Appendix C

Geotechnical Information - "Input to Feasibility Study", dated October 23, 2007, by GEI Consultants, Inc.

GEI Consultants

October 23, 2007
Project 06400-0

Geotechnical
Environmental and
Water Resources
Engineering

Mr. Richard L. Stewart, P.E.
Principal Civil Engineer
The Louis Berger Group, Inc.
100 Elm Street, Suite 203
Manchester, NH 03101

Dear Mr. Stewart:

Re: Input to Feasibility Study
Replacement or Removal of the Taylor River Dam
Hampton and Hampton Falls, New Hampshire

The purpose of this letter is to provide input regarding geotechnical and water supply well issues to the Louis Berger Group (Berger) feasibility study for replacement or removal of the Taylor River Dam. The site location is shown on Figure 1.

The I-95 highway embankment forms the main body of the dam across the Taylor River. However, the New Hampshire Department of Environmental Services (NHDES) Dam Bureau and the New Hampshire Department of Transportation (NHDOT) have generally referred to the overflow structure at the north end of the embankment, adjacent to the highway bridge, as the Taylor River Dam or the Taylor River Pond Dam (Dam No. 106.08). For this report, when we refer to the Taylor River Dam (or simply, the Dam), we are referring to only the overflow structure. We will refer to the overflow structure between the Dam and the historic location of the Taylor River channel as the Taylor River Relief Structure. The Dam Bureau refers to this structure as the Taylor River Pond Dike (Dike No. 106.09). The Dam Bureau refers to the dam at Coffins Mill that is owned by Fran Rice as the Taylor River Pond Dam (Dam No. 106.06). In this report, we will refer to that dam as the Rice Dam.

Based on our review of readily available information:

1. The available geotechnical information is sufficient for identification of major issues associated with dam replacement but is not sufficient for final design of a replacement dam.

2. The replacement of the Dam in the proposed location in the historic Taylor River channel is feasible from a geotechnical perspective.

3. The identified water supply wells in the vicinity of the Dam are bedrock wells used mostly for residential potable water supply.

4. We do not know whether any existing water supply wells are being affected by salt water.

5. The removal of the Dam is unlikely to significantly affect the salinity in the existing potable water supply wells, but this would need to be evaluated in detail in future studies.

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Scope of Work

We performed the following scope of work:

- Collected and reviewed readily available published information on the geology of the project area.
- Reviewed available geotechnical and foundation information in the NHDOT Bureau of Materials and Research's files and obtained from the NHDOT Bureau of Bridge Design regarding the Taylor River Bridge and Dam and the Taylor River Relief Structure.
- Collected and reviewed available information from the New Hampshire Department of Environmental Services Dam Bureau regarding the Dam, the Taylor River Relief Structure, and the Rice Dam.
- Collected and reviewed readily available information from the NHDES on water wells in the project vicinity.
- Visited the site and observed the bridges and dams indicated above and the surrounding areas.
- Formed initial opinions as to the feasibility of replacing the Dam and the potential impacts of salt water on the nearby water wells following Dam removal.
- Discussed potential design alternatives with the Berger team.
- Prepared this report to be incorporated into the Berger Feasibility Report. This report: 1) describes the available geotechnical data for the existing Dam, 2) presents the readily available data for water supply wells in the vicinity of the existing Dam, 3) presents our initial opinions and recommendations on geotechnical issues associated with replacement of the Dam, and 4) presents our initial opinions and recommendations on the potential for salt water intrusion affecting nearby water wells following the removal of the Dam.

We also requested available information on the Towle Farm Road Bridge over the Taylor River from the NHDOT and the Towns of Hampton and Hampton Falls but were unable to obtain any information.

Existing Geotechnical Data

Published Geology and Soil Survey Information

We reviewed published information on bedrock and surficial geology, published Soil Survey information, and information available from the "GRANIT" website. Table 1 contains a list of available references. The GRANIT (Geographically Referenced Analysis and Information Transfer) website is New Hampshire's statewide geographic information system and contains information on a number of topics, including transportation, geology, land use, and conservation and wetland areas. The website address is: http://www.granit.sr.unh.edu/. The search engine within GRANIT can be accessed directly at:

http://www.granit.sr.unh.edu/cgi-bin/load_file?PATH=/data/database/index.html

We have included selected references or information from references in Appendix A (Published Geological Information) and Appendix B (Soil Survey Information).

Bedrock Geology

The 1969 publication, **The Geology of the Seacoast Region,** (Reference 9) identifies the bedrock in the project area as part of the Kittery Formation, possibly containing slate, phyllite, schist, quartzite, or lime-silicate rock. Figure A1 contains the applicable portion of the map from that reference, and Figure A2 is the map legend. Table A1 contains an excerpt from the text of the reference that describes the conditions.

Surficial Geology

The surficial geology maps of the Exeter and Hampton quadrangles (References 3 and 8) show interpretations of surficial geology for the western and eastern portions, respectively, of the project area. The interpretations have been incorporated into the mapping available on the GRANIT website (Reference 7) to provide a combined picture. Figure A3 was obtained from the GRANIT website. Table A2 contains descriptions of the map units, based on the descriptions in Reference 3.

The surficial soils within the Taylor River's historic course and the level areas to either side are identified as salt marsh deposits – partly decomposed organic material mixed or interbedded with estuarine silt, clay, and sand. Soils just upslope from these areas to either side of the river are identified as glaciomarine silt and clay. In the higher elevations, the soils are identified as glacial till.

The 1953 publication, **Clays of Southeastern New Hampshire, A Preliminary Report,** (Reference 4) describes the extent of marine clays in the New Hampshire Seacoast area. It indicates that in the project area, the clay deposits follow the course of the Taylor River and underlie the Estuarine (salt marsh) deposits and portions of the adjacent Glaciomarine (glacially deposited sand, silt, and clay) deposits. The report describes potential commercial uses of the clay but does not provide helpful geotechnical information.

Soil Survey Information

The Rockingham County Soil Survey (Reference 10) provides very detailed information on the soil within 5 feet of the ground surface. It contains aerial photographs with the various map units (areas within which soils are similar) delineated, and the text of the reference contains descriptions of the soils in each unit. These delineations have been incorporated into the mapping available on the GRANIT website (see Figure B1). Appendix B contains copies of applicable pages with soil descriptions from the Soil Survey.

The Soil Survey information describes the surficial soils along the Taylor River's historic course as "Ipswich mucky peat." The rest of the project area is divided into a number of different map units, but the soils in most of those units are generally described as "sandy loam."

NHDOT Geotechnical Information

We have reviewed the following NHDOT geotechnical information. The elevation datum is not given on the drawings. We expect that the datum was NGVD 1929, which is about 0.8 foot below NAVD 1988 in this area.

- 1948 drawings for the Taylor River Bridge under what is now the southbound I-95 embankment. These drawings included a boring location plan and logs of 21 borings that were drilled to the west of the highway embankment, presumably to identify a location for the bridge. Appendix C contains copies of the boring plan, logs, and legend. The information from the borings can be summarized as follows:

  - Historic Taylor River Channel: Fifteen of the borings (Borings 1 through 19; no data were available for Borings 4, 6, 9, and 11) were performed in a nearly level area at approximate El. 4 adjacent to the historic Taylor River channel. These borings encountered deposits of very soft organic soils, described as soft peat, peaty silt, silt, and mud, extending to depths of up to 22 feet (El. -18). These soils were underlain by a layer of clay that extended to depths of up to 57 feet (El. -53). The clay was generally very soft to soft, but in places, the upper part of the clay (as much as 10 feet) was stiff to very stiff. In some of the borings, the upper part of the clay layer was found to contain layers of sand or silty sand, with occasional mention of shells or gravel in the logs. The clay was underlain by loose to medium dense fine sand and clay, with some zones containing gravel. This layer ranged from 4 to 20 feet in thickness. Refusal, interpreted on most of the logs as bedrock ("ledge") or a boulder, was encountered just below the sand layer, at depths of about 50 to 70 feet in these borings.

  - Lower River Bank: One of the other borings, No. 26, appears to have been drilled up on the river bank, at El. 9, and encountered no soft organic soils at the surface, but instead encountered 14 feet of silty sand with little clay. Below this sand, the boring encountered conditions similar to those in the borings described above: 20 feet of soft clay, underlain by 15 feet of loose to medium dense sand and clay. The top of this sand/clay layer was at El. -25. The boring was stopped, possibly upon refusal, at a depth of 49 feet (El. -40).

  - Upper River Bank: The remaining 5 borings (Borings 21, 22, 23, 24, and 25) were drilled higher on the bank to the north of the Taylor River channel. The ground surface was at about El. 13 for these borings. These borings encountered no soft organic deposits. The surficial soils were medium dense to dense sand and silt with little clay, extending to depths of 12 to 15 feet. In 3 of these borings, the surficial sand was underlain by 2 to 13 feet of soft to medium stiff clay, which was underlain in turn by dense to very dense sand and gravel. In the other 2 borings, the surficial sand was underlain directly by the dense to very dense sand and gravel. This dense granular soil appears to be different than the sand found beneath the clay in the other borings. The top of the dense granular soil ranged from El. -15 to +1. The borings were stopped at elevations ranging from -22 to -8, though refusal was noted for only one of the borings.

The drawings indicate that the bridge consists of a concrete slab supported by sheetpiles driven to elevations varying from -8 to -12, into the dense sand underneath the clay. It appears that the bridge location was selected so that it could be easily founded in the dense sand. The river channel is indicated to be at El. 0, and the underside of the top slab is at El. 8. The bridge span is 15 feet.

- A 1953 drawing showing modifications to the Dam. The drawing does not include geotechnical information but indicates that the sheetpiles making up the Dam were to have been driven to elevations varying from -13 to -22. Based on the boring logs described above, these sheetpiles would have been driven into the dense sand and gravel underlying the clay. The overflow portion of the Dam is indicated to be at El. 8, and the nonoverflow portions are shown at El. 11. The plan of the Dam appears to be similar to the existing condition. The drawing shows stone fill against the downstream face of the overflow section, though no stone is now visible in this area. The drawing shows no stoplogs or fishway (fish ladder).

- 1971-72 drawings for the extension of the Taylor River Bridge under the proposed (now existing) northbound embankment. One of the drawings includes a boring location plan and logs of 3 borings. The borings found dense to very dense granular soils and cobbles from the ground surface to refusal at El. -33 to -22. A copy of this drawing is included in Appendix C.

  The bridge extension followed the same design as the original bridge, except that all of the sheetpiles are shown to be driven to El. -12. The drawings show the overflow of the Dam at El. 7.8. They also show proposed rehabilitation of the existing sheetpiles, by means of 3/8-inch steel plates attached to the portions of the sheetpiles between El. 2.75 and 7.25.

- 1971-72 drawings for a contract (Project P-1235-B, Contract 2) for construction of the current northbound embankment from Route 107 to Towle Farm Road, with the exception of a 1,065-foot length where the highway crosses the historic location of the Taylor River. That 1,065-foot portion was apparently in another contract, the drawings for which are not available. Fortunately, the available contract drawings show some information in the Taylor River area, on the highway profiles and cross sections. The cross sections show the then-existing ground surface and the bottom of the "muck." They indicate that the muck was to have been excavated within the footprint of the highway embankment and that a sand drainage blanket was to have been placed in the bottom of the excavation before the embankment fill was placed. The muck excavation ranged up to about 30 feet in depth, down to approximate El.-20. No boring logs are included in the drawings.

- 1971-72 drawings (Revised 1975) for the Taylor River Relief Structure (corrugated metal culvert and sheetpile overflow structure). These drawings do not contain boring logs, but they show the foundation for the inlet structure to consist of sheetpiles driven to El. -25. The drawings show the overflow crest at El. 9 and a concrete apron downstream of the overflow at El. 6. They also show that the culvert was originally to be located to the south of its present location, in the historic channel of the Taylor River, at Sta. 195+00. The 1975 as-built information indicates that the location was shifted to Sta. 196+50 during construction, to an area where the geotechnical conditions were more favorable. Based on the 1948 boring logs, the current location, which is close to Boring No. 26, is outside of the limits of the soft organic soils and where the soft clay is not as thick. It appears that the sheetpiles would have reached the sand/clay layer underlying the soft clay. These drawings also show the sand drainage blanket indicated in the above Project P-1235-B drawings.

Supplemental Geotechnical Investigation

No supplemental geotechnical investigation was performed for this project.

Reconnaissance Summary

Taylor River Dam and Relief Structure (Dam No. 106.08 and Dike No. 106.09)

Background Information

The I-95 embankment forms the main body of the Dam across the Taylor River. The Dam, located at the north edge of the pond, is a steel sheetpile structure with an overflow section, built about 1950. The 1953 drawing (see above) shows the layout and dimensions of the Dam but not the existing fishway. We reviewed no information on the fishway, but we understand from Berger that it was built in the late 1960s. The downstream channel for the Dam is the Taylor River Bridge, under I-95. The drawing indicates that the crest of the overflow is at El. 8 and that the bottom of the channel is at El. 0.

The Taylor River Relief Structure (No. 106.09) is the sheetpile overflow structure located to the south of the Dam. The details of this structure are shown on the 1974-75 drawings described above. The drawings show the overflow to be at El. 9, slightly higher than the Dam.

Appendix D contains a copy of information we obtained from the NHDES Dam Bureau on these structures, including a report of a 2004 inspection by the Bureau. Information on the dams is also available from the NHDES online database. The database indicates that the Dam is 18.5 feet high (the height of the I-95 embankment above the historic river channel), with a 37-acre impoundment and a drainage area of 10.6 square miles. The database indicates that the Relief Structure is 11 feet high, with a 37-acre impoundment and a drainage area of 10.6 square miles.

The NHDES online database indicates that the Dam is classified as a Class A Structure and that the Relief Structure is classified as a Class AA Structure. According to a January, 2005 Dam Bureau memorandum, the Bureau indicated that the Dam should be reclassified as a Class B structure. According to the New Hampshire dam regulations, the design storms for dams are as follows:

Dam Classification		Design Flood	
Class	Hazard Potential	Existing Dams (pre-1981)	New Dams
AA	Not a Menace	(Not indicated)	50-year
A	Low	50-year	100-year
B	Significant	100-year	½ PMF
C	High	250% of 100-year	PMF

Site Observations

Our observations are based on our September 26, 2006 site visit. The highway embankment that forms the main part of the Dam is in excellent condition, with a very wide crest, gentle slopes, and no apparent seepage from the downstream slope. The sheetpile structure is heavily corroded, with major leakage through the sheetpiles. The crest of the overflow has been raised by about 0.7 foot (to approximate El. 8.5 feet) by means of wooden flashboards. There appears to be a steel chute, perhaps a foot wide and several inches high, through the sheetpiles, about 1 to 2 feet below the tops of the flashboards. We do not know its intended purpose. As indicated above, the stone fill that is shown on the 1953 drawings against the downstream face of the overflow section is not present. We do not know whether it was never placed or was carried away by heavy flows. At the time of our site visit, the water level in the pond was about an inch above the tops of the flashboards.

The fishway is located to the right of the Dam, and flow through the fishway enters the basin on the downstream side of the sheetpiles by means of a rectangular hole cut in the sheetpiles. At the time of the September 26 visit, little, if any, water was flowing through the fishway. The concrete structure has suffered from deterioration, but generally appeared to be in fair condition.

Little of the channel underneath I-95 (i.e., the Taylor River Bridge) was visible, but those visible portions appeared to be in good condition. The rock-lined channel downstream of the I-95 embankment was in good condition.

The Taylor River Relief Structure appears to be in good condition, though some vegetation and debris are present at the entrance. At the time of our site visit, the water level in the pond was several inches lower than the overflow crest. The culvert passing underneath I-95 is in reasonably good condition. The invert is paved. We understand that the paving was done within the past two years because of severe corrosion of the pipe invert. The rock-lined channel downstream of the outlet was in good condition at the time of the site visit.

Rice Dam (Dam No. 106.06)

Background Information

The Rice Dam is a stone and earth dam located on the Taylor River just upstream of the crossing of Old Stage Road over the river. The NHDES database indicates that the Rice Dam is 14 feet high, with a 6.3-acre impoundment and a drainage area of 9.75 square miles. No drawings of the Rice Dam are available.

Appendix D contains a copy of the information in the NHDES Dam Bureau files on the Rice Dam. The information includes a 2004 inspection report by the Bureau. The inspection report indicates that the Rice Dam is 125 feet long, with a 52-foot-wide by 5-foot-high spillway, a 10-foot-wide by 3.7-foot-high spillway, and a 2.5-foot-square low level gate.

The NHDES online database indicates that the Rice Dam is classified as a Class A (Low Hazard Potential) Structure. Therefore, the design flood for this structure would be the 50-year flood.

Site Observations

Our observations are based on our September 26, 2006 and January 11, 2007 site visits. The Rice Dam is constructed of cobbles and boulders, mortared in places. It is possible that the entire dam was mortared but that the mortar has fallen out in many locations. In a number of locations, mortar has separated from adjacent stones, indicating movement of the stones.

The right-hand portion of the Rice Dam consists of a concrete wall, apparently an overflow section, about 10 feet wide. Immediately adjacent to the concrete section, a 15- to 20-foot length of the dam is as much as 4 feet higher than the concrete overflow. The crest of the remainder of the dam is slightly lower than the concrete overflow. It is possible that the left-hand portion of the dam was originally at the same elevation as the middle section but was either removed or washed away. The crest of most of the dam appears to be about 6 to 8 feet above the downstream toe. The 14-foot dam height listed in the NHDES database could be based on the higher middle portion. At the time of the September 2006 site visit, no water was flowing over any part of the dam, and water was leaking through the dam at several locations. At the time of the January 2007 site visit, the pond level was as much as several inches above the left-hand part of the dam, and water was flowing over that section. Only a trickle of water was flowing over the concrete section.

A gated low-level outlet, about 2.5 feet square, is located at the base of the concrete section. A mechanism to operate the gate is not visible.

Foundation Considerations for Dam Replacement

We understand that the options being considered for the Taylor River Dam include elimination of the Dam and replacement of the Dam with a similar type with either the same or a slightly lower crest elevation. We understand that a replacement Dam would be located on the upstream edge of the I-95 embankment at the historic Taylor River channel, and that it would consist of an overflow structure conceptually similar to the existing Dam, with an adjacent fishway structure. Water flowing over the structure would flow into an open channel underneath a new highway bridge. In plan, the Dam would be rectangular or U-shaped, with an overflow weir on either the upstream side or three sides. The ends of the Dam would tie into the highway embankment.

We believe this type of structure is feasible. Due to the soft underlying soils, the structure should be supported on piles that penetrate the "muck" and clay and bear in sand or till underlying the clay (at El. -45 to -75, or possibly deeper). A seepage cutoff should be provided along the upstream edges (3 sides) of the structure. The cutoff should consist of sheetpiles driven into the clay soils (El. 0 to -25) or driven through the clay into the underlying sand or till and should be tied into the existing highway embankment. If the sheetpiles are driven into the denser soils, than they could serve as both the support piles and the seepage cutoff.

We recommend that the fishway structure be supported on deep foundations, also.

Potential Impacts of Salt Water on Water Supply Wells Following Removal of the Dam

One of the options currently being considered for this project is removal of the Dam. Because the Dam acts as a boundary between the fresh water of the Taylor River and seawater of the Atlantic Ocean, elimination of the Dam would permit the tidal seawater to travel up to approximately 0.6 mile upstream to the Towle Farm Road Bridge and possibly as much as 1 mile upstream to the Rice Dam (see Fig. 1). A number of potable water supply wells are located near this stretch of the River, so we evaluated the potential for salt water intrusion to affect these wells following removal of the Dam.

Topographic and Tidal Elevation Constraints

The average high tide in the vicinity of the Dam measured by Berger between September 26 and November 2, 2006 was approximate El. 5 (NGVD). The topographic and bathymetric data collected by Berger for this project indicates that the bottom of the Taylor River is at El. 5 or below as far upstream as the Towle Farm Road Bridge. Some areas between the Towle Farm Road Bridge and the Rice Dam are also below El. 5, but it is not clear whether a continuous channel below El. 5 exists in this area.

If the Dam is removed, the width of the estuarine tidal area beyond the current Dam location would be limited by the topographic contours within the Taylor River. Assuming that the new I-95 bridge and the existing bridge at Towle Farm Road would not restrict tidal flows during spring tide conditions, estuarine conditions could exist well upstream of Towle Farm Road toward Rice Dam.

This estuarine area, based upon the 5-foot (NGVD29) contour, would be about 21 acres, or roughly half of the existing impoundment area.

The relatively small area covered by salt water limits the likelihood of the Taylor River to become a source of water flow into the underlying aquifer. In addition, based on topographic relief and the elevation of water in the wells near the Taylor River Pond, we expect that the diminished Taylor River would be a "gaining stream," which obtains water from the surrounding overburden aquifer. We expect that as a result, the overall flow within the system would be from the fresh water aquifer into the Taylor River, thereby inhibiting salt water intrusion into the overburden aquifer.

