine possible causes of seepage and sinkhole development at the dam left abutment. Prepared Drilling Program Plan to perform drilling and grouting of soluble bedrock in the vicinity of the sinkholes.

Clifford D Craig Memorial Dam, Western Virginia Water Authority, Roanoke, VA. Project Manager. Performed the first dam inspection report and PFMA session in general accordance with FERC guidelines for this non-FERC regulated dam. The safety inspection report was prepared according to the FERC Part 12D Safety Inspection Report outline. The dam is a 243-foot high RCC dam constructed on karst bedrock with a history of seepage.

Lake Spaulding Dams Part 12D Inspection, PG&E, Nevada County, CA. Project Engineer. Performed the Tenth Part 12D Safety Inspection for Lake Spaulding Dam Nos. 1, 2, and 3, as required by the Federal Energy Regulatory Committee (FERC) along with the FERC-Approved Independent Consultants. Participated in the PFMA review session. Prepared the Part 12D Safety Inspection Report, PFMA Addendum, and updated STID for review by the FERC.

Northfield Mountain Pumped Storage Project Part 12D Inspection, FirstLight Power Resources, Northfield, MA. Project Engineer. Performed the Ninth Part 12D Safety Inspection as required by the Federal Energy Regulatory Committee (FERC) along with the FERC-Approved Independent Consultant. Participated in the PFMA review session. Prepared the Part 12D Safety Inspection Report and PFMA Addendum for review by the FERC. Also prepared updates to the STID and SMP for review by the FERC.

Moosehead Storage Project Part 12D Inspection, Brookfield Renewable, Somerset County, ME. Project Engineer. Performed the Ninth Part 12D Safety Inspection for the East and West Outlet Dams as required by the Federal Energy Regulatory Committee (FERC) along with the FERC-Approved Independent Consultant. Participated in the PFMA review session. Prepared the Part 12D Safety Inspection Report and PFMA Addendum for review by the FERC.

Brassua Dam Slope Remediation Project, Brookfield Renewable, Rockwood, ME. Project Manager. Prepared a FERC approved Drilling Program Plan for subsurface investigation through embankments at a high hazard dam in Rockwood, Maine. Coordinated and oversaw subsurface investigation, including borings using cased rotary wash methods, Standard Penetration Tests (SPTs), and rock coring. Casagrande-type piezometers were installed in select borings. Prepared geotechnical data report and recommended material strength properties for final design. Responsible for preparation of SEEP/W and SLOPE/W analyses at six cross-sections at the embankments. Reviewed and responsible for 50% design package, including design report and drawings, for submittal to FERC. Design includes internal filter/drainage system and flattening of the downstream slopes to improve factors of safety for stability. Currently preparing 100% Design Submittal.

New Exchequer Dam and McSwain Dam Spillway Condition Assessments, Merced Irrigation District, Mariposa County, CA. Inspection Lead. Performed field inspection of spillway concrete structures at two high hazard dams. Reviewed record drawings, historical construction photographs, and historical documents. Prepared Spillway Condition Assessment reports for both dam spillways with results of document review, spillway condition assessment, conclusions, and recommendations for safety of the spillways. Participated in focused Potential Failure Mode Analysis (PFMA) for both spillways with the FERC and DSOD.

Lakeview Hydroelectric Project, Kruger Energy, Colonial Heights, VA. Project Manager. Reviewed prior stability analyses and field investigations by others. Performed seepage and stability analysis for the left embankment under IDF conditions. Provided recommendations to Owner based on stability results.

Flagstaff Dam Part 12D Inspection, Brookfield Renewable, ME. Project Engineer. Performed the Eighth Part 12D Safety Inspection as required by the Federal Energy Regulatory Committee (FERC) along with the FERC-Approved Independent Consultant. Prepared the Part 12D Safety Inspection for review by the FERC.

Stillwater Dam Part 12D Inspection, Hudson River-Black River Regulating District, Webb, NY. Project Engineer. Performed the Seventh Part 12D Safety Inspection as required by the Federal Energy Regulatory Committee (FERC) along with the FERC-Approved Independent Consultant. Prepared the Part 12D Safety Inspection for review by the FERC.

Conklingville Dam Part 12D Inspection, Hudson River-Black River Regulating District, Hadley, NY. Project Engineer. Performed the Third Part 12D Safety Inspection as required by the Federal Energy Regulatory Committee (FERC) along with the FERC-Approved Independent Consultant. Prepared the Part 12D Safety Inspection for review by the FERC.

Seismic Stability for the Scrubber Sludge Complex, Tennessee Valley Authority, Drakesboro, KY. Project Manager. Performed liquefaction triggering analyses on borings and CPTs at four cross-sections at the gypsum fly ash and gypsum embankments. Calculated post-earthquake strengths for layers that triggered. Performed pseudo-static and post-earthquake stability analysis.

Guntersville Dam Seepage and Piping Potential Evaluation, Tennessee Valley Authority, Guntersville, AL. Project Engineer. Performed review of historic documents related to seepage and piping of the 75-year-old dam constructed on karst bedrock. Evaluated potential for seepage and piping, performed calculations to assess the factor of safety against heave of the dam toe, performed post-earthquake stability analyses, and was part of a team that created a GIS database of available information for the dam. Participated in the risk assessment conference to assess risk for potential failure modes (PFMs) relating to seepage and piping potential at the dam.

Korty Dam Fuse Plug Replacement, Nebraska Public Power District, Paxton, NE. Project Engineer. Reconstruction of fuse plug spillway that was breached during September 2013 flood event. Determined material properties and performed seepage and stability models for fuse plug. Calculated erosion rate for fuse plug using WinDamB and USBR methodology. Prepared design report, technical specifications, and design drawings. Prepared final construction report for submittal to the FERC.

Northern Supply Canal Toe Drain Design and Construction, Nebraska Public Power District, North Platte, NE. Project Engineer. The Northern Supply Canal was constructed in the 1930's and has been experiencing seepage in select locations since construction. Header, pipe and toe drains were installed in 1936 to control seepage in select locations. Analyzed data from observation wells and weekly monitoring of 10 toe drain locations for total suspended solids, turbidity, flow rate and temperature. Performed seepage and stability analyses for a local stability berm and drainage system for 10 toe drain locations to prevent piping along the conduits and improve downstream slope stability. Prepared design report, design drawings, and technical specifications for the proposed stability berm and drainage system. Performed on-site construction observation and prepared final construction report for submittal to the FERC.