Geologic Constraints

A review of the bedrock and overburden geologic maps of the area (see Table 1 and Appendix A) and 1948 borings conducted by NHDOT (Appendix C) indicates that the Taylor River is underlain by fine grained (silt- and clay-sized) sediments. Beneath the fine grained fluvial sediments lie glacial till and then bedrock. The fluvial sediments and glacial till are likely to have low hydraulic conductivities, especially in the vertical direction. These low hydraulic conductivity materials generally inhibit the ability of salt water to intrude significantly into the bedrock aquifers. We also believe that the basal flow of the aquifers toward the ocean and the associated fresh water lens overlying the salt water wedge will limit the potential for salt water intrusion.

Based on studies conducted along coastal areas in New England (Table 2), the salt water and fresh water interface should be limited by these geologic conditions and the likely low pumping rates associated with residential potable water usage. The studies indicate that:

- Little to no salt water intrusion occurred beyond ¼ mile from the ocean; and
- Significantly impacted bedrock potable water supply wells were usually within 200 ft of the ocean and had a direct hydraulic connectivity through bedrock to the ocean.

Water Supply Well Data

We understand from representatives of the towns of Hampton and Hampton Falls that there is no public water service in these towns and that the only private water company is Aquarion Water, who serves parts of Hampton. We understand from a representative of Aquarion that their service does not extend west of I-95. Therefore, in areas potentially affected by the project, we believe that all water supply is by means of private household wells and community water supply wells.

Since 1984, the State has required submittal of installation data for new water wells, and the NHDES maintains a database of this installation data. In general, the State does not have information on wells installed before 1984, except for wells that are used as public water supply or community wells. Some of the installation data in the State's database has been incorporated into the NHDES GIS system. The NHDES Geology Unit (New Hampshire Geological Survey) conducted 3 searches for us on this project: 2 for wells in the GIS system (one centered on the Dam and one centered at Coffin's Mill (Rice Dam)) and one for all wells in Hampton and Hampton Falls in the general database. We included data from these searches in Appendix E. Figures E1 and E2 are the location plans produced by the 2 GIS searches. Based on our evaluation of the potential effects on wells described above, we have prepared Figure E3, which shows the wells located within ¼ mile of the existing pond, and Table E1, which is the summary of data for those wells. Table E2 is the data summary for wells that are not listed in Table E1 but are listed in the NHGS general database for Hampton and Hampton Falls and appear to be within ¼ mile of the Taylor River Pond. Some of the well location information is missing, so some of the wells we included in

Table E2 may be more than ¼ mile from the Pond. Also included in Appendix E is the NHDES description of the fields in the summary tables.

Note that it is likely that a number of wells within ¼ mile of the Taylor River Pond are not listed in these tables, either because they were installed before 1984 or because the required well installation logs were not submitted to the State. Either a house-to-house field survey or research of tax assessment records or both would be necessary to account for wells not included in the Appendix.

Wells being used for public/community water supply are regulated by the State, regardless of the date of installation of the wells. Well locations and laboratory test data are available from the NHDES "One Stop Program GIS" website. Figure E4 is a plan of public water supply well locations from the website, and Table E3 contains data from the website for those wells. Three active wells (2 wells serving Taylor River Estates and 1 serving the Hemlock Haven mobile home park) are within ¼ mile of the Taylor River Pond.

All of the water supply wells in Tables E1, E2, and E3 are identified as bedrock wells. We expect that wells in the vicinity of the Taylor River that are not in the state database also typically draw water from the bedrock aquifer and not the overburden aquifer. We expect that the bedrock wells draw water from a deep regional bedrock aquifer that likely flows southeast toward the ocean. Typical household potable water supply wells in bedrock draw in water at a low rate, because the water contained within the well acts as storage, allowing for a slow, steady flow of water during pumping conditions. Consequently, we do not expect to observe a large radius of influence with most of the bedrock wells.

Summary of Salt Water Intrusion Potential Following Dam Removal

Based on our review of published studies and existing project information, we expect that the removal of the Dam is unlikely to affect the usability of potable water supply wells that draw water from bedrock aquifers. All of the nearby wells that are listed in the NHDES database are bedrock wells, and we expect that the potable water wells that are not listed are also bedrock wells. Although unlikely, it is possible that any individual well may be connected via bedrock fractures in a more direct way to the Taylor River than is currently known. In that event, wells within 200 feet of the Taylor River Pond would be most likely to be influenced, although salt water intrusion has been reported as much as ¼ mile inland. Groundwater flow analyses based on additional data collection would be necessary to better evaluate potential limits of salt water intrusion. In general, public/community water supply wells are more likely to be affected than household wells, due to the higher rate of pumping that could draw water from a greater distance.

It is possible that wells that draw water from overburden aquifers also exist within the project limits. These wells would be more susceptible to negative effects from salt water intrusion. Further work, in the form of house-to-house field surveys, would be necessary to establish their locations.

We appreciate the opportunity to work with you on this project. Please call me at 781-721-4084 if you have any questions.

Sincerely,

GEI CONSULTANTS, INC.

Richard F. Tobin

Richard F. Tobin, P.E.
Senior Project Manager

RFT/db

TABLES

Table 1 – Geology References
Table 2 – References on Salt Water Intrusion

FIGURES

Figure 1 – Site Vicinity Map

APPENDICES

Appendix A – Published Geological Information
Appendix B – Soil Survey Information
Appendix C – Subsurface Information from 1948 and 1971-1972 NHDOT Drawings
Appendix D – NHDES Dam Bureau Information on Taylor River Dam, Taylor River Relief Structure, and Rice Dam
Appendix E – NHDES Water Well Data

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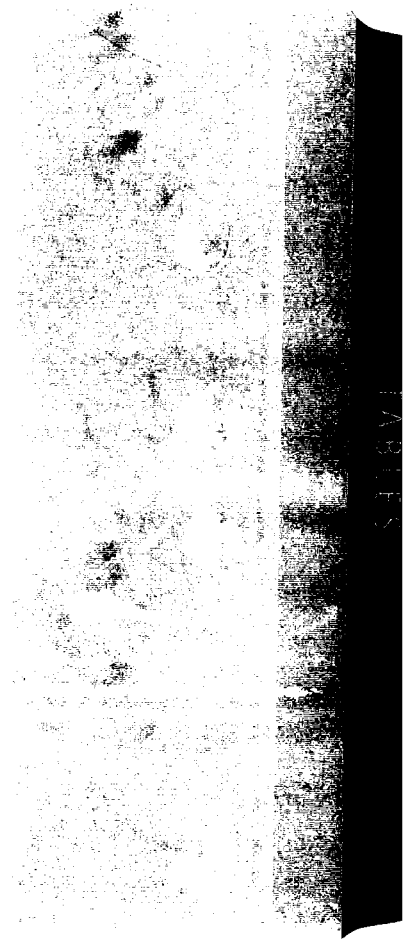

Table 1. Geology References
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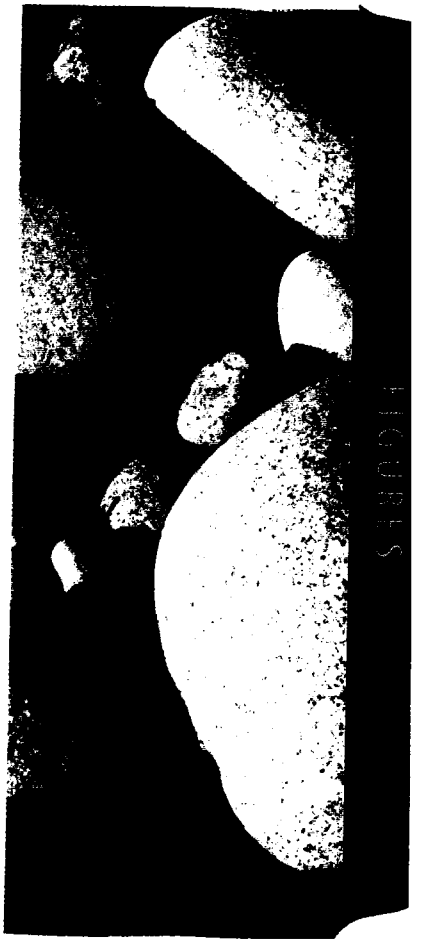

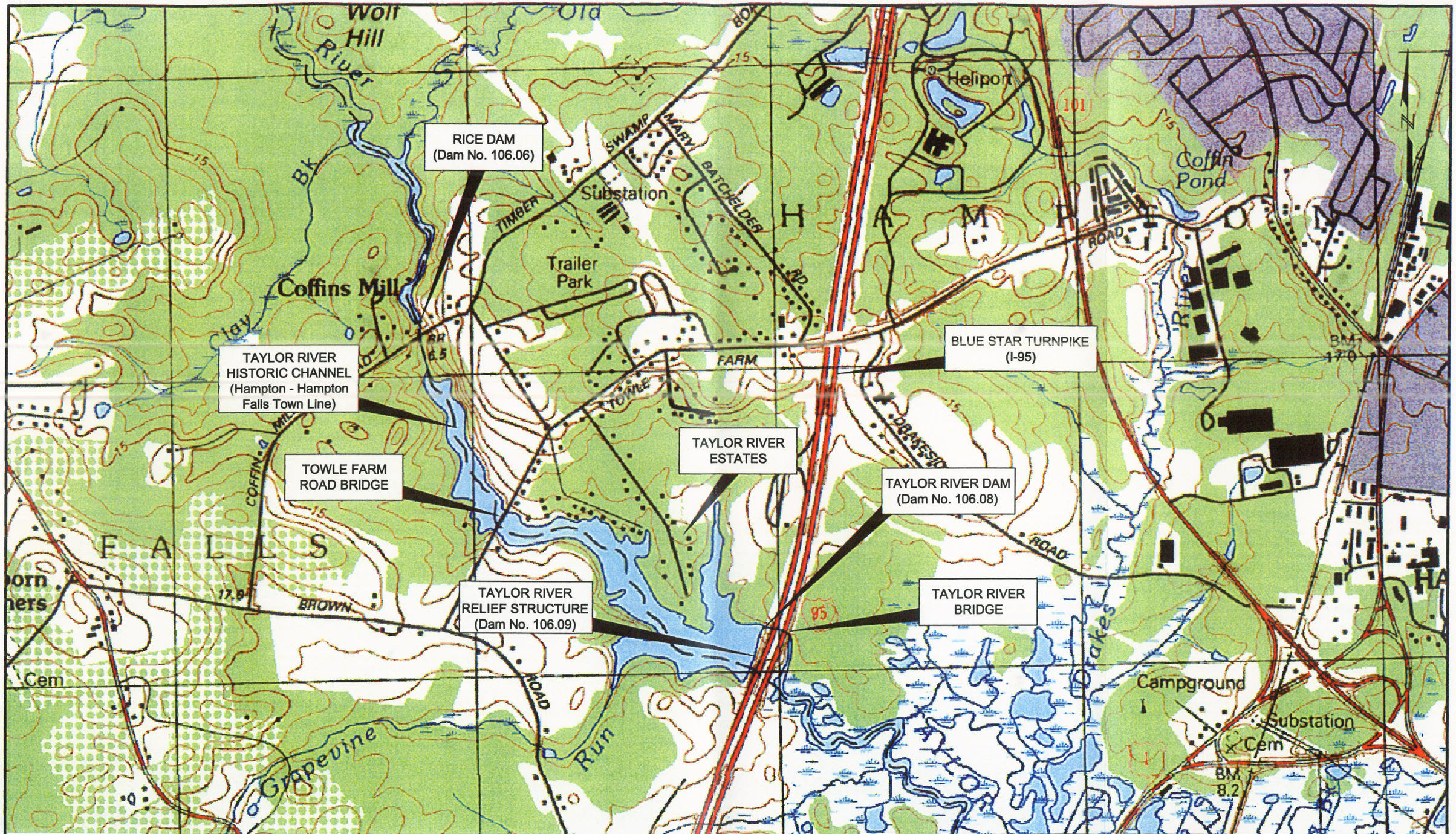

NOTES:

1. BASE MAP IS FROM THE EXETER, NH QUADRANGLE, 1992, CONTOUR INTERVAL 3 METERS, PROVIDED BY MAPTECH, TERRAIN NAVIGATOR.

Input to Feasibility Study
Replacement or Removal of the Taylor River Dam
Hampton and Hampton Falls, New Hampshire

The Louis Berger Group
Manchester, New Hampshire

GEI Consultants

SITE VICINITY MAP

Project 06400-0 | March 2007 | Fig. 1

064000-01 djm/ptc 3/23/07

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Geotechnical
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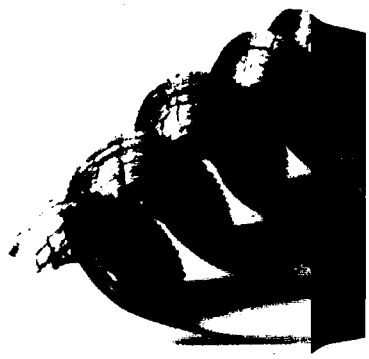
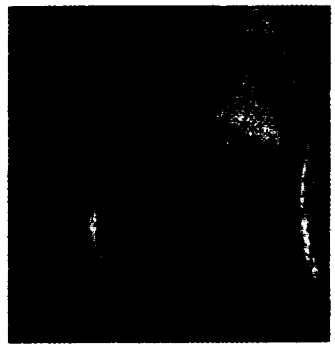
Water Resources
Engineering





Appendix A

Published Geological Information

Table A1. Description of the Kittery Formation
Input to Feasibility Study
Replacement or Removal of the Taylor River Dam
Hampton and Hampton Falls, New Hampshire

This sedimentary unit was first named the Kittery Quartzite by Katz (1917) from the excellent exposures to be seen along the Piscataqua River in Kittery, Maine. Here he estimated the thickness of the formation to be 1500 feet. Because of the diversity of rock types present within the unit, Novotny (1963) proposed that the name be changed to Kittery Formation. In New Hampshire abundant exposures are to be seen along the Piscataqua River opposite the type area, along the western shore of Great and Little Bays, and along Interstate 95 which traverses the entire length of the major belt of the Kittery Formation in New Hampshire. A second belt, now largely displaced by the Exeter pluton, consists of four separate remnants which now flank the pluton (Plate 1).

In the field most outcrops of the Kittery Formation show gray, brownish-gray or dark green, fine-grained, banded, impure quartzite. Technically, the use of the term quartzite for a significant portion of the Kittery Formation may well be questioned (Lyons, John B., Personal communication). Modal analyses by Novotny (Table 3, Appendix) and in southwestern Maine by Woodard (1968) indicate that the lighter beds of the formation might well be termed fine-grained, lime-silicate granofels. However, as the association of the term quartzite with the formation is widespread, the questioned portion is considered as impure quartzite in this report. This type of rock is often interbedded with slate, phyllite, or fine-grained schist. As the latter rocks decompose and disintegrate more rapidly than the quartzite, a false impression is often gained that the formation consists almost entirely of quartzite. A characteristic of the quartzitic portions of the formation relates to jointing. A number of sets of joints and incipient fractures criss-cross the brittle quartzite. These rarely intersect near right angles, as is common in many rocks. A result of this unusual jointing is the production of distinctive, highly irregular and angular fragments as the rock disintegrates.

Banding in the impure quartzite horizons resembles that of varved clays and silts of glacial areas. Seasonal banding is indicated (Plate 11A). At this time, however, there is no evidence, other than appearance, to support a relationship to glaciation. Chemical analyses of the light and dark bands are given by Billings and Wilson (1964).

Detailed information of the various rock types in the Kittery Formation, with the mineral content of each, is given in Table 3, Appendix.

From Novotny, 1969 (Reference 9)

Table A2. Description of Surficial Geology Map Units
Input to Feasibility Study
Replacement or Removal of the Taylor River Dam
Hampton and Hampton Falls, New Hampshire

Adapted from Goldsmith, 2001 (Reference 3).

DESCRIPTION OF MAP UNITS

A thin layer of windblown sand and silt generally less than 3 ft (I m) thick covers much of the map area but is not shown. The lower part of this layer is generally mixed with underlying surficial deposits.

af **Artificial Fill (Holocene).** Earth-fill material in road and railroad embankments and made land. Many small bodies not shown on map.

Qal **Alluvium (Holocene).** Sand, silt, and minor gravel in flood plains along present-day rivers and streams. As much as 20 ft (7 m) thick and underlain by adjacent deposits. Extent of alluvium indicates most areas flooded in the past which may be subject to future flooding.

Qw **Fresh Water Wetlands Deposits [Swamp Deposits] (Holocene).** Partially decomposed organic material (peat), silt, and sand underlying poorly drained areas. Generally 5 to 15 ft (2-5 m) thick.

Qsm **Salt March Deposits (Holocene).** Partly decomposed organic material mixed or interbedded with estuarine silt, clay, and sand. Five to 20 ft (2-6 m) thick.

Qmw **Wave-Formed Deposits (Pleistocene).** Sand and Gravel derived from till deposits by reworking of the sea. Some wave-formed deposits occur on other till and glaciomarine deposits but are too small to map.

GLACIOMARINE DEPOSITE (PLEISTOCENE).

Sand, gravel, silt and clay, poorly to well stratified. Deposited in or graded to the synglacial sea by meltwater streams at and beyond ice-marginal positions of the retreating ice sheet. Sea level ranged from about 110 ft (33.5 m) altitude in the southeast corner of the map area to about 150 ft (45.7 m) in the northwestern part. Ice marginal deposits are mostly deltaic, composed of sand and gravel and mark successive ice-retreat positions. Deposits laid down on the sea bottom beyond the deltas consist of sand, clay, and silt of the Presumpscot Formation.

Qps **Presumpscot Formation.** Composed of two facies, Qps and Qpc. Qps: Sand, fine to coarse, locally contains small pebbles, may contain thin beds of silt and clayey silt. Thickness generally less than 20 ft (6.1 m) thick but may be as much as 30 ft (9.1 m).

Qpc Qpc: Clayey silt or silty clay, locally contains silt and fine sand beds. Thickness as much as 55 ft (16.7).

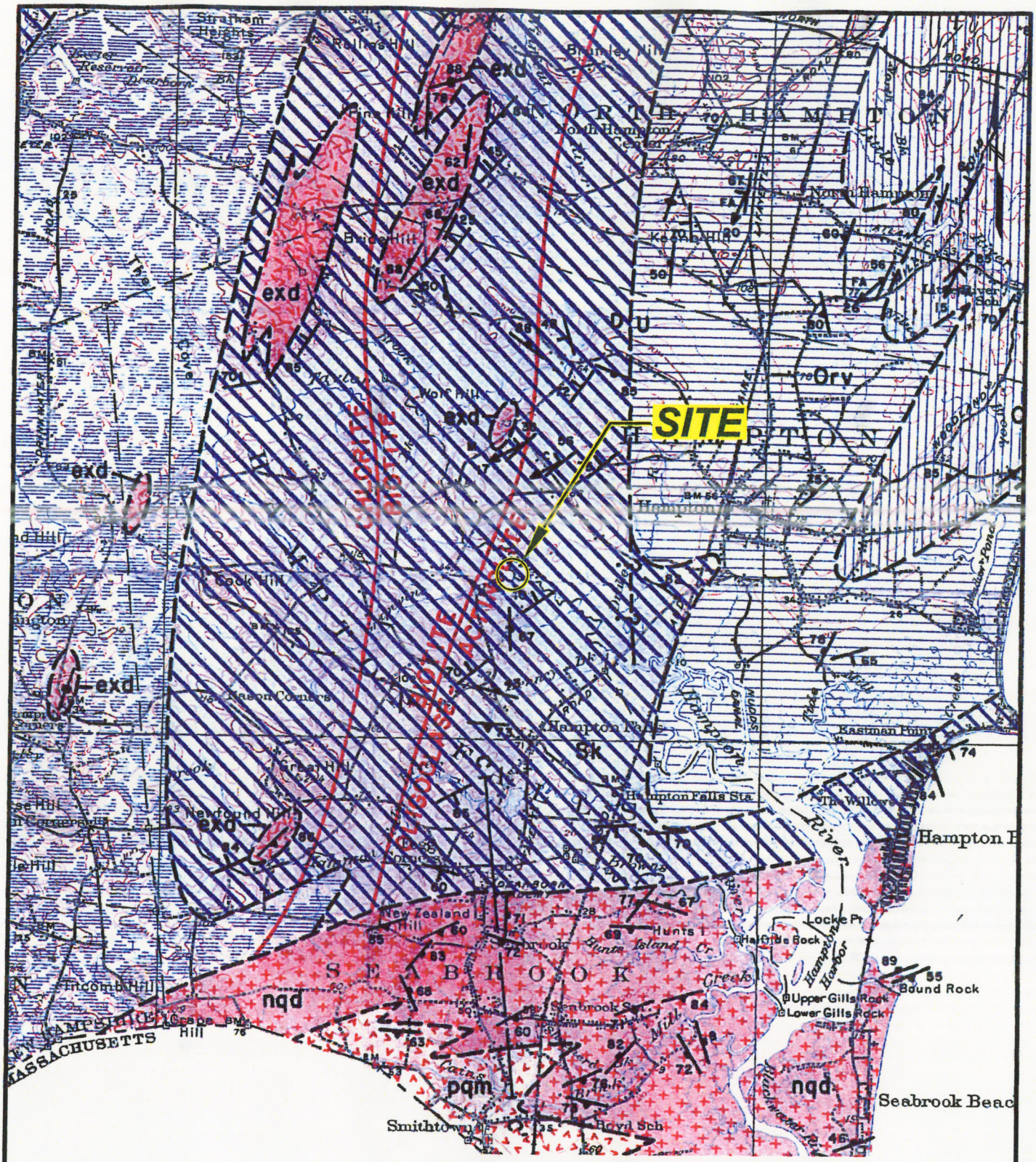
Qps intertongues laterally and downward with Qpc.

Qmwd **Wave-Modified Marine Delta Deposits.**

TILL (PLEISTOCENE).

Qt **Till.** Non-sorted to poorly sorted mixture of clay, silt, sand, pebbles, cobbles, and boulders; dominant grain size is silt or to small pebbles; locally contains small irregular masses of sand and gravel. Deposited directly by the ice sheet. Thickness is variable, thin, 5 to 15 ft (1.5-4.6 m) thick, but as much as 100 ft (30.5 m) under the crests of drumlins. Locally – clayey, a source for clay.

Qtt **Thin Till.**



Note:

For Legend see Figure A2.

Reference:

From Novotny, 1969 (Reference 9)

Feasibility Study Replacement or Removal of the Taylor River Dam Hampton and Hampton Falls, New Hampshire	GEI Consultants	BEDROCK GEOLOGY MAP
The Louis Berger Group Manchester, New Hampshire	Project 06400-0	March 2007 Fig. A1

064000-06 djm/ptc 3/23/07

IGNEOUS ROCKS

Late Devonian? — Hillsboro Plutonic Series — DEVONIAN?

qm

Quartz monzonite

Medium- to coarse-grained, massive, light-gray to buff quartz monzonite, composed chiefly of oligoclase, microcline, microcline-microperthite, and quartz.

exd

Exeter diorite

Light-gray to black, fine- to coarse-grained, massive diorite, quartz diorite, gabbro, and quartz monzonite, composed chiefly of oligoclase, andesine, or labradorite, hypersthene or augite, hornblende, biotite, and microcline.

pqm

Porphyritic quartz monzonite

Medium- to coarse-grained, porphyritic, medium-gray, moderately- to well-foliated quartz monzonite, composed chiefly of microcline phenocrysts and hornblende, biotite, and chlorite.

nqd

Newburyport quartz diorite

Medium- to coarse-grained, well-foliated, medium-gray quartz diorite, composed of oligoclase or andesine, quartz, hornblende, biotite, and chlorite.

gr

Granite and pegmatite

Medium- to coarse-grained, white to tan, massive to well-foliated granite and pegmatite, composed of quartz, microcline, oligoclase, and muscovite, with minor garnet, tourmaline, and biotite.

METAMORPHIC ROCKS

Lower Devonian — DEVONIAN

Dl

Littleton formation

Medium- to coarse-grained, well-foliated, thin-bedded, silvery gray, quartz-staurolite-mica schist, quartz-staurolite-garnet-mica schist, with porphyroblasts of staurolite and garnet.

Middle Silurian? — SILURIAN?

Sb

Berwick formation

Fine- to medium-grained, thin-bedded to massive, light- to dark-gray or black feldspathic quartz-biotite schist, biotite-quartz-sericite schist, and quartz-sericite schist; fine- to medium-grained, light-gray to light gray-green, thin to thick beds and lenses of lime-silicate rock, containing oligoclase-andesine, actinolite, diopside, garnet, epidote-zoisite, calcite, and biotite; minor beds of feldspathic quartzite.

Se

Eliot formation

Dark-gray slate; dark-gray to dark-green phyllite, commonly dolomitic; light- to dark-gray to black biotite schist, quartz-biotite schist, and feldspathic quartz-biotite schist; massive, light-gray to light gray-green, fine-grained quartzite, in part feldspathic, in part dolomitic; light gray-green to brown, fine- to medium-grained, lime-silicate rock, containing actinolite.

Sk

Kittery formation

Dark-gray slate; dark gray-green to silvery gray phyllite; fine- to medium-grained, finely-laminated to massive, poorly- to well-foliated quartz-biotite schist, biotite-sericite schist, and feldspathic quartz-biotite schist, commonly calcareous and actinolitic; light gray-green to dark-gray, well-bedded to massive, fine-grained quartzite and feldspathic quartzite; thin-bedded to massive, medium-grained, light-gray to light gray-green lime-silicate rock.

ORDOVICIAN?

Orv
Orm

Rye formation

Upper metavolcanic member: Orv — dark-gray, medium- to coarse-grained, foliated quartz-biotite-plagioclase gneiss, finely interlaminated fine-grained, maroon feldspathic quartz-biotite schist and fine-grained gray-green feldspathic quartz-actinolite schist; medium- to coarse-grained, dark-gray biotitic or hornblendic injection and permeation gneiss; dark-green to black, fine- to coarse-grained amphibolite and hornblende schist; minor fine-grained gray quartzite.

Lower metasedimentary member: Orm — fine- to coarse-grained, light- to dark-gray and black mica schist and quartzo-feldspathic schist, commonly containing garnet and sillimanite; fine- to medium-grained, thin-bedded to massive, gray quartzite, commonly feldspathic and garnetiferous; fine- to coarse-gained, dark-green to black amphibolite, commonly containing diopside and garnet.

METAMORPHIC ZONES

Indicated by key minerals and separated by isograds
Chlorite zone
Biotite zone
Oligoclase-actinolite zone
Sillimanite zone

CONTACTS

Approximate — Projected

FAULTS

U / D

Dashed where approximate; queried where doubtful
U: Upthrown side
D: Downthrown side

STRUCTURAL SYMBOLS

60 — Inclined — Vertical
Strike and dip of bedding

70 — Inclined — Vertical
Strike and dip of foliation in metamorphic and plutonic rocks

50 — Inclined — Vertical
Strike and dip of cleavage

Inclined — Vertical
Strike and dip of joints

15
Bearing and plunge of minor structures
FA: Small fold axes
M: Mineral alignment
C: Crinkles or corrugations
CB: Cleavage-bedding intersections

QUARRIES

Operating — Abandoned

Reference:

From Novotny, 1969 (Reference 9)

Feasibility Study Replacement or Removal of the Taylor River Dam Hampton and Hampton Falls, New Hampshire	GEI Consultants	BEDROCK GEOLOGY EXPLANATION
The Louis Berger Group Manchester, New Hampshire	Project 06400-0	March 2007 Fig. A2

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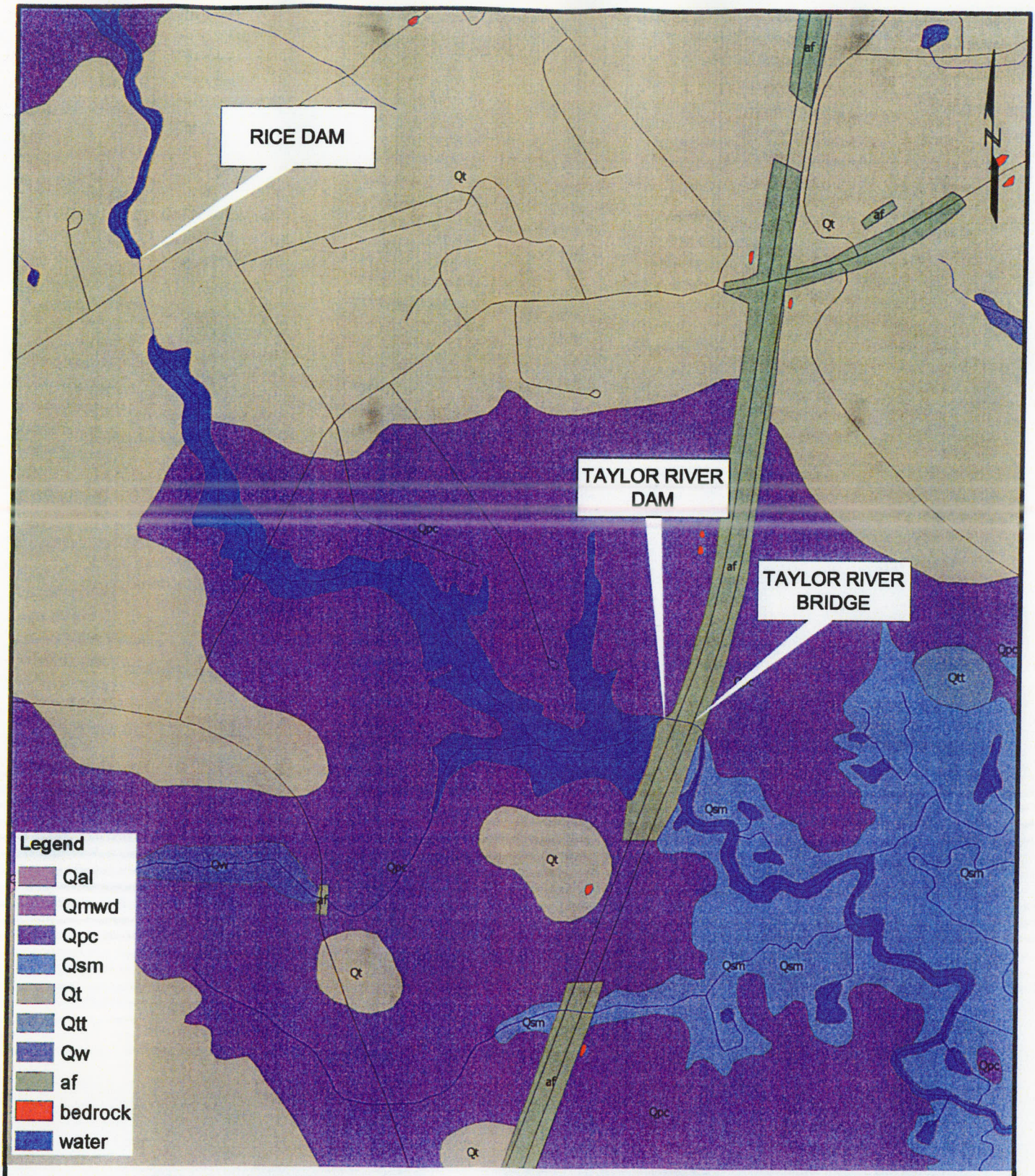


0 1000 2000

APPROXIMATE SCALE, FEET

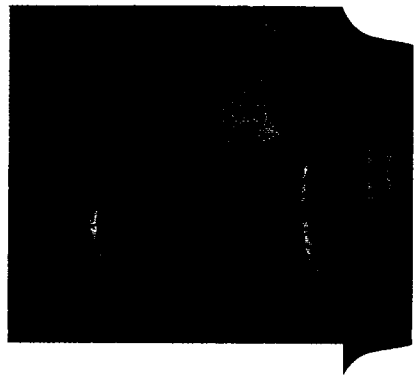
Reference: GRANIT Internet Site (Reference 7)
Legend: For Legend see Table A2.

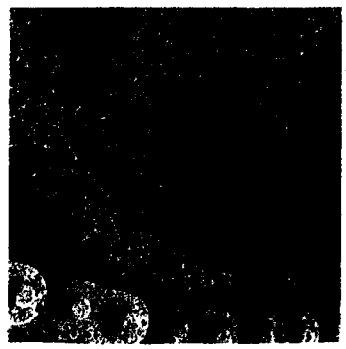
Feasibility Study Replacement or Removal of the Taylor River Dam Hampton and Hampton Falls, New Hampshire	GEI Consultants	SURFICIAL GEOLOGY
The Louis Berger Group Manchester, New Hampshire	Project 06400-0	March 2007 Fig. A3

064000-04 djm 3/23/07

GEI Consultants

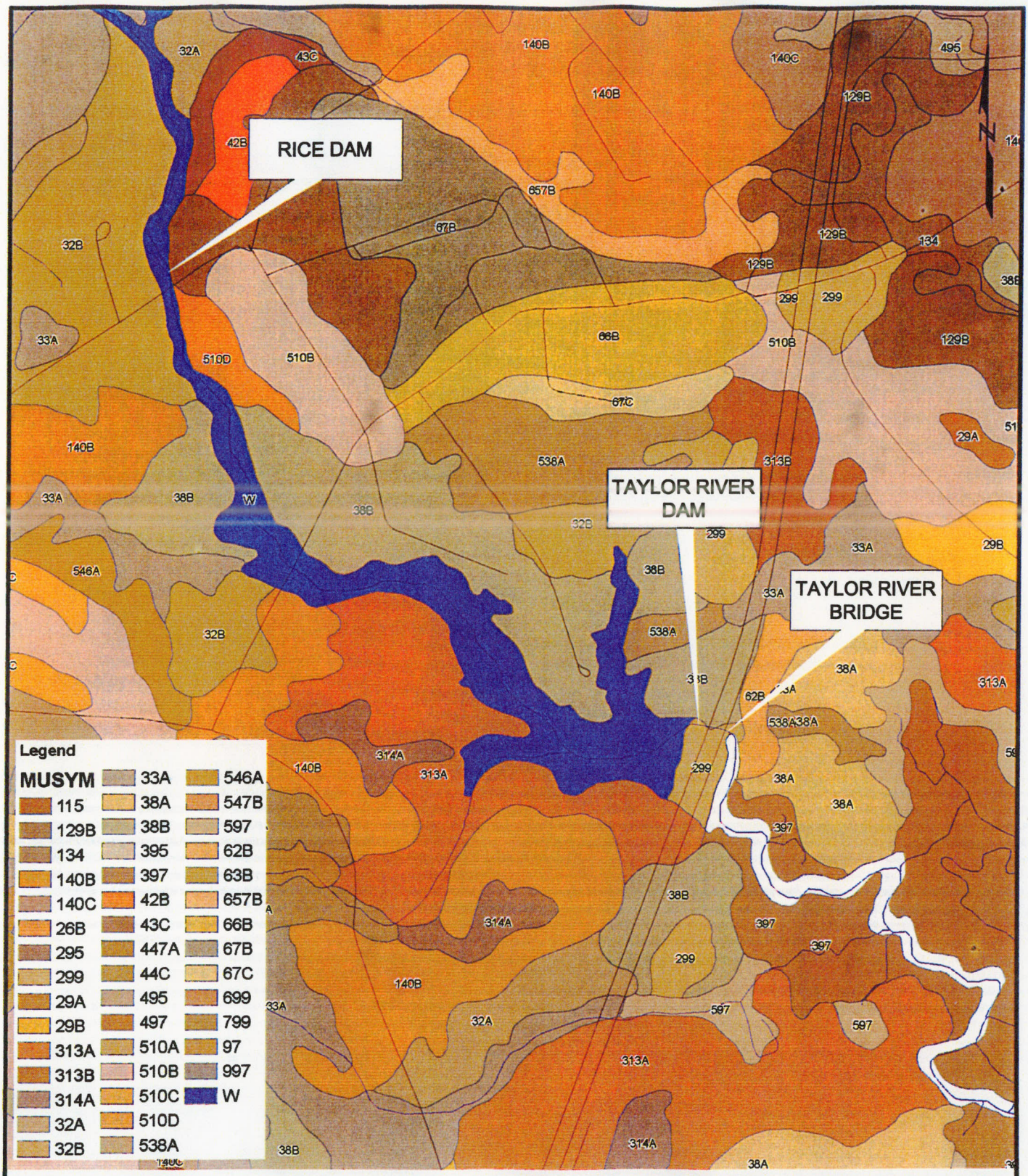
Geotechnical
Environmental and
Water Resources
Engineering





Appendix B

Soil Survey Information



Reference: GRANIT Internet Site (Reference 7)

Feasibility Study Replacement or Removal of the Taylor River Dam Hampton and Hampton Falls, New Hampshire	GEI Consultants	SOIL SURVEY MAP
The Louis Berger Group Manchester, New Hampshire	Project 06400-0	March 2007 Fig. B1

064000-04 djm/ptc 3/23/07

32A—Boxford silt loam, 0 to 3 percent slopes. This nearly level soil is on low, gentle rises on broad plains or on low rises at the base of hills or adjacent to streams. Areas are oval or irregularly shaped and are 4 to 125 acres in size.

A generalized profile of this soil is as follows:

Surface Layer:
dark brown silt loam

Subsoil (upper part):
dark yellowish brown silt loam

Subsoil (lower part):
mottled olive silt loam

Substratum:
mottled olive silty clay

Inclusions make up about 20 percent of the map unit. Among these are Scitico and Squamscott soils in hollows and drainageways and Eldridge soils on scattered low rises throughout the map unit.

Soil features affecting use—

Drainage class: moderately well drained and somewhat poorly drained
Depth to a seasonal high water table: 1 to 3 feet
Depth to bedrock: more than 60 inches
Permeability: slow
Available water capacity: high
Flooding: none
Potential for frost action: high
Shrink-swell potential: moderate

Most areas of this soil are used as woodland. Some areas are used for cultivated crops or forage. In most areas the soil is considered prime farmland.

This soil is well suited to cultivated crops and forage species, but it is wet and thaws slowly during the early part of the growing season. The wetness and low soil temperature hamper early planting of the crops that require a long growing season. Because of the restricted permeability, the soil is wet after a heavy rain. Although a subsurface drainage system may not be effective, land grading can reduce the wetness. Early planting should be avoided. Working the soil during wet periods results in the formation of ruts, compaction, and clodding. Grazing of undrained pasture should be delayed until the soil dries out. Frost action is a limitation. Perennial plants that can withstand wetness and frost action should be selected for planting. For example, alfalfa does not grow well on this soil because frost heaving damages the roots. A better choice of perennial forage would be a grass-legume mixture that includes clover.

This soil is well suited to woodland. The most common trees are paper birch, eastern white pine, eastern hemlock, and northern red oak. Areas of this soil can be good sites for white pine and produce high-quality pine sawlogs, but preventing the invasion of hardwoods or hemlock is difficult. For example, after an area has been clearcut, red maple, aspen, or hemlock will reseed rather than white pine. Partial cutting can favor white pine. Shelterwood cutting, in which half of the trees are removed, is not recommended because strong winds may uproot the remaining trees. A better alternative is improvement cutting, in which only a third of the trees are harvested and thus the hazard of windthrow is reduced. The soil is wet in spring and late fall. Logging in midwinter, when the ground is frozen, helps to prevent the formation of ruts and reduces the likelihood that the equipment will become bogged down. Midsummer harvesting can result in little rut formation if the summer has been dry. Because of the restricted permeability, however, a single heavy rainstorm can wet the site enough for machine traffic to cause the formation of deep ruts.

This soil is suited to urban development, but the wetness, the restricted permeability, and frost action are limitations. Fill is generally used to raise septic systems above compact soil layers and the seasonal high water table. Footing drains around the foundations can reduce the wetness, though sump pumps may still be needed. Storm water management is critical because of the restricted permeability. Land shaping, ditching, and installing culverts around the development can help to remove surface water and reduce the hazard of ponding, which can occur after heavy rains. Because of the potential for frost action, foundations should have adequate footings. Properly designing road subgrades can reduce the hazard of frost heaving.

32B—Boxford silt loam, 3 to 8 percent slopes. This gently sloping soil is on low knolls in broad, low areas and on the lower side slopes adjacent to hills. Areas are long and narrow or irregularly shaped and are 4 to 140 acres in size.

A generalized profile of this soil is as follows:

Surface Layer:
dark brown silt loam

Subsoil (upper part):
dark yellowish brown silt loam

Subsoil (lower part):
mottled olive silt loam

Substratum:
mottled olive silty clay

Inclusions make up about 20 percent of the map unit. Among these are Scitico soils in hollows, Eldridge soils in scattered areas throughout the map unit, and soils that have slopes of more than 8 percent or less than 3 percent.

Soil features affecting use—

Drainage class: moderately well drained and somewhat poorly drained
Depth to a seasonal high water table: 1 to 3 feet
Depth to bedrock: more than 60 inches
Permeability: slow
Available water capacity: high
Flooding: none
Potential for frost action: high
Shrink-swell potential: moderate

Most areas of this soil are used as woodland. In most areas the soil is considered additional farmland of statewide importance.

This soil is well suited to cultivated crops and forage species. Because of the slope, however, erosion is a hazard. In areas used for corn silage, this hazard can be reduced by no-till farming and other forms of conservation tillage or by short rotations, such as 2 years of corn and 5 years of hay. In areas where row crops, such as vegetables, are grown year after year, diversions and terraces may be needed as erosion-control measures. The soil is wet and thaws slowly during the early part of the growing season. The wetness and low soil temperature hamper early planting of the crops that require a long growing season. Because of the restricted permeability, the soil is wet after a heavy rain. Although a subsurface drainage system may not be effective, land grading can reduce the wetness. Early planting should be avoided. Working the soil during wet periods results in the formation of ruts, compaction, and clodding. Grazing of undrained pasture should be delayed until the soil dries out. Frost action is a limitation. Perennial plants that can withstand wetness and frost action should be selected for planting. For example, alfalfa does not grow well on this soil because frost heaving damages the roots. A better choice of perennial forage would be a grass-legume mixture that includes clover.

This soil is well suited to woodland. The most common trees are paper birch, eastern white pine, eastern hemlock, and northern red oak. Areas of this soil can be good sites for white pine and produce high-quality pine sawlogs, but preventing the invasion of hardwoods or hemlock is difficult. For example, after an area has been clearcut, red maple, aspen, or hemlock will reseed rather than white pine. Partial cutting can favor white pine. Shelterwood cutting, in which half of the trees are removed, is not recommended because strong winds may uproot the remaining trees. A better alternative is improvement cutting, in which only a third of the trees are harvested and thus the hazard of windthrow is reduced. The soil is wet in spring and late fall. Logging in midwinter, when the ground is frozen, helps to prevent the formation of ruts and reduces the likelihood that the equipment will become bogged down. Midsummer harvesting can result in little rut formation if the summer has been dry. Because of the restricted permeability, however, a single heavy rainstorm can wet the site enough for machine traffic to cause the formation of deep ruts.

This soil is suited to urban development, but the wetness, the restricted permeability, and frost action are limitations. Fill is generally used to raise septic systems above compact soil layers and the seasonal high water table. Footing drains around the foundations can reduce the wetness, though sump pumps may still be needed. Storm water management is critical because of the restricted permeability. Land shaping, ditching, and installing culverts around the development can help to remove surface water and reduce the hazard of ponding, which can occur after heavy rains. Because of the potential for frost action, foundations should have adequate footings. Properly designing road subgrades

can reduce the hazard of frost heaving. Because of the slope, erosion is a hazard during earth-moving operations. Common erosion- and sediment-control measures are sediment traps and a good plant cover.

Erosion is a factor in the management of storm water. Riprap, catch basins, a good plant cover, and diversions can control the runoff of storm water.

33A—Scitico silt loam, 0 to 5 percent slopes. This nearly level and gently sloping soil is on broad, low plains and in drainageways. Areas are long and narrow or irregularly shaped and are 4 to 400 acres in size.

A generalized profile of this soil is as follows:

1 ft. —

2 ft. —

3 ft. —

4 ft. —

Surface Layer:
very dark grayish brown silt loam

Subsoil:
mottled olive gray silty clay loam

Substratum:
mottled dark gray silty clay

In some areas the part of the substratum below a depth of 36 inches is more olive.

Inclusions make up about 15 percent of the map unit. Among these are Maybid soils in hollows and drainageways, Squamscott soils on low rises near the margins of the map unit, and Boxford soils on knolls.

Soil features affecting use—

Drainage class: poorly drained
Depth to a seasonal high water table: 0 to 1 foot
Depth to bedrock: more than 60 inches
Permeability: slow
Available water capacity: high
Flooding: none
Potential for frost action: high
Shrink-swell potential: moderate

Most areas of this soil are used as woodland. In some areas the soil is classified as wetland.

This soil is poorly suited to cultivated crops and forage species. It is wet and thaws slowly in spring. The wetness and low soil temperature hamper early planting of the crops that require a long growing season. Because of the restricted permeability, the soil is wet after a heavy rain. Although a subsurface drainage system may not be effective, bedding systems and land grading can reduce the wetness. Early planting should be avoided, and grazing of undrained pasture should be delayed until the soil dries out. Working the soil during wet periods results in the formation of ruts, compaction, and clodding. Frost action is a limitation. Perennial plants that can withstand wetness and frost action should be selected for planting. For example, alfalfa does not grow well on this soil because frost heaving damages the roots. A better choice of perennial forage would be a grass-legume mixture that includes clover.

This soil is suited to woodland. The most common trees are red maple, eastern white pine, and white ash. The trees are of low quality, though the stands may be densely stocked and yields may be high. The site conditions favor the production of fuelwood. Various species of wildlife are attracted to areas of this soil. In areas managed for fuelwood, scattered ribbon-shaped or kidney-shaped clearcuts should be throughout the lot. The clearcuts should be no more than 200 feet across. The small clearcuts can reduce the hazard of windthrow and provide a varied habitat for wildlife. Harvesting methods that leave a diversity of trees, such as snag trees, trees with cavities, and a variety of size classes, improve the habitat for wildlife. The soil is wet in spring and late fall. Logging in midwinter, when the ground is frozen, helps to prevent the formation of ruts and reduces the likelihood that the equipment will become bogged down. Midsummer harvesting can result in little rutting if the summer has been dry. Because of the restricted permeability, however, a single heavy rainstorm can wet the site enough for machine traffic to cause the formation of deep ruts.

This soil is poorly suited to urban development because of the wetness, ponding, frost action, and the restricted permeability. Fill is generally used to raise septic systems above compact soil layers and the seasonal high water table. Footing drains around the foundations can reduce the wetness, but outlets for the drains are not readily available in some areas. Sump pumps may still be needed. Storm water management is critical because of the restricted permeability. Land shaping, ditching, and installing culverts around the development can help to remove surface water, but ponding may still occur after heavy rains. Because of the potential for frost action, foundations should have adequate footings. Properly designing road subgrades can reduce the hazard of frost heaving.

38B—Eldridge fine sandy loam, 3 to 8 percent slopes. This gently sloping soil is at the base of hills, on low rises in broad drainageways, and on broad plains. Areas are oval or irregularly shaped and are 4 to 200 acres in size.

A generalized profile of this soil is as follows:

Surface Layer:
dark yellowish brown fine sandy loam

Subsoil (upper part):
yellowish brown loamy fine sand

Subsoil (lower part):
mottled yellowish brown loamy fine sand

Substratum:
mottled grayish brown silt loam

In some places depth to the loamy substratum is more than 40 inches. In other places the substratum is more than 18 percent clay.

Inclusions make up about 20 percent of the map unit. Among these are Squamscott and Scitico soils in drainageways, in hollows, and near the margins of the map unit; Boxford soils in scattered areas throughout the map unit; and well drained soils on the tops of knolls.

Soil features affecting use—

Drainage class: moderately well drained
Depth to a seasonal high water table: 1 to 2 feet
Depth to bedrock: more than 60 inches
Permeability: rapid in the upper part of the profile and moderately slow in the lower part
Available water capacity: high
Flooding: none
Potential for frost action: moderate
Shrink-swell potential: low

Most areas of this soil are used as woodland. Some areas are used for cultivated crops or forage. In most areas the soil is considered prime farmland.

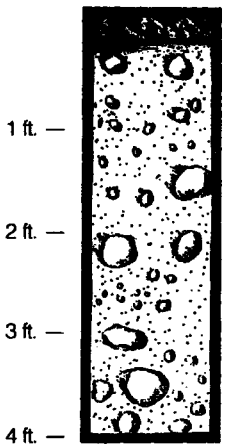
This soil is well suited to cultivated crops and forage species, but it is wet during the early part of the growing season. The wetness hampers early planting of the crops that require a long growing season. Working soil during wet periods results in the formation of ruts and in compaction. If the wetness in areas of cropland is reduced by a subsurface drainage system, the crops can be planted on schedule. Land shaping and grading also can reduce the wetness. Grazing of undrained pasture should be delayed until the soil dries out. Farm machinery should not be used when the soil is wet. Because of the slope, erosion is a hazard. In areas used for corn silage, this hazard can be reduced by no-till farming, chisel plowing, and other forms of conservation tillage or by short rotations, such as 2 years of corn and 5 years of hay. In areas where row crops, such as vegetables, are grown year after year, diversions and terraces may be needed as erosion-control measures.

This soil is well suited to woodland. The most common trees are eastern white pine and northern red oak. Areas of this soil are good sites for white pine and produce high-quality pine sawlogs, but care must be taken to keep hardwoods from invading. For example, after an area has been clearcut, red maple, elm, and other hardwoods will reseed rather than white pine. An alternative that would favor the regeneration of white pine is improvement cutting, in which approximately a third of the trees are harvested. Shelterwood cutting, in which half of the trees are removed, is not recommended because of the hazard of windthrow. Scarifying the surface after the trees are harvested can help the pine seeds to sprout. Stands of white pine respond well to intensive stand improvement measures, such as thinning and pruning. The soil is wet in spring and late fall. Logging in midwinter, when the ground is frozen, or midsummer, when the soil is drier, helps to prevent the formation of ruts and reduces the likelihood that the equipment will become bogged down.

This soil is suited to urban development, but the wetness and the restricted permeability are limitations. Fill is generally used to raise septic systems above compact soil layers and the seasonal high water table. Footing drains around the foundations can reduce the wetness, though sump pumps may still be needed. Land shaping around the development can help to remove surface water and reduce the hazard of ponding, which can occur after heavy rains. Frost action is a limitation. A properly designed road subgrade is needed to prevent frost heaving. Because of the potential for frost action, foundations should have adequate footings. Erosion is a hazard during earth-moving operations. Common erosion- and sediment-control measures are sediment traps and a good plant cover.

62B—Charlton fine sandy loam, 3 to 8 percent slopes. This gently sloping soil is on the tops of ridges, knolls, and low hills. Areas are oval or irregularly shaped and are 4 to 125 acres in size.

A generalized profile of this soil is as follows:



Surface Layer:
dark yellowish brown fine sandy loam

Subsoil:
yellowish brown gravelly fine sandy loam

Substratum:
yellowish brown gravelly fine sandy loam

Inclusions make up about 20 percent of the map unit. Among these are Scituate, Newfields, and Woodbridge soils in hollows and adjacent to drainageways; Walpole soils in drainageways; and Canton and Chatfield soils in scattered areas throughout the higher landscape positions.

Soil features affecting use—

Drainage class: well drained
Depth to a seasonal high water table: more than 6 feet
Depth to bedrock: more than 60 inches
Permeability: moderate
Available water capacity: moderate
Flooding: none
Potential for frost action: low
Shrink-swell potential: low

Most areas of this soil are used for cultivated crops or forage. Some areas are used as woodland. In most areas the soil is classified as prime farmland.

This soil is well suited to cultivated crops and forage species. Because of the slope, however, erosion is a hazard. In areas used for corn silage, this hazard can be reduced by no-till farming and other forms of conservation tillage or by short rotations, such as 2 years of corn and 5 years of hay. In areas where row crops, such as vegetables, are grown year after year, diversions and terraces may be needed as erosion-control measures.

This soil is well suited to woodland. The most common trees are eastern white pine, red pine, sugar maple, shagbark hickory, and northern red oak. Areas of this soil are good sites for the production of sawlogs and lower grade pallet logs from softwoods or hardwoods. Fuelwood can be a by-product of harvesting. Clear-cutting can result in the invasion of lower quality trees. The quality of the trees on the lot can be maintained by partial cutting. For a short period in early spring, the soil is wet and intermittent streams are flowing at full capacity. Harvesting during this peri- causes the formation of ruts and the siltation of streams. Also, machines are likely to become bogged down during this period. A better alternative is logging in winter, when the ground and streams are frozen, or in summer and fall, when the soil is drier and the beds of intermittent streams are dry.

This soil is well suited to urban development, but erosion is a hazard during earth-moving operations. Common erosion- and sediment-control measures are sediment traps and a good plant cover.

66B—Paxton fine sandy loam, 3 to 8 percent slopes. This gently sloping soil is on the tops of smooth, rounded hills that in most places have a northwest orientation. Areas are oval or irregularly shaped and are 4 to 100 acres in size.

A generalized profile of this soil is as follows:

Surface Layer:
dark yellowish brown fine sandy loam

Subsoil:
light yellowish brown fine sandy loam

Substratum:
firm olive fine sandy loam

Inclusions make up about 15 percent of the map unit. Among these are Woodbridge soils in hollows and the more nearly level areas and soils that have slopes of less than 3 percent and are on broad hilltops.

Soil features affecting use—

Drainage class: well drained
Depth to a seasonal high water table: 1.5 to 2.5 feet
Depth to bedrock: more than 60 inches
Permeability: moderate in the upper part of the profile and slow in the lower part
Available water capacity: moderate
Flooding: none
Potential for frost action: moderate
Shrink-swell potential: low

Most areas of this soil are used for cultivated crops or forage. Some areas are used as woodland, and some are used for urban development. In most areas the soil is classified as prime farmland.

This soil is well suited to cultivated crops and forage species. Because of the slope, however, erosion is a hazard. In areas used for corn silage, this hazard can be reduced by no-till farming and other forms of conservation tillage or by short rotations, such as 2 years of corn and 5 years of hay. In areas where row crops, such as vegetables, are grown year after year, diversions and terraces may be needed as erosion-control measures.

This soil is well suited to woodland. The most common trees are eastern white pine, red pine, sugar maple, and northern red oak. Areas of this soil are good sites for the production of sawlogs and lower grade pallet logs from softwoods or hardwoods. Fuelwood can be a by-product of harvesting. Clear-cutting can result in the invasion of lower quality trees. The quality of the trees on the lot can be maintained by partial cutting. In early spring, the soil is wet and intermittent streams are flowing in full capacity, and in late fall the soil can be wet if the fall rains have been particularly heavy. Harvesting during these periods causes the formation of ruts and the siltation of streams. Also, machines are likely to become bogged down during these periods. A better alternative is logging in midwinter, when the ground and streams are frozen, or in midsummer, when the soil is drier and the beds of intermittent streams are dry.

This soil is well suited to urban development, but the wetness in spring and the restricted permeability are limitations. Fill is generally used to raise septic systems above compact soil layers and the seasonal high water table. Footing drains around the foundations can reduce the wetness in cellars. Land shaping around the development can help to remove surface water and reduce the hazard of ponding, which can occur after heavy spring rains. Frost action is a limitation. A properly designed road subgrade is needed to prevent frost heaving. Because of the potential for frost action, foundations should have adequate footings. Erosion is a hazard during earth-moving operations. Common erosion- and sediment-control measures are sediment traps and a good plant cover.

67B—Paxton fine sandy loam, 3 to 8 percent slopes, very stony. This gently sloping soil is on the tops and sides of smooth, rounded hills that in most places have a northwest orientation. Areas are oval or irregularly shaped and are 4 to 100 acres in size. Stones cover 0.01 to 3 percent of the surface.

A generalized profile of this soil is as follows:

Surface Layer:
dark yellowish brown fine sandy loam

Subsoil:
light yellowish brown fine sandy loam

Substratum:
firm olive fine sandy loam

Inclusions make up about 15 percent of the map unit. Among these are Woodbridge soils in hollows and the more nearly level areas, soils that have slopes of less than 3 percent and are on broad hilltops, and soils that have slopes of more than 8 percent and are on hillsides. Also included, in the seacoast region, are Canton and Hoosic soils at the base of hills and near the margins of the map unit.

Soil features affecting use—

Drainage class: well drained
Depth to a seasonal high water table: 1.5 to 2.5 feet
Depth to bedrock: more than 60 inches
Permeability: moderate in the upper part of the profile and slow in the lower part
Available water capacity: moderate
Flooding: none
Potential for frost action: moderate
Shrink-swell potential: low

Most areas of this soil are used as woodland.

This soil is poorly suited to cultivated crops and forage species because of surface stones. Special machinery, such as stone pickers and bulldozers equipped with rock rakes, is needed to remove the surface stones before cropping can begin.

This soil is well suited to woodland. The most common trees are eastern white pine, red pine, sugar maple, and northern red oak. Areas of this soil are good sites for the production of sawlogs and lower grade pallet logs from softwoods or hardwoods. Fuelwood can be a by-product of harvesting. Clear-cutting can result in the invasion of lower quality trees. The quality of the trees on the lot can be maintained by partial cutting. In early spring, the soil is wet and intermittent streams are flowing at full capacity, and in late fall the soil can be wet if the fall rains have been particularly heavy. Harvesting during these periods causes the formation of ruts and the siltation of streams. Also, machines are likely to become bogged down during these periods. A better alternative is logging in midwinter, when the ground and streams are frozen, or in midsummer, when the soil is drier and the beds of intermittent streams are dry.

This soil is suited to urban development, but the wetness in spring and the restricted permeability are limitations. Fill is generally used to raise septic systems above compact soil layers and the seasonal high water table. Footing drains around the foundations can reduce the wetness in cellars. Land shaping around the development can help to remove surface water and reduce the hazard of ponding, which can occur after heavy spring rains. Frost action is a limitation. A properly designed road subgrade is needed to prevent frost heaving. Because of the potential for frost action, foundations should have adequate footings. Erosion is a hazard during earth-moving operations. Common erosion- and sediment-control measures are sediment traps and a good plant cover. Surface stones can hinder landscaping. Once the stones are removed, lawns can be easily established.

67C—Paxton fine sandy loam, 8 to 15 percent slopes, very stony. This strongly sloping soil is on the tops and sides of smooth, rounded hills that in most places have a northwest orientation. Areas are oval or irregularly shaped and are 4 to 150 acres in size. Stones cover 0.01 to 3 percent of the surface.

A generalized profile of this soil is as follows:

Surface Layer:
dark yellowish brown fine sandy loam

Subsoil:
light yellowish brown fine sandy loam

Substratum:
firm olive fine sandy loam

Inclusions make up about 20 percent of the map unit. Among these are Canton and Montauk soils at the base of the hills, Woodbridge soils in hollows, and soils that have slopes of less than 8 percent or more than 15 percent.

Soil features affecting use—

Drainage class: well drained
Depth to a seasonal high water table: 1.5 to 2.5 feet
Depth to bedrock: more than 60 inches
Permeability: moderate in the upper part of the profile and slow in the lower part
Available water capacity: moderate
Flooding: none
Potential for frost action: moderate
Shrink-swell potential: low

Most areas of this soil are used as woodland.

This soil is poorly suited to cultivated crops and forage species because of surface stones. Special machinery, such as stone pickers and bulldozers equipped with rock rakes, is needed to remove the surface stones before cropping can begin. Because of the slope, care is needed in operating some types of farm machinery.

This soil is well suited to woodland. The most common trees are eastern white pine, red pine, sugar maple, and northern red oak. Areas of this soil are good sites for the production of sawlogs and lower grade pallet logs from softwoods or hardwoods. Fuelwood can be a by-product of harvesting. Clear-cutting can result in the invasion of lower quality trees. The quality of the trees on the lot can be maintained by partial cutting. In early spring, the soil is wet and intermittent streams are flowing at full capacity, and in late fall the soil can be wet if the fall rains have been particularly heavy. Harvesting during these periods causes the formation of ruts and the siltation of streams. Also, machines are likely to become bogged down during these periods. A better alternative is logging in midwinter, when the ground and streams are frozen, or in midsummer, when the soil is drier and the beds of intermittent streams are dry. Because of the slope, the main access roads may be subject to erosion. Waterflow can be controlled and the hazard of erosion reduced by a variety of conservation measures, such as water bars, stone fords, culverts, ditches, and a permanent plant cover.

This soil is suited to urban development, but the wetness in spring, the restricted permeability, and the slope are limitations. Fill is generally used to raise septic systems above compact soil layers and the seasonal high water table. Footing drains around the foundations can reduce the wetness in cellars. Land shaping around the development can help to remove surface water and reduce the hazard of ponding, which can occur after heavy spring rains. Frost action is a limitation. A properly designed road subgrade is needed to prevent frost heaving. Because of the potential for frost action, foundations should have adequate footings. Because of the slope, cutting and filling are needed to level sites for septic tank absorption fields. Erosion is a hazard during earth-moving operations. Common erosion- and sediment-control measures are sediment traps, diversions, debris basins, sediment screens, and a good plant cover. If erosion is to be controlled once the development is completed, the design of subdivisions should include adequate management of storm water through properly designed ditches, culverts, riprap, a good plant cover, and catch basins. Surface stones can hinder landscaping. Once the stones are removed, lawns can be easily established.

129B—Woodbridge fine sandy loam, 3 to 8 percent slopes, very stony. This gently sloping soil is on the tops and sides of smooth, rounded hills that in most places have a northwest orientation. Areas are oval or irregularly shaped and are 4 to 100 acres in size. Stones cover 0.01 to 3 percent of the surface.

A generalized profile of this soil is as follows:

Surface Layer:
dark brown fine sandy loam

Subsoil (upper part):
yellowish brown fine sandy loam

Subsoil (lower part):
mottled yellowish brown fine sandy loam

Substratum:
firm mottled light yellowish brown fine sandy loam

Inclusions make up about 25 percent of the map unit. Among these are Ridgebury soils in hollows and drainageways, Paxton soils on knolls and near the margins of the map unit, and Scituate soils in scattered areas throughout the map unit. Also included are soils that have slopes of less than 3 percent or more than 8 percent and areas where less than 0.01 percent of the surface is covered by stones.

Soil features affecting use—

Drainage class: moderately well drained
Depth to a seasonal high water table: 1.5 to 2.5 feet
Depth to bedrock: more than 60 inches
Permeability: moderate in the upper part of the profile and slow in the lower part
Available water capacity: moderate
Flooding: none
Potential for frost action: high
Shrink-swell potential: low

Most areas of this soil are used as woodland.

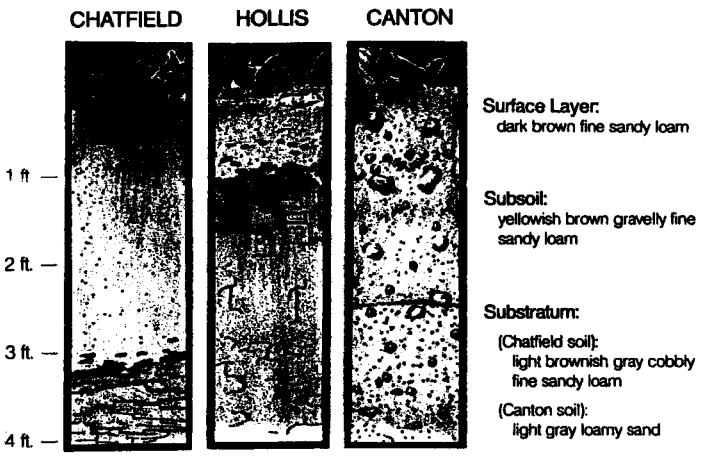
This soil is poorly suited to cultivated crops and forage species because of surface stones. Special machinery, such as stone pickers and bulldozers equipped with rock rakes, is needed to remove the surface stones before cropping can begin. The soil is wet during the early part of the growing season. Working the soil during wet periods results in the formation of ruts, compaction, and clodding.

This soil is well suited to woodland. The most common trees are eastern white pine, red pine, sugar maple, and northern red oak. Areas of this soil are good sites for the production of sawlogs and fuelwood from softwoods or hardwoods. Clear-cutting can result in the invasion of lower quality trees. The quality of trees on the lot can be maintained by some form of partial cutting, in which only a portion of the trees are removed. Shelterwood cutting, in which half of the trees are removed, is not recommended because strong winds may uproot the remaining trees. A better alternative is improvement cutting, in which only a third of the trees are harvested and thus the hazard of windthrow is reduced. The soil is wet in spring and late fall. Logging in midwinter, when the ground is frozen, or midsummer, when the soil is drier, helps to prevent the formation of ruts and reduces the likelihood that the equipment will become bogged down.

This soil is suited to urban development, but the wetness and the restricted permeability are limitations. Fill is generally used to raise septic systems above compact soil layers and the seasonal high water table. Footing drains around the foundations can reduce the wetness, though sump pumps may still be needed. Land shaping around the development can help to remove surface water and reduce the hazard of ponding, which can occur after heavy rains. Frost action is a limitation. A properly designed road subgrade is needed to prevent frost heaving. Because of the potential for frost action, foundations should have adequate footings. Erosion is a hazard during earth-moving operations. Common erosion- and sediment-control measures are sediment traps and a good plant cover. Surface stones can hinder landscaping. Once the stones are removed, lawns can be easily established.

140B—Chatfield-Hollis-Canton complex, 3 to 8 percent slopes, very stony. These gently sloping soils occur as areas so intermingled that mapping them separately was not practical. They are on low, knobby hills and ridges that in most places have a northeast orientation. Areas are irregularly shaped and are 4 to 400 acres in size. They are about 35 percent Chatfield soil, 20 percent Hollis soil, 20 percent Canton soil, and 25 percent other soils. Stones cover 0.01 to 3 percent of the surface.

Generalized profiles of these soils are as follows:



In some areas, the subsoil of the Chatfield and Hollis soils is redder or the bedrock is softer and more rippable. In other areas the substratum of the Canton soil has less silt and more sand and gravel.

Inclusions make up about 25 percent of the map unit. Among these are Newfields soils in the lower landscape positions, Walpole soils along drainageways, Ossipee and Greenwood soils in hollows, and rock outcrops on the tops of ridges and on slope breaks. Also included are areas of Hoosic soils in the seacoast region and areas of Montauk soils.

Soil features affecting use—

Drainage class: Chatfield and Canton—well drained; Hollis—somewhat excessively drained and well drained
Depth to a seasonal high water table: more than 6 feet
Depth to bedrock: Chatfield—20 to 40 inches; Hollis—10 to 20 inches; Canton—more than 60 inches
Permeability: Chatfield and Hollis—moderately rapid; Canton—moderately rapid or rapid
Available water capacity: Chatfield and Canton—moderate; Hollis—very low
Flooding: none
Potential for frost action: Chatfield and Hollis—moderate; Canton—low
Shrink-swell potential: low

Most areas of these soils are used as woodland. Some areas are used for urban development.

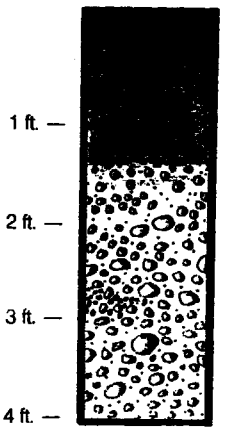
These soils are poorly suited to cultivated crops and forage species because of surface stones and outcrops of bedrock. Special machinery, such as stone pickers and bulldozers equipped with rock rakes, is needed to remove the surface stones before cropping can begin. The outcrops of bedrock can cause damage to farm machinery. Unless they are removed by blasting, they should be avoided during cultivation. Once the soils are cleared of surface stones, erosion, the depth to bedrock, and the available water capacity are continuing management concerns. Erosion control is critical in maintaining the productivity of the Chatfield and Hollis soils because of the depth to bedrock. The available water capacity in the Chatfield and Hollis soils can be improved by adding organic material, such as manure. Crops that are tolerant of droughty conditions should be selected for planting.

These soils are suited to woodland. The most common trees are eastern white pine and northern red oak. The trees are of low quality, and the stands will not be densely stocked. If properly managed, the soils are suitable for the production of fuelwood and can provide habitat for wildlife. In areas managed for fuelwood, scattered ribbon-shaped or kidney-shaped clearcuts should be established throughout the lot. The clearcuts should be no more than 200 feet across. The small clearcuts can reduce the hazard of windthrow and provide a varied habitat for wildlife. Harvesting methods that leave a diversity of trees, such as snag trees, trees with cavities, and a variety of size classes, improve the habitat for wildlife. For a short period in early spring, the soils are wet and intermittent streams are flowing at full capacity. Harvesting during this period causes the formation of ruts and the siltation of streams. Also, machines are likely to become bogged down during this period. A better alternative is logging in winter, when the ground and streams are frozen, or in summer and fall, when the soils are drier and the beds of intermittent streams are dry.

These soils are suited to urban development. Because of the depth to bedrock, careful selection of sites for septic systems and buildings is important. Where bedrock is encountered and areas of deeper soils are not available for use as building sites, blasting may be necessary before basements are constructed and fill may be needed to raise septic systems above

299—Udorthents, smoothed. These soils are in areas that have been excavated and regraded or that have been filled with soil material and graded. Areas are rectangular or irregularly shaped and are 4 to 20 acres in size. Most support vegetation.

A generalized profile of these soils is as follows:



Surface Layer:
dark brown loamy sand

Substratum:
stratified layers of brownish yellow to very dark grayish brown loamy sand to gravelly coarse sand

Inclusions make up about 15 percent of the map unit. Among these are natural soils near the margins of the map unit, parking lots and other areas that have an impervious surface, and upgraded areas.

Soil features affecting use—

Drainage class: poorly drained to excessively drained
Depth to a seasonal high water table: 0 to more than 6 feet
Depth to bedrock: 10 to more than 60 inches
Permeability: slow to very rapid
Available water capacity: very low to high
Flooding: none
Potential for frost action: low to high
Shrink-swell potential: low or moderate

These soils are used for urban development or landfills or are left idle.

The suitability of these soils for crops, forage, and woodland varies, depending on the degree to which the surface is disturbed. The soil limitations vary so much that the suitability for urban development cannot be specified. Onsite investigation is needed.

313A—Deerfield fine sandy loam, 0 to 3 percent slopes. This nearly level soil is in the slightly higher landscape positions on broad, low plains and on low rises in drainageways. Areas are irregularly shaped and are 4 to 150 acres in size.

A generalized profile of this soil is as follows:

1 ft. —

2 ft. —

3 ft. —

4 ft. —

Surface Layer:
dark brown fine sandy loam

Subsoil:
yellowish brown loamy sand

Substratum:
mottled yellowish brown sand

Inclusions make up about 20 percent of the map unit. Among these are Pipestone soils in hollows and drainageways and Windsor soils on the higher rises and knolls. Also included, in the coastal region, are Squamscott soils in drainageways and Eldridge soils in scattered areas.

Soil features affecting use—

Drainage class: moderately well drained
Depth to a seasonal high water table: 1.5 to 3.0 feet
Depth to bedrock: more than 60 inches
Permeability: moderately rapid or rapid
Available water capacity: low
Flooding: none
Potential for frost action: moderate
Shrink-swell potential: low

Most areas of this soil are used as woodland. Some areas are used for urban development.

This soil is suited to cultivated crops and forage species, but it is wet in early spring. The wetness hampers early planting of the crops that require a long growing season. Working the soil during wet periods results in the formation of ruts and compaction. If the wetness in areas of cropland is reduced by a subsurface drainage system, the crops can be planted on schedule. In pastured areas, where a subsurface drainage system is not economically feasible, open drainage ditches can reduce the wetness. Farm machinery should not be used when the soil is wet. Because of the sandy texture, the soil may be droughty in summer. Certain crops, such as vegetables, may require irrigation in summer to maintain yields.

This soil is well suited to woodland. The most common trees are eastern white pine, red maple, and northern red oak. Areas of this soil are good sites for white pine and produce high-quality pine sawlogs, but care must be taken to keep hardwoods from invading. For example, after an area has been clearcut, gray birch, white oak, and other hardwoods will reseed rather than white pine. Management that favors the regeneration of white pine includes cuttings in which only a portion of the trees are harvested. Scarifying the surface after the trees are harvested can help the pine seeds to sprout. Stands of white pine respond well to intensive stand improvement measures, such as pruning. Because of the sandy texture, water moves downward through the soil quickly and the trees can be harvested any time of the year, except for a short period in early spring. Wet, narrow drainageways extend through areas of this soil. If possible, skid trails should be routed around these drainageways.

This soil is suited to urban development, but the wetness in early spring, a poor filtering capacity, and frost action are limitations. Footing drains can help to keep cellars dry if drainage outlets are available. If outlets are not available, sump pumps may be needed. Fill is generally used to raise septic tank absorption fields above the seasonal high water table. Because of the sandy texture, the soil is poor filtering material for the leachate from septic systems. The effluent may pass through the soil too fast to be adequately purified before reaching the water table. Care is needed in excavating the soil because steep cutbanks commonly cave in. Adding retaining walls or grading long side slopes can keep the banks from collapsing. Frost action is a limitation. A properly designed road subgrade is needed to prevent frost heaving.

314A—Pipestone sand, 0 to 5 percent slopes. This nearly level and gently sloping soil is in broad basins and drainageways of wide plains and in narrow drainageways between hills. Areas are irregularly shaped and are 4 to 150 acres in size. In most places, the surface has scattered low hummocks less than 1 foot in height.

A generalized profile of this soil is as follows:

Surface Layer:
mottled very dark gray sand

Subsoil:
mottled yellowish red sand

Substratum:
yellowish brown sand

Inclusions make up about 25 percent of the map unit. Among these are Deerfield soils on low rises, Scarboro and Chocorua soils in basins and drainageways, and soils that have a cemented layer at a depth of about 1 foot. Also included, in the seacoast region, are Squamscott soils and soils that have a loamy substratum at a depth of more than 40 inches.

Soil features affecting use—

Drainage class: somewhat poorly drained
Depth to a seasonal high water table: 0.5 foot to 1.5 feet
Depth to bedrock: more than 60 inches
Permeability: rapid
Available water capacity: low
Flooding: none
Potential for frost action: moderate
Shrink-swell potential: low

Most areas of this soil are used as woodland. In places the soil is classified as wetland.

This soil is poorly suited to cultivated crops and forage species. It is wet in spring. The wetness hampers early planting of the crops that require a long growing season. Working the soil during wet periods results in the formation of ruts and compaction. If the wetness in areas of cropland is reduced by a subsurface drainage system, the crops can be planted on schedule. Land grading also can reduce the wetness. Grazing of undrained pasture should be delayed until the soil dries out. Farm machinery should not be used when the soil is wet. Because of the sandy texture, the soil may be droughty in summer. Certain crops, such as vegetables, may require irrigation in summer to maintain yields.

This soil is suited to woodland. The most common trees are red maple, eastern white pine, and northern red oak. Areas of this soil can be good sites for white pine and produce high-quality pine sawlogs, but hardwoods may dominate the site or may be introduced through management practices. For example, after an area has been clearcut, red maple, elm, and other hardwoods will reseed rather than white pine. An alternative that would favor the regeneration of white pine is improvement cutting, in which approximately a third of the trees are harvested. Shelterwood cutting, in which half of the trees are removed, is not recommended because of the hazard of windthrow. Scarifying the surface after the trees are harvested can help the pine seeds to sprout. If hardwoods dominate the site, the area can be managed for fuelwood. Small, ribbon-shaped or kidney-shaped clearcuts in scattered areas throughout the lot can reduce the hazard of windthrow and provide a varied habitat for wildlife. The soil is wet in spring and late fall. Logging in midwinter, when the ground is frozen, or midsummer, when the soil is drier, helps to prevent the formation of ruts and reduces the likelihood that the equipment will become bogged down.

This soil is poorly suited to urban development. The wetness, a poor filtering capacity, and frost action are limitations. Footing drains can help to keep cellars dry if drainage outlets are available. If outlets are not available, sump pumps may be needed. Fill is generally used to raise septic systems above the seasonal high water table. Because of the sandy texture, the soil is poor filtering material for the leachate from septic systems. The effluent may pass through the soil too fast to be adequately purified before reaching the water table. Care is needed in excavating the soil because steep cutbanks commonly cave in. Adding retaining walls or grading long side slopes can keep the banks from collapsing. Frost action is a limitation. A properly designed road subgrade is needed to prevent frost heaving. Because of the potential for frost action, foundations should have adequate footings.

397—Ipswich mucky peat. This nearly level soil is in tidal marshes. Areas are irregularly shaped and are 4 to 1,000 acres in size. The content of salts in the soil is more than 1 percent.

A generalized profile of this soil is as follows:

1 ft. —

2 ft. —

3 ft —

4 ft. —

Surface Layer:
very dark grayish brown mucky peat

Subsoil:
dark reddish brown mucky peat

Substratum:
dark reddish brown mucky peat

Inclusions make up about 10 percent of the map unit. Among these are Pawcatuck soils near the central part of the marshes and Westbrook soils near the margins of the marshes.

Soil features affecting use—

Drainage class: very poorly drained
Seasonal high water table: at the surface or as much as 1 foot above the surface
Depth to bedrock: more than 60 inches
Permeability: moderate
Available water capacity: high
Flooding: frequent
Potential for frost action: high

Most areas of this soil are used as wildlife habitat. In most places the soil is classified as wetland.

This soil is generally unsuited to woodland. Because of the frequent flooding and high salinity, trees cannot grow in the tidal marshes.

This soil is unsuited to cultivated crops and forage species. Because of the periodic flooding by tidal seawater, the wetness, low strength, and the content of salts, farming is impractical. The only suitable plants are those that can withstand a high content of salts.

This soil is very poorly suited to urban development because of the tidal flooding.

510B—Hoosic gravelly fine sandy loam, 3 to 8 percent slopes. This gently sloping soil is on low hills, knolls, and ridges, generally at an elevation of 60 to 160 feet. Areas are oval or irregularly shaped and are 5 to 100 acres in size.

A generalized profile of this soil is as follows:

Surface Layer:
brown gravelly fine sandy loam

Subsoil:
yellowish brown very gravelly fine sandy loam

Substratum:
brown very gravelly coarse sand

Inclusions make up about 10 percent of the map unit. Among these are moderately well drained soils in hollows and soils that are underlain by hard bedrock or have a dense hardpan in the substratum.

Soil features affecting use—

Drainage class: somewhat excessively drained
Depth to a seasonal high water table: more than 6 feet
Depth to bedrock: more than 60 inches
Permeability: moderately rapid in the upper part of the profile and very rapid in the lower part
Available water capacity: low
Flooding: none
Potential for frost action: low
Shrink-swell potential: low

Most areas of this soil are used for cultivated crops or forage. Some areas are used for urban development, and some are used as woodland. In most areas the soil is classified as additional farmland of statewide importance. It is a source of sand and gravel.

This soil is suited to cultivated crops and forage species, but it is droughty during dry summers. Adding organic material, such as manure or crop residue, can increase the available water capacity. Certain crops, such as vegetables, may require irrigation during the dry summers to maintain yields. Because of the summer droughtiness, the soil is most productive as pasture in early spring. Because of the slope, erosion is a hazard. In areas used for corn silage, this hazard can be reduced by no-till farming and other forms of conservation tillage or by short rotations, such as 2 years of corn and 5 years of hay. In areas where row crops, such as vegetables, are grown year after year, diversions and terraces may be needed as erosion-control measures.

This soil is well suited to woodland. The most common trees are eastern white pine, sugar maple, and northern red oak. Areas of this soil are good sites for white pine and produce high-quality pine sawlogs, but care must be taken to keep hardwoods from invading. For example, after an area has been clearcut, gray birch, white oak, and other hardwoods will reseed rather than white pine. Management that favors the regeneration of white pine includes cuttings in which only a portion of the trees are harvested. Scarifying the surface after the trees are harvested can help the pine seeds to sprout. Stands of white pine respond well to intensive stand improvement measures, such as pruning. Because the soil is droughty, the trees can be harvested any time of the year, even in spring.

This soil is well suited to urban development. Because of the sandy texture, however, it is poor filtering material for the leachate from septic systems. The effluent may pass through the soil too fast to be adequately purified before reaching the water table. Care is needed in excavating the soil because steep cutbanks commonly cave in. Adding retaining walls or grading long side slopes can keep the banks from collapsing. Lawns may require irrigation during dry summers, when the soil is droughty. Incorporating organic material, such as plant residue or manure, into the soil can increase the available water capacity. Mulching and frequent watering may be required in disturbed areas. Erosion is a hazard during earth-moving operations. Common erosion- and sediment-control measures are sediment traps and a good plant cover.

538A—Squamscott fine sandy loam, 0 to 5 percent slopes. This nearly level and gently sloping soil is in drainageways and on broad, low plains. Areas are irregularly shaped and are 4 to 150 acres in size. Scattered hummocks that are about 1 foot high are throughout the map unit.

A generalized profile of this soil is as follows:

Surface Layer:
mottled light brownish gray fine sandy loam

Subsoil:
mottled brownish yellow loamy sand

Substratum:
mottled gray silt loam

In places depth to the loamy substratum is more than [illegible] inches.

Inclusions make up about 15 percent of the map unit. Among these are Scitico and Maybid soils in hollows and drainageways and Eldridge soils on low rises and knolls.

Soil features affecting use—

Drainage class: poorly drained
Depth to a seasonal high water table: 0 to 1 foot
Depth to bedrock: more than 60 inches
Permeability: rapid in the upper part of the profile and moderately slow in the lower part
Available water capacity: high
Flooding: none
Potential for frost action: high
Shrink-swell potential: low

Most areas of this soil are used as woodland. Some areas are used for cultivated crops or forage. In places the soil is classified as wetland.

This soil is suited to cultivated crops and forage species, but it is wet in spring. The wetness hampers early planting of the crops that require a long growing season. Working the soil during wet periods results in the formation of ruts and compaction. Although a subsurface drainage system may not be effective, land grading can reduce the wetness. Early planting should be avoided. Grazing of undrained pasture should be delayed until the soil dries out. Farm machinery should not be used when the soil is wet.

This soil is suited to woodland. The most common trees are red maple and eastern white pine. Areas of this soil can be good sites for white pine and produce high-quality pine sawlogs, but hardwoods may dominate the site or may be introduced through management practices. For example, after an area has been clearcut, red maple, aspen, or elm will reseed rather than white pine. An alternative that would favor the regeneration of white pine is improvement cutting, in which approximately a third of the trees are harvested. Shelterwood cutting, in which half of the trees are removed, is not recommended because of the hazard of windthrow. Scarifying the surface after the trees are harvested can help the pine seeds to sprout. If hardwoods dominate the site, the area can be managed for fuelwood. Small, ribbon-shaped or kidney-shaped clearcuts in scattered areas throughout the lot can reduce the hazard of windthrow and provide a varied habitat for wildlife. The soil is wet in spring and late fall. Logging in midwinter, when the ground is frozen, or midsummer, when the soil is drier, helps to prevent the formation of ruts and reduces the likelihood that the equipment will become bogged down.

This soil is poorly suited to urban development because of the wetness, ponding, frost action, and the restricted permeability. Fill is generally used to raise septic systems above compact soil layers and the seasonal high water table. Footing drains around the foundations can reduce the wetness, but outlets for the drains may not be available. Sump pumps may still be needed. Storm water management is critical because of the restricted permeability. Land shaping, ditching, and installing culverts around the development can help to remove surface water, but ponding may still occur after heavy rains. Because of the potential for frost action, foundations should have adequate footings. Properly designing road subgrades can reduce the hazard of frost heaving.

546A—Walpole very fine sandy loam, 0 to 5 percent slopes. This nearly level and gently sloping soil is in drainageways. Areas are long and narrow or irregularly shaped and are 4 to 30 acres in size.

A generalized profile of this soil is as follows:

Surface Layer:
very dark grayish brown very fine sandy loam

Subsoil:
mottled light yellowish brown sandy loam

Substratum:
mottled light olive brown gravelly loamy sand

Inclusions make up about 15 percent of the map unit. Among these are Scarboro soils in scattered areas throughout the map unit and Newfields soils on low rises and near the margins of the map unit.

Soil features affecting use—

Drainage class: poorly drained
Depth to a seasonal high water table: 0 to 1 foot
Depth to bedrock: more than 60 inches
Permeability: moderately rapid or rapid
Available water capacity: moderate
Flooding: none
Potential for frost action: moderate
Shrink-swell potential: low

Most areas of this soil are used as woodland. Some areas are used for cultivated crops or forage. In places the soil is classified as wetland.

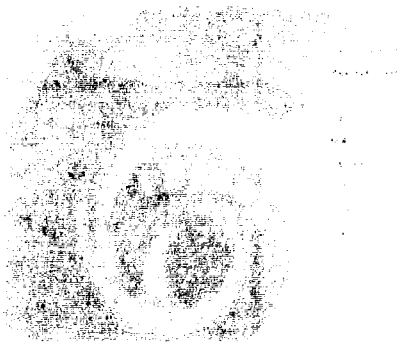
This soil is suited to cultivated crops and forage species, but it is wet in spring. The wetness hampers early planting of the crops that require a long growing season. Working the soil during wet periods results in the formation of ruts, compaction, and the siltation of nearby streams. If the wetness in areas of cropland is reduced by a subsurface drainage system, the crops can be planted on schedule. Land grading also can reduce the wetness. Grazing of undrained pasture should be delayed until the soil dries out. Farm machinery should not be used when the soil is wet. Frost action is a limitation. Perennial plants that can withstand wetness and frost action should be selected for planting. For example, alfalfa does not grow well on this soil because frost heaving damages the roots. A better choice of perennial forage would be a grass-legume mixture that includes clover.

This soil is suited to woodland. The most common trees are red maple, eastern white pine, white ash, and eastern hemlock. The trees are of low quality, though the stands may be densely stocked and yields may be high. The site conditions favor the production of fuelwood. Various species of wildlife are attracted to areas of this soil. In areas managed for fuelwood, scattered ribbon-shaped or kidney-shaped clearcuts should be established throughout the lot. The clearcuts should be no more than 200 feet across. The small clearcuts can reduce the hazard of windthrow and provide a varied habitat for wildlife. Harvesting methods that leave a diversity of trees, such as snag trees, trees with cavities, and a variety of size classes, improve the habitat for wildlife. The soil is wet in spring and late fall. Logging in midwinter, when the ground is frozen, or midsummer, when the soil is drier, helps to prevent the formation of ruts and reduces the likelihood that the equipment will become bogged down.

This soil is poorly suited to urban development. The wetness, a poor filtering capacity, and frost action are limitations. Land shaping and grading can reduce the wetness. Footing drains can help to keep cellars dry if drainage outlets are available. If outlets are not available, sump pumps may be needed. Fill is generally used to raise septic systems above the seasonal high water table. Because of the sandy texture, the soil is poor filtering material for the leachate from septic systems. The effluent may pass through the soil too rapidly to be adequately purified before reaching the water table. Care is needed in excavating the soil because steep cutbanks commonly cave in. Adding retaining walls or grading long side slopes can keep the banks from collapsing. Frost action is a limitation. A properly designed road subgrade is needed to prevent frost heaving. Because of the potential for frost action, foundations should have adequate footings.

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering

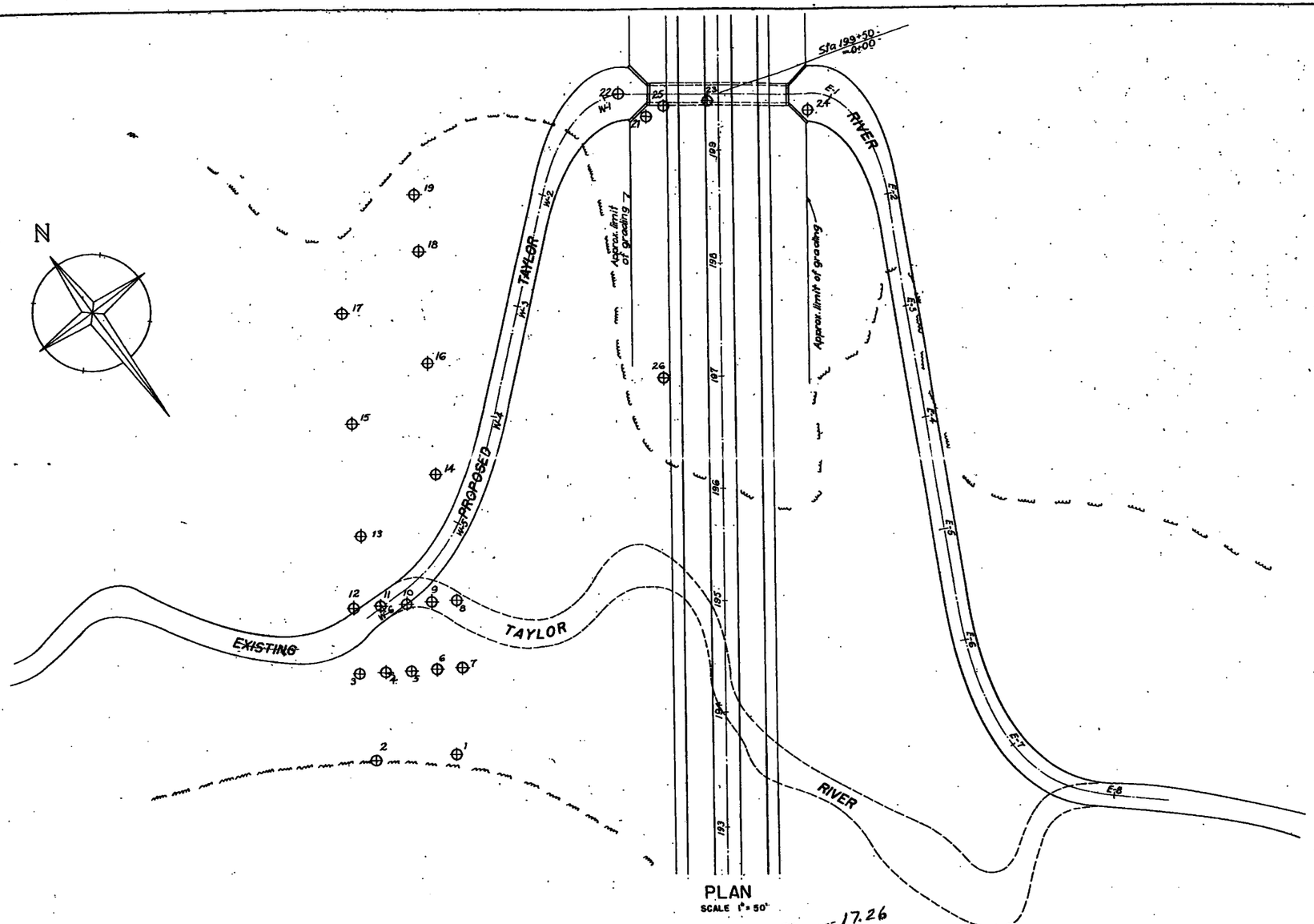


Appendix C

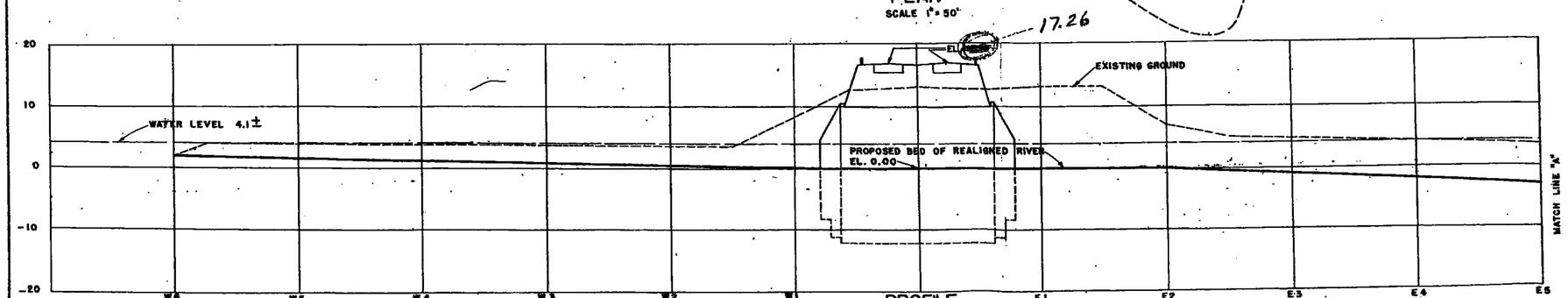
Subsurface Information from 1948 and 1971-1972 NHDOT Drawings

FED. ROAD DIST. NO.	STATE	PROJ. NO.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
5	N. H.				

WORKING DRAWING NO. 26



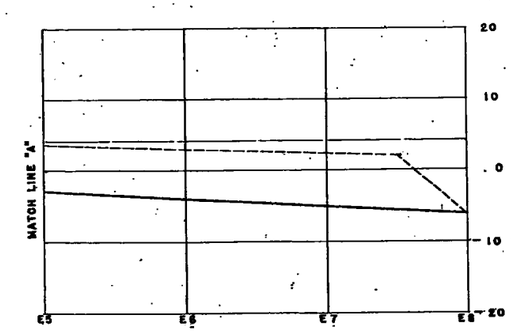
PLAN
SCALE 1" = 50'



PROFILE
SCALES: 1" = 50' HOR., 1" = 10' VERT.

NOTES

AT THE OPTION OF THE CONTRACTOR AND SUBJECT TO THE APPROVAL OF THE ENGINEER THE CHANNEL MAY BE EXCAVATED BY THE USE OF EXPLOSIVES. PAYMENT WILL BE MADE UNDER ITEM 7.3— UNCLASSIFIED CHANNEL EXCAVATION.



NEW HAMPSHIRE HIGHWAY DEPARTMENT
NEW HAMPSHIRE TURNPIKE

TAYLOR RIVER
STRUCTURE NO. 5
PLAN & PROFILE

SCALE AS SHOWN — DATE AUG. 15, 1948

PARSONS, BRINKERHOFF, HOGAN AND MACDONALD
ENGINEERS — NEW YORK

PROJ. NO.	SHEET NO.	TOTAL
23/8/5	26	

REVISIONS AFTER POSAL

DATE	STA.	TO STA.	DESCRIPTION

BOOK NO. | PAGE

PLAN TRACED BY
CHECKED
PROFILE TRACED BY
CHECKED

DATE

1500 3-48 PRINTED IN U.S.A. HARRISON PRINTING CLUBS 17-27 GALE PLACE N.Y., BRONX, N.Y.

LEGEND

B - Boulder	H - Hard	Sa - Sandy
BH - Bottom of Hole	Hn - Hardpan	Sd - Solid
Bl - Blue	L - Loam	Se - Seamy
BR - Bed Rock	Le - Ledge	Sh - Sharp
Br - Brown	Li - Little	Si - Silt
C - Clay	Ls - Loose	Sm - Small
Co - Compact	Ly - Loamy	So - Soft
Cs - Coarse	M - Medium	St - Stones
F - Fill	Mu - Mud	Sy - Shaley
Fi - Fine	P - Peat	V - Very
Fm - Firm	R - Rock	W - Water
G - Gravel	Rd - Road	Y - Yellow
Gr - Grey	S - Sand	

BLOWS PER FT. ARE BLOWS REQUIRED TO DRIVE 1 1/8" PIPE ONE FT., USEING 135 lb. WEIGHT FALLING TWO FT., EXCEPT AS NOTED BELOW.

THE INTERPRETATION OF BORINGS IS NOT GUARANTEED TO SHOW ACTUAL CONDITIONS. CONTRACTORS MAY INSPECT SAMPLES OF BORINGS AT THE OFFICE OF THE DEPARTMENT AND MAKE THEIR OWN INTERPRETATION.

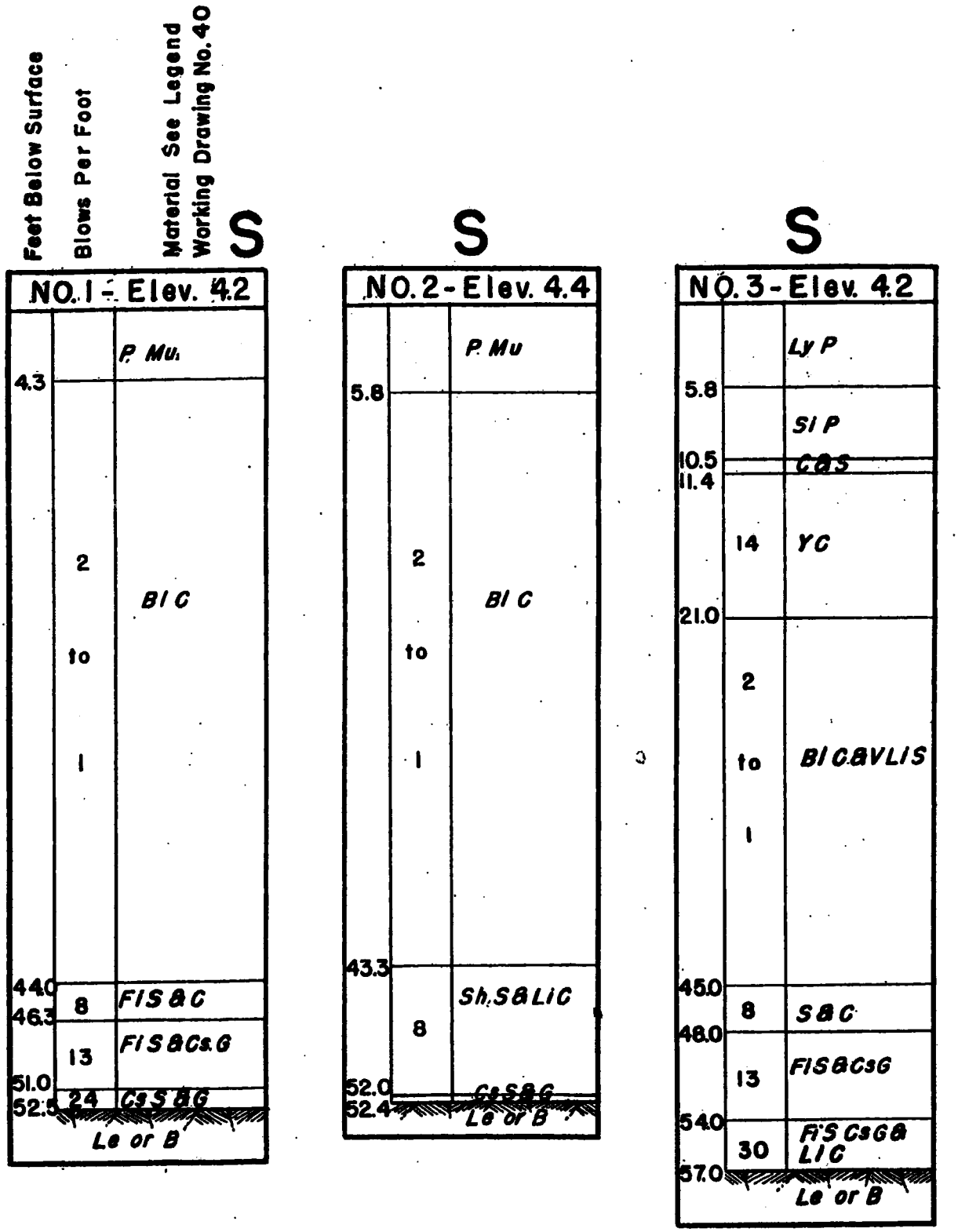
S ALL BORINGS MARKED "S" ARE 125 LB. HAMMER, BLOWS ON SPOON.

NEW HAMPSHIRE HIGHWAY DEPARTMENT
NEW HAMPSHIRE TURNPIKE

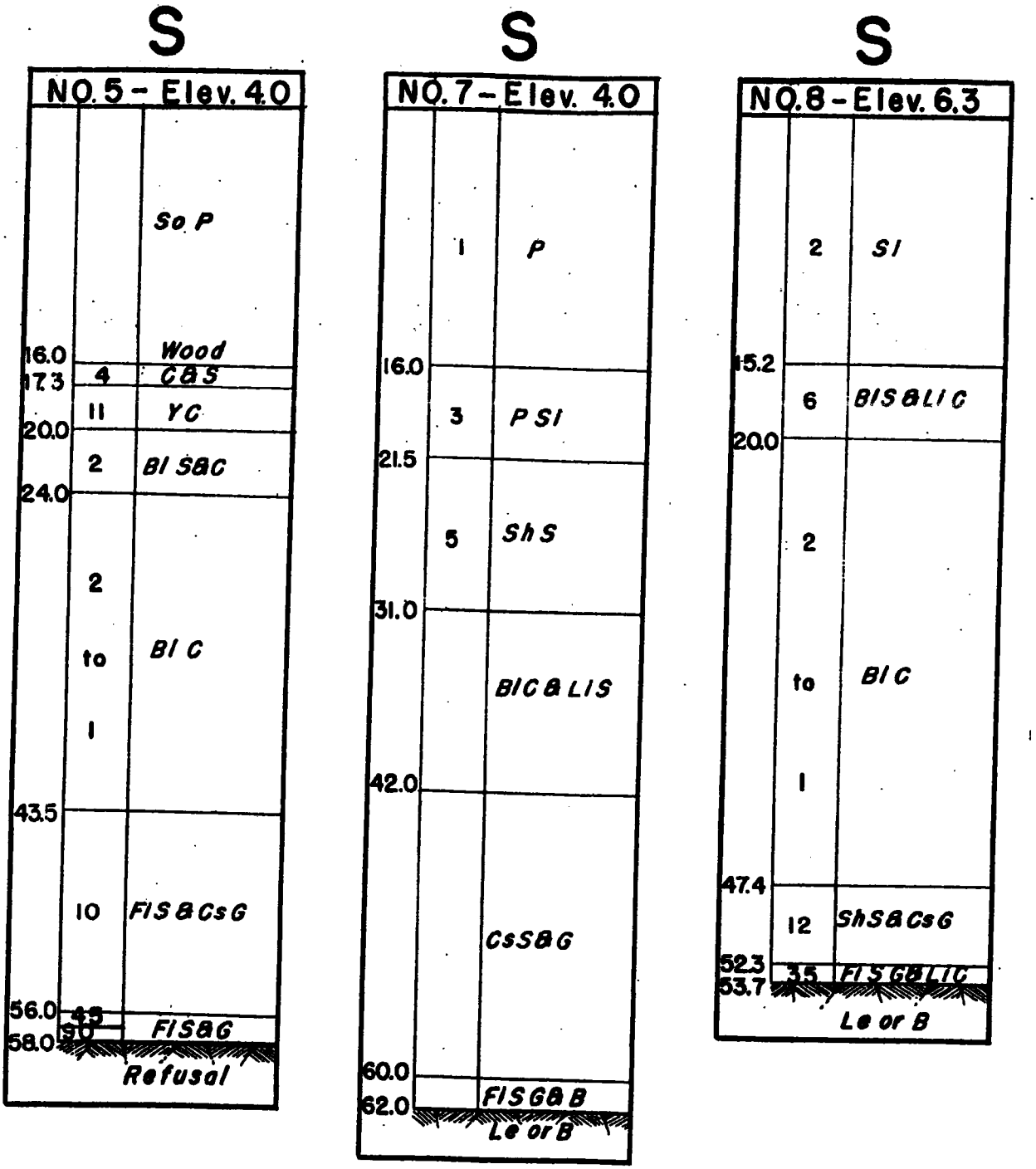
ROUTE 101-D STR. NO. 9
HAMPTON FALLS - EXETER RD. STR. NO. 4
OCEAN RD. STR. NO. 13 POST RD. STR. NO. 11
HAMPTON - EXETER RD. STR. NO. 8
BORINGS

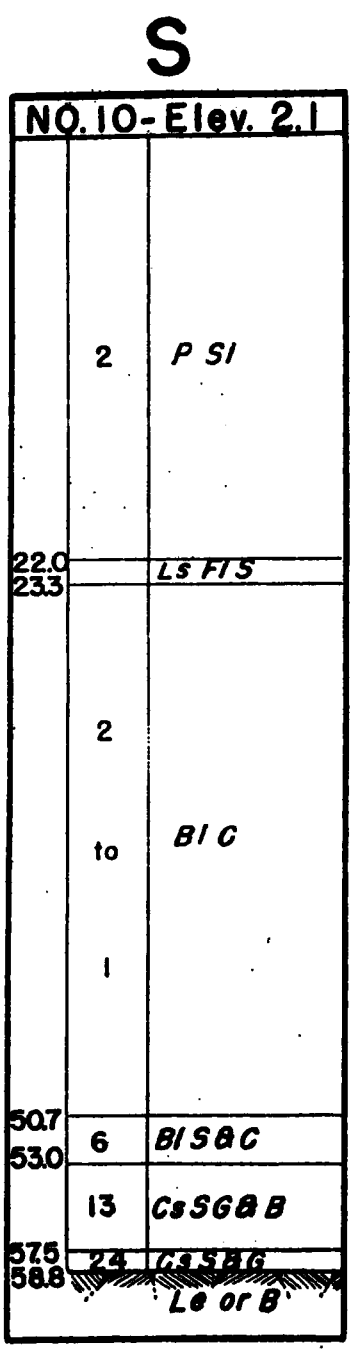
SCALE: NONE DATE AUG. 15, 1948

PARSONS, BRINCKERHOFF, HOGAN & MACDONALD
ENGINEERS NEW YORK



Note: Borings Nos. 4, 6, 9, 11, 20 No Data


S
NO. 5 - Elev. 4.0
So P
16.0
Wood
17.3
4
C&S
11
YC
20.0
2
Bl S&C
24.0
2
to
1
Bl C
43.5
10
FlS&CsG
56.0
4.5
9.0
FlS&G
58.0
Refusal
S
NO. 7 - Elev. 4.0
1
P
16.0
3
P Sl
21.5
5
Sh S
31.0
Bl C & Ll S
42.0
Cs S&G
60.0
Fl S G&B
62.0
Le or B
S
NO. 8 - Elev. 6.3
2
Sl
15.2
6
Bl S & Ll C
20.0
2
to
1
Bl C
47.4
12
Sh S & Cs G
52.3
3.5
Fl S G & Ll C
53.7
Le or B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2
P SI
22.0
23.3
Ls FI S
2
to
1
BI C
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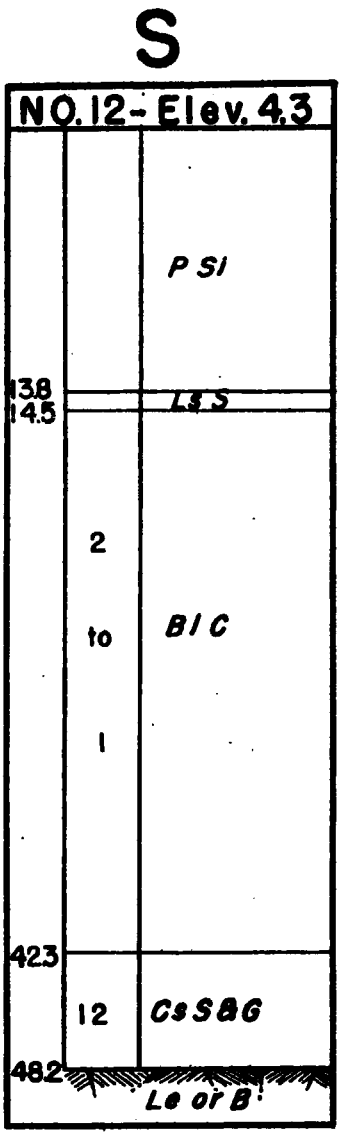
53.0
6
BI S & C
13
Cs SG & B
57.5
58.8
24
Cs S & G
Le or B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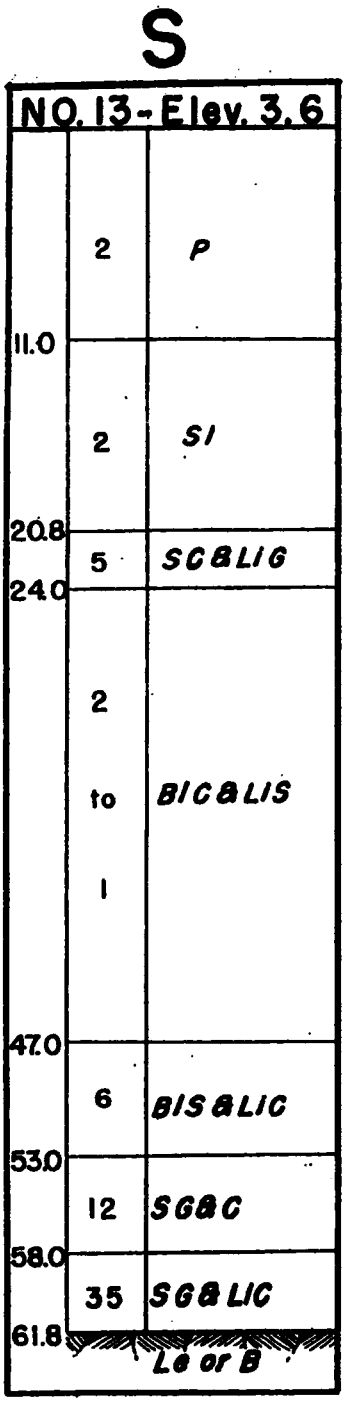
NO. 12 - Elev. 4.3
P SI
13.8
14.5
Ls S
2
to
1
BI C
42.3
12
Cs S & G
48.2
Le or B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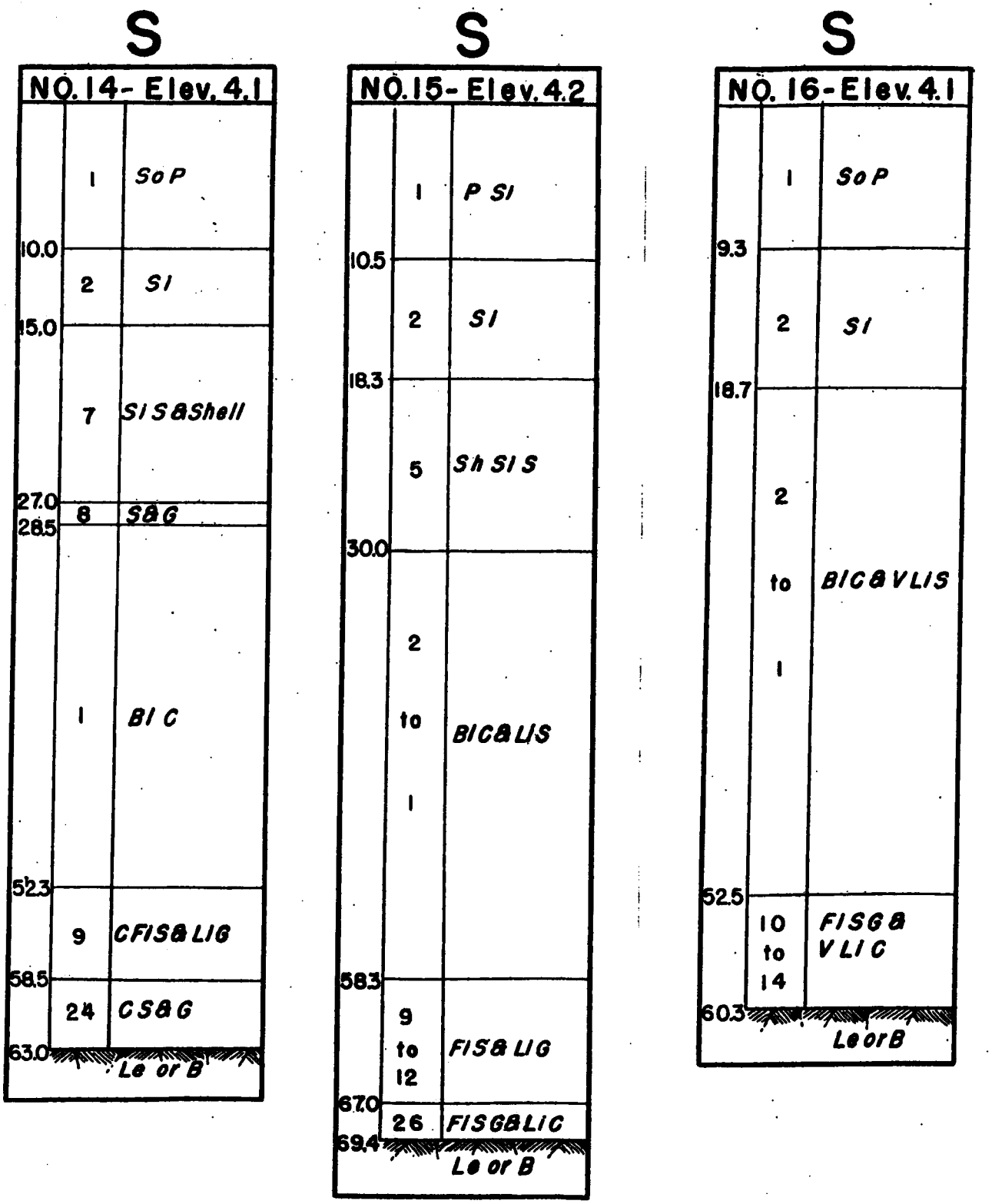
2
P
11.0
2
SI
20.8
5
SC & LIG
24.0
2
to
1
BI C & LIS
47.0
6
BI S & LIC
53.0
12
SG & C
58.0
35
SG & LIC
61.8
Le or B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1 SoP
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2 SI
15.0
7 SI S & Shell
27.0
8 S&G
28.5
1 BI C
52.3
9 CFIS & LIG
58.5
24 CS&G
63.0
Le or B
S
NO. 15 - Elev. 4.2
1 P SI
10.5
2 SI
18.3
5 Sh SI S
30.0
2 to 1 BIC & LIS
58.3
9 to 12 FIS & LIG
67.0
26 FIS G & LIC
69.4
Le or B
S
NO. 16 - Elev. 4.1
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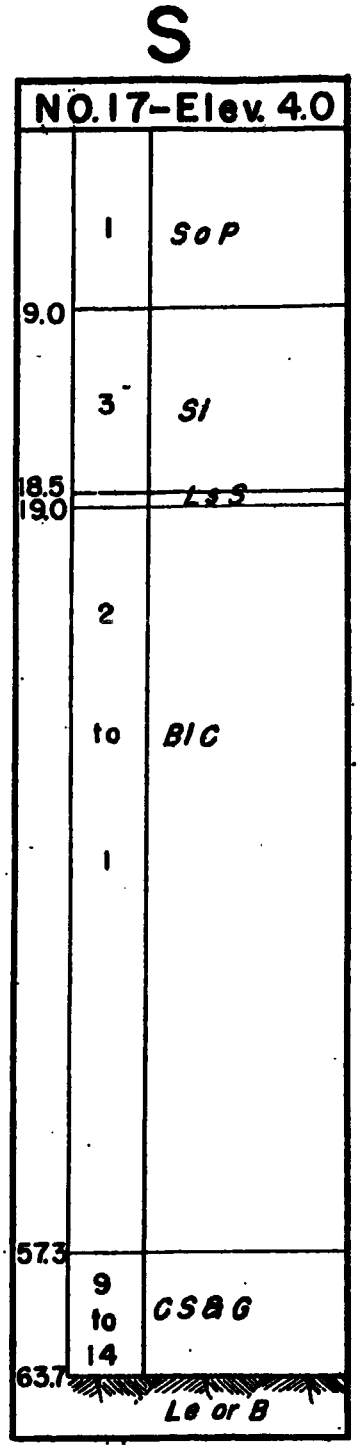
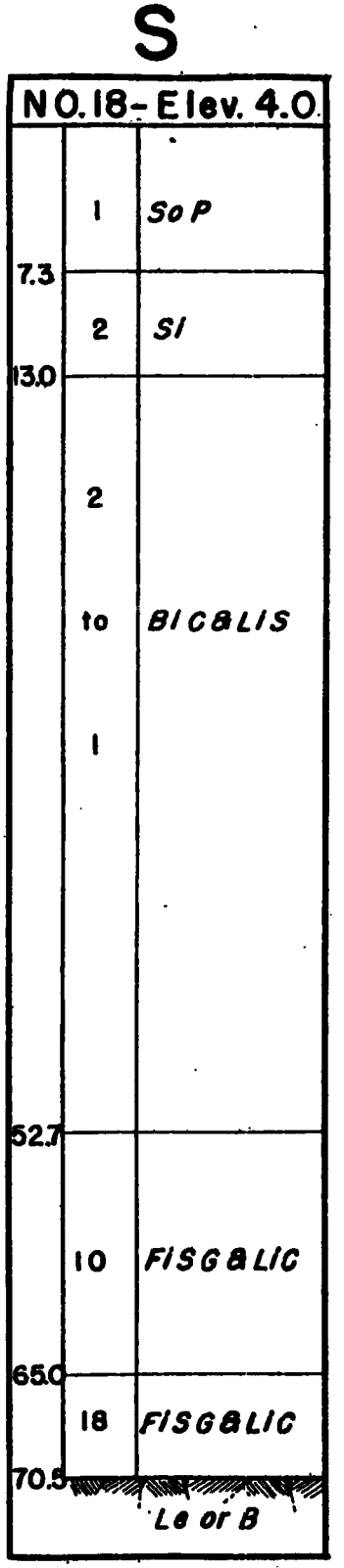
9.3
2 SI
18.7
2 to 1 BIC & VLIS
52.5
10 to 14 FIS G & VLIC
60.3
Le or B


S
NO. 17-Elev. 4.0
1
SoP
9.0
3
SI
18.5
19.0
LsS
2
to
1
BIC
57.3
9
to
14
CSBG
63.7
Le or B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1
SoP
7.3
2
SI
13.0
2
to
1
BICBLIS
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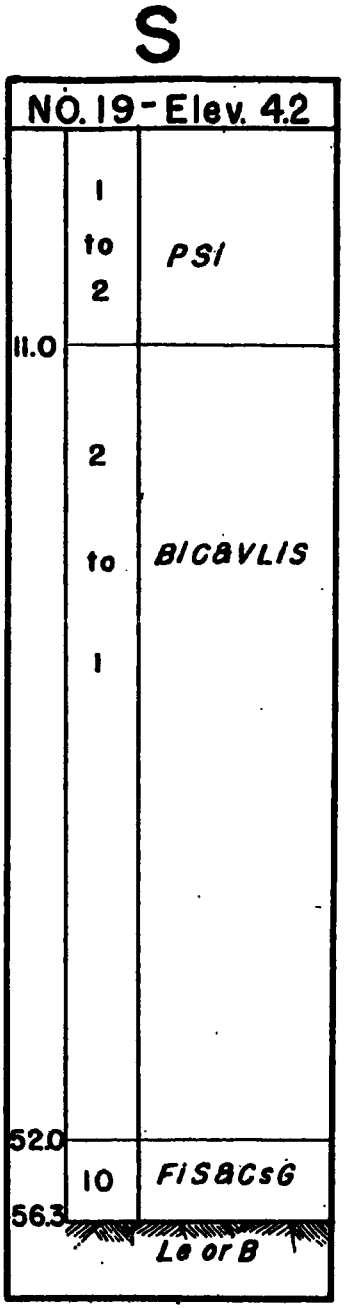
10
FISGBLIC
65.0
18
FISGBLIC
70.5
Le or B


S
NO. 19-Elev. 4.2
1
to
2
PSI
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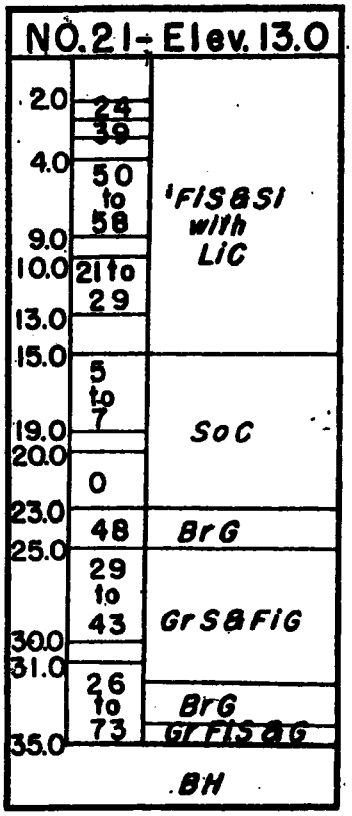
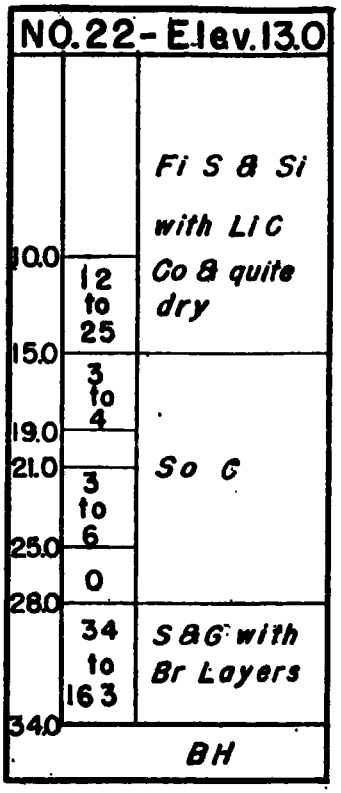
2
to
1
BICBVLIS
52.0
10
FISBCsG
56.3
Le or B


NO.21-Elev.13.0
2.0
24
39
4.0
50 to 58
9.0
10.0
21 to 29
13.0
15.0
5 to 7
19.0
20.0
0
23.0
48
25.0
29 to 43
30.0
31.0
26 to 73
35.0
FI S & SI with LI C
So C
Br G
Gr S & FI G
Br G
Gr FI S & G
BH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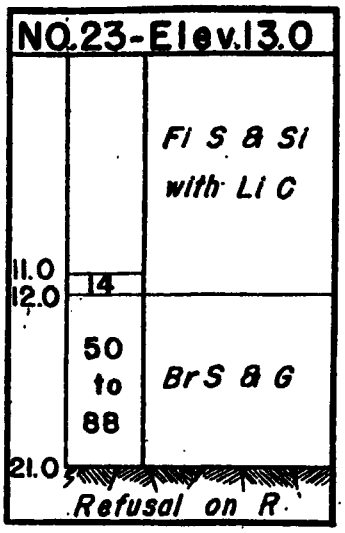
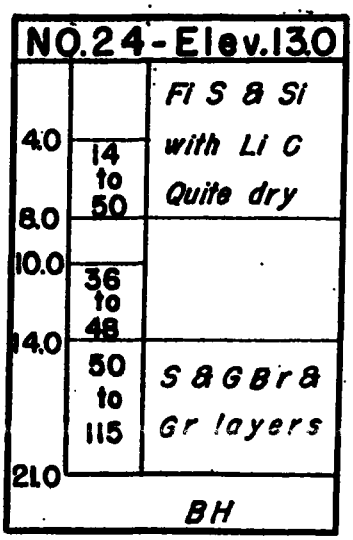
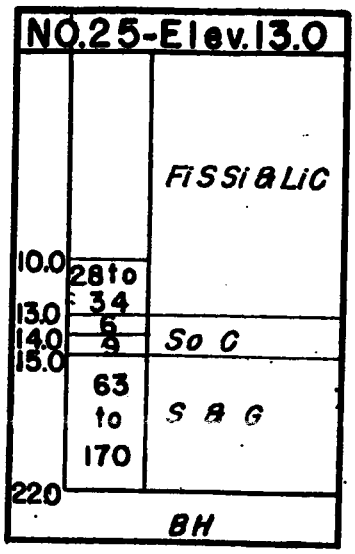
10.0
12 to 25
15.0
3 to 4
19.0
21.0
3 to 6
25.0
0
28.0
34 to 163
34.0
Fi S & Si with Li C
Co & quite dry
So C
S & G with Br Layers
BH


NO.23-Elev.13.0
11.0
12.0
14
50 to 88
21.0
Fi S & Si with Li C
Br S & G
Refusal on R.


NO.24-Elev.13.0
4.0
8.0
10.0
14.0
21.0
14 to 50
36 to 48
50 to 115
Fi S & Si with Li C Quite dry
S & G Br & Gr layers
BH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13.0
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15.0
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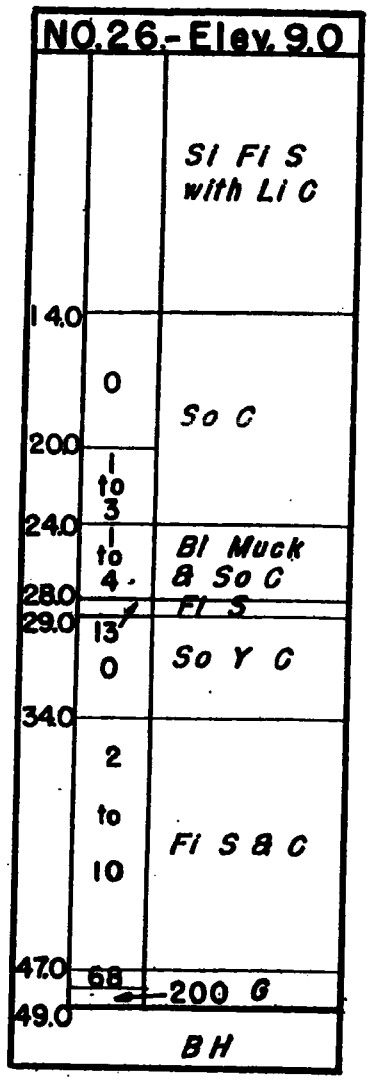
28 to 34
5
9
63 to 170
Fi S Si & Li C
So C
S & G
BH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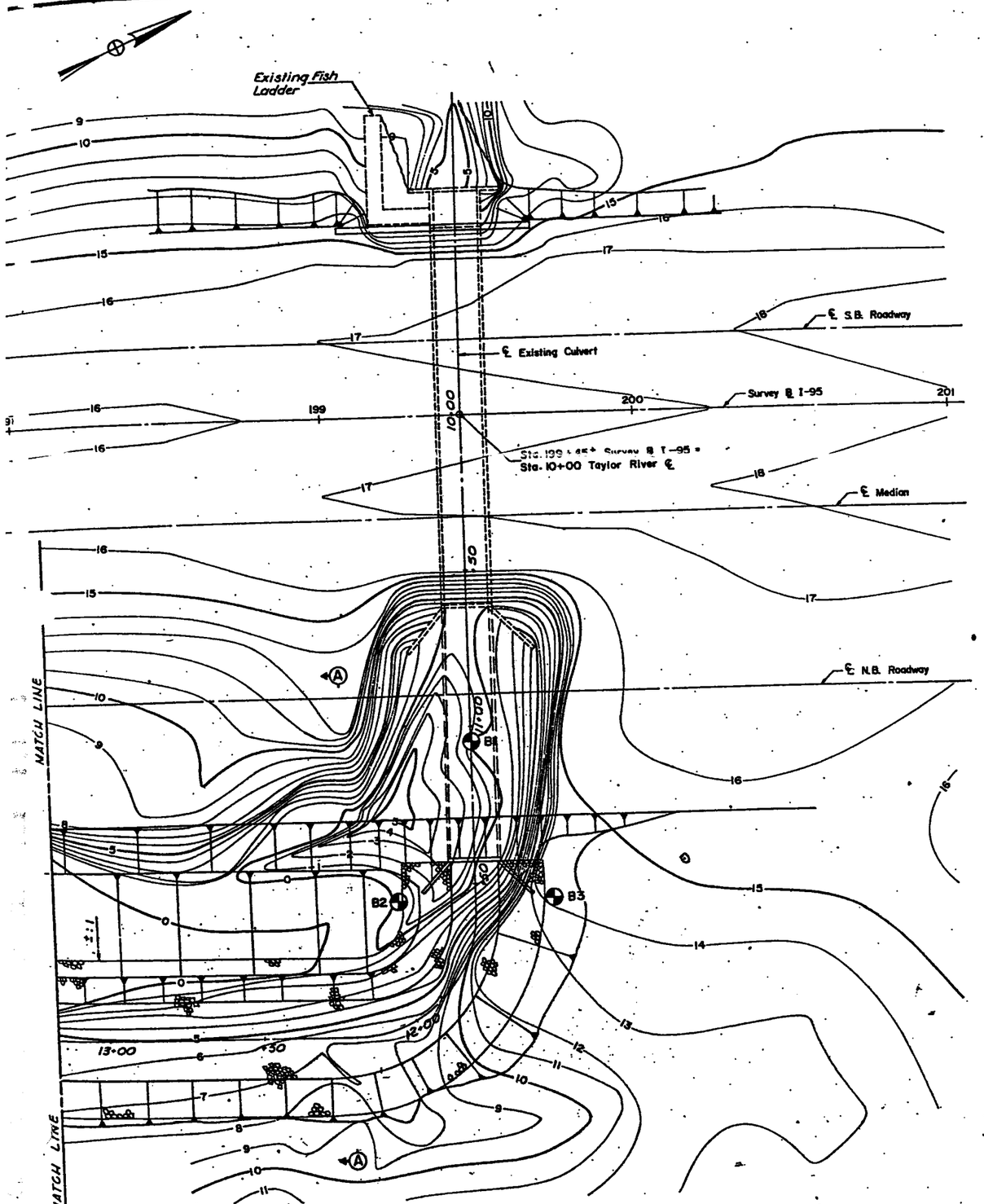
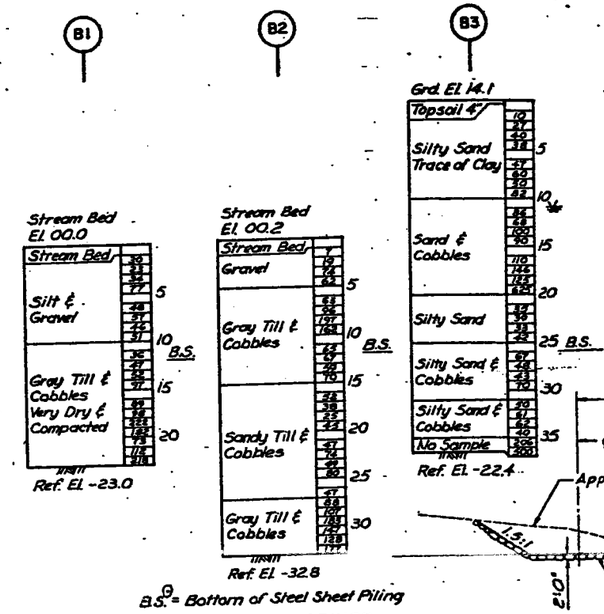
14.0
20.0
24.0
28.0
29.0
34.0
47.0
49.0
0
1 to 3
1 to 4
13
0
2 to 10
68
Si Fi S with Li C
So C
Bl Muck & So C
Fi S
So Y C
Fi S & C
200 G
BH

FED. ROAD DIV. NO.	STATE	PROJ.	FISCAL YEAR	SHEET NO.	TOTAL SHEETS
1	N. H.				



BORING LAYOUT & CONTOUR PLAN

1"=20'



B.S. = Bottom of Steel Sheet Piling

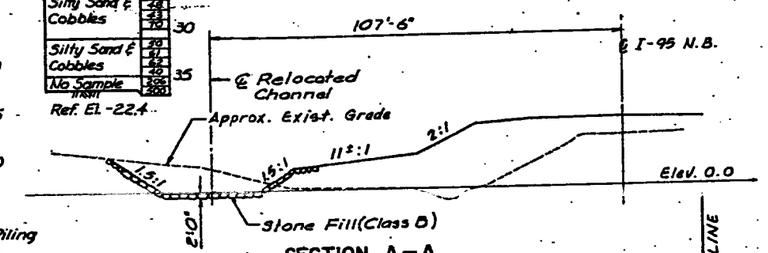
LOG OF BORINGS

Vertical 1/8" = 1'-0"

NOTES

Borings made by Sprague & Henwood Inc. 221 West Olive St. Scranton, Pennsylvania, March 10, 1971. Figures in right hand column indicate number of blows required to drive 1 3/8" O.D. Open end rod one foot, using 140 lb. weight falling 2'-6". Borings are for design and show conditions of boring points only and do not necessarily indicate materials to be encountered during construction.

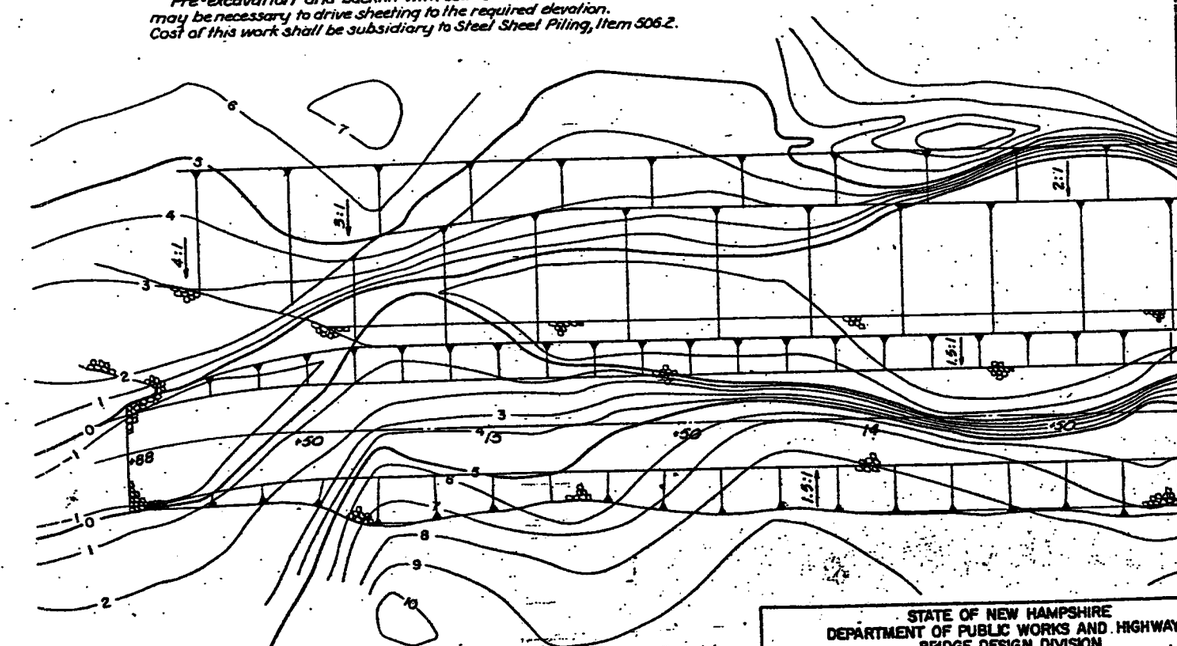
Indicates water level.



SECTION A—A

1" = 20'

NOTE:
Pre-excavation and backfill with suitable material may be necessary to drive sheeting to the required elevation. Cost of this work shall be subsidiary to Steel Sheet Piling, Item 506.2.



STATE OF NEW HAMPSHIRE
DEPARTMENT OF PUBLIC WORKS AND HIGHWAYS
BRIDGE DESIGN DIVISION

TOWN HAMPTON — BRIDGE NO. 120/102

I.S. PROJECT 1831(2) Contract #2 — STATE PROJECT P-1235 B

LOCATION ROUTE I-95 N.B. & S.B. (E.N.H. TURNPIKE WIDENING) over TAYLOR RIVER

BORING LOGS & CONTOUR PLAN

	BY	DATE		BY	DATE	
DESIGNED	I.S.	10-71	CHECKED	R.E.F.	10-71	BRIDGE SHEET NO. 3 OF 6
DRAWN	S.A.L.	11-71	CHECKED	I.S.	2/72	
TRACED			CHECKED			FILE NUMBER 28 - 3 - 5
QUANTITIES	D.I.	9-72	CHECKED	R.E.F.	9-72	

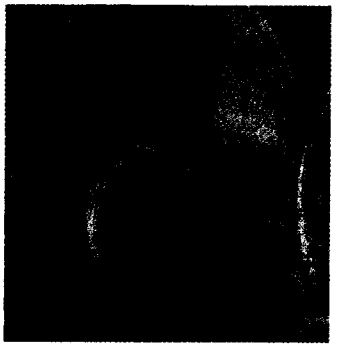
△	DESCRIPTION	BY	DATE
	REVISIONS		

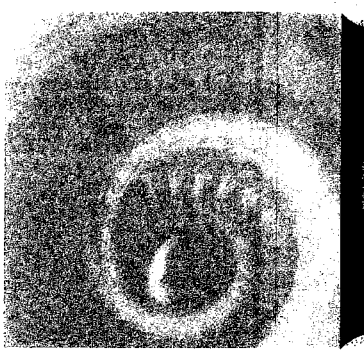
HOWARD, NEEDLES, TAMMEN & BERGENDOFF CONSULTING ENGINEERS — HNTB — BOSTON

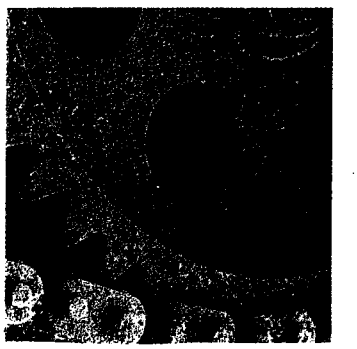
SHEET NO. — TOTAL SHEETS

GEI Consultants

Geotechnical
Environmental and
Water Resources
Engineering







Appendix D

NHDES Dam Bureau Information on Taylor River Dam, Taylor River Relief Structure, and Rice Dam

STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

DATE: January 25, 2005

FROM: Grace E. Levergood, P.E. **AT(OFFICE):** Water Division
Dam Safety Engineer gel Dam Bureau

SUBJECT: **Taylor River Pond Dam and Taylor River Pond Dike, Hampton Falls Dam #106.08 (Haz. Class A to B) and Dike #106.09 (Haz. Class AA)**

TO: Harvey Goodwin
NH Dept. of Transportation
Bureau of Turnpikes

On July 2, 2004, the State of New Hampshire Department of Environmental Services (DES) conducted a scheduled inspection of the aforementioned dam and dike. Under the provisions of RSA Chapter 482, Sections 8 through 15, DES is authorized to inspect all dams in the State, which by reason of their physical condition, height and location may be a menace to the public safety.

The following is the result of our file reviews and site inspection:

DAM #106.08:

1. The sheet pile spillway was badly deteriorated with a 12" diameter hole in the downstream face adjacent to the right abutment;
2. The downstream left concrete wall of the fishway that abuts the right spillway training wall was badly deteriorated with exposed rebar and leakage;
3. Cracking was evident along the left wall of the fishway;
4. The stoplog bay sill which forms the crest of the spillway was deteriorated;
5. There was settlement of the left abutment adjacent to the sheet pile training wall;
6. There is no operation and maintenance plan (O&M) on file with the DES; and
7. An Emergency Action Plan (EAP) is now required due to the reclassification of this structure.

DES is recommending the following:

1. Make repairs to the steel sheet piling in the following locations:
   a. The spillway face
   b. The crest of the sheet pile spillway
   c. The left abutment wall which are badly deteriorated;
2. Make concrete repairs to the fishway in the following locations:
   a. The downstream left concrete wall of the fishway that abuts the right spillway training wall, is badly deteriorated with exposed rebar and leakage;
   b. The left wall of the fishway that is badly cracked;
3. Bring the left earthen embankment level with the left abutment wall where there is settlement;

4. Complete and submit to DES an O&M plan. Refer to the enclosed guidelines; and

5. Submit a draft EAP. Contact Ms. Bethann McCarthy for assistance with completing this document.

The dam was automatically classified as a low hazard, Class A dam due to its structural height being greater than 6 feet and the maximum storage behind the dam being greater than 50 acre-feet. However, upon examining the structure, the road embankment of Interstate 95 forms the dam. A failure of the primary spillway may cause minor damage to I-95. For this reason and according to Env-Wr 101.05 (d), the dam should be classified as a significant hazard, class B dam.

DES also recommends that Dam #106.09 be combined with #106.08 as one dam number due to the juxtaposition of the dams and our general policy to make immediately adjacent structures one.

Dike #106.09:

1. There was brush along the upstream face of the dam in the vicinity of the road culvert; and

2. There is no operation and maintenance plan (O&M) on file with the DES.

DES is recommending the following:

1. Remove the brush from the upstream face of the dam in the vicinity of the road culvert; and

2. Complete and submit to DES an O&M plan. Refer to the enclosed guidelines.

In lieu of repairs to both the dam and dike, removal of the dam should be considered. A meeting was held on January 4, 2005 at NH Department of Transportation (DOT) in Concord to discuss proposed culvert replacement at the emergency spillway and fisheries issues. (See attached memo)

We strongly recommend that any dam repair activities, either to address the items noted above or otherwise, be coordinated with the Dam Safety Section of DES's Dam Bureau. Additionally, should any of these items result in a change in the structural configuration, height, length, or discharge capacity of the dam, a reconstruction permit will be required from the Dam Bureau. Likewise, should completion of any of these items fall under the jurisdiction of the Wetlands Bureau, an application to dredge or fill in the waters of the State may be necessary. If you have any questions relative to the aforementioned findings, please do not hesitate to inquire. Thank you.

Attachments: Sketch Illustrating Deficiencies, Guideline for an O&M plan, memo
cc: Mark Kirorac, NHF&G
Jim Gallagher, P.E., Chief Water Resources Engineer
Jimmy Leung, P.E., Maintenance Section
Bethann McCarthy, P.E., EAP Coordinator
John Nelson, Chief of Marine Fisheries, NHF&G
GEL/was/h:/safety/wendy/memo/10608&09mem2005.doc

STATE OF NEW HAMPSHIRE
INTER-DEPARTMENT COMMUNICATION

FROM: Grace Levergood, P.E. gel
Dam Safety Engineer
Dam Bureau

DATE: January 12, 2005
AT: Environmental Services
Water Division

SUBJECT: Taylor River Pond Dam, Hampton Falls, NH
Dam #106.08

ATTENDEES: Kevin Nylan, Wayne Brooks, Bill Hauser – DOT
Cheri Patterson, NHFG
Grace Levergood, Ted Diers, Jen Droziak - DES

A meeting was held on January 4, 2005 at NH Department of Transportation (DOT) in Concord to discuss proposed culvert replacement at the Taylor River Pond Dam emergency spillway and fisheries issues. Plans are underway at DOT to line the badly corroded CMP pipe arch culvert that goes under I-95 from the emergency spillway by September 2005. The culvert was inspected by a DOT consultant and found to be in very poor shape. Although not inspected at the same time, the bridge under I-95 at the main spillway is also suspected to be in need of repairs due to its sheet pile make-up. Suggestions were made to forego the repair work on the CMP pipe arch culvert and use the money towards another project. A proposed feasibility study would look at the option of replacing the main spillway with a natural fishway and possibly eliminating the need for the emergency spillway and pipe arch culvert.

NHFG commented that the fish ladder does not function as intended. Also fish are trying to move up the pipe arch culvert with ends at the emergency spillway and has no fish passage instead of moving further upstream to the fish ladder at the main spillway. See the attached NHFG report that discusses the drastic decline in fish passed by the ladder as well as the degraded water quality in the pond upstream of the dam.

Next steps will include:

- Ted Diers of the DES Coastal Program will have Milone & MacBroom and Dick Quinn of USFWS will examine the site and give their expert advice on fish passage.
- DES Dam Bureau will issue their dam safety inspection report to DOT.
- DES and NHFG will develop a dam removal/fish passage concept to DOT.

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Taylor River Dam and Fish Ladder

Diadromous fish were denied access to freshwater portions of New Hampshire's coastal rivers to complete their life cycle with the construction of dams in the nineteenth century. The construction of six fishways on five coastal rivers in the late 1960's and early 1970's (Exeter, Lamprey, Oyster, Cocheco and Taylor Rivers) provided anadromous fish access to many acres of freshwater spawning and nursery habitat. Deterioration of these structures due to normal aging make it necessary to assess their effectiveness in passing fish and the reason for impounding water.

The majority of anadromous fish using the fishways in the spring are alewife and blueback herring (river herring). Adult and juvenile river herring are a very important forage fish for inland, estuarine, and coastal species. For example, juvenile river herring provide a forage base within inland rivers and lakes for such freshwater species as bass and pickerel. In addition, juveniles and adults migrating between the ocean and natal rivers are preyed upon by many sportfish (striped bass, bluefish, etc.) within the Great Bay and Hampton/Seabrook Estuaries. Also, fishermen net adult river herring during the spring spawning run to be used as bait for sport fishing or lobster.

The Taylor River in Hampton/Hampton Falls, New Hampshire has 45 acres of available spawning and nursery habitat between the head of tide dam and next upstream dam. This river system has experienced the most dramatic decline in river herring spawning runs than any other coastal river. The Taylor River had the highest recorded river herring runs (1976 passed 450,000 river herring) in coastal New Hampshire rivers but now is one of the lowest runs (2003 passed 1,300 river herring). This impoundment also has indications of potential water quality concerns as noted in the following pictures with the large growth of algae and weeds during the summer months.

Currently, portions of the cement walls in the Taylor River fish ladder contain substantial holes that allow water to escape thereby reducing its efficiency in attracting and passing a variety of diadromous fish. The Department of Transportation (DOT) owned concrete and steel dam adjacent to I95 also is in severe disrepair that is affecting the integrity of this class A dam. A Department of Environmental Services (DES) dam inspection has been initiated and the final report will be given to DOT in late 2004. At this point New Hampshire Fish and Game, DES and DOT hope to confer on the next logical steps to be taken to remedy this situation of deteriorated structures, water quality and viable habitat for diadromous species utilizing this river system. This may be in the form of repairing the structures or dam removal.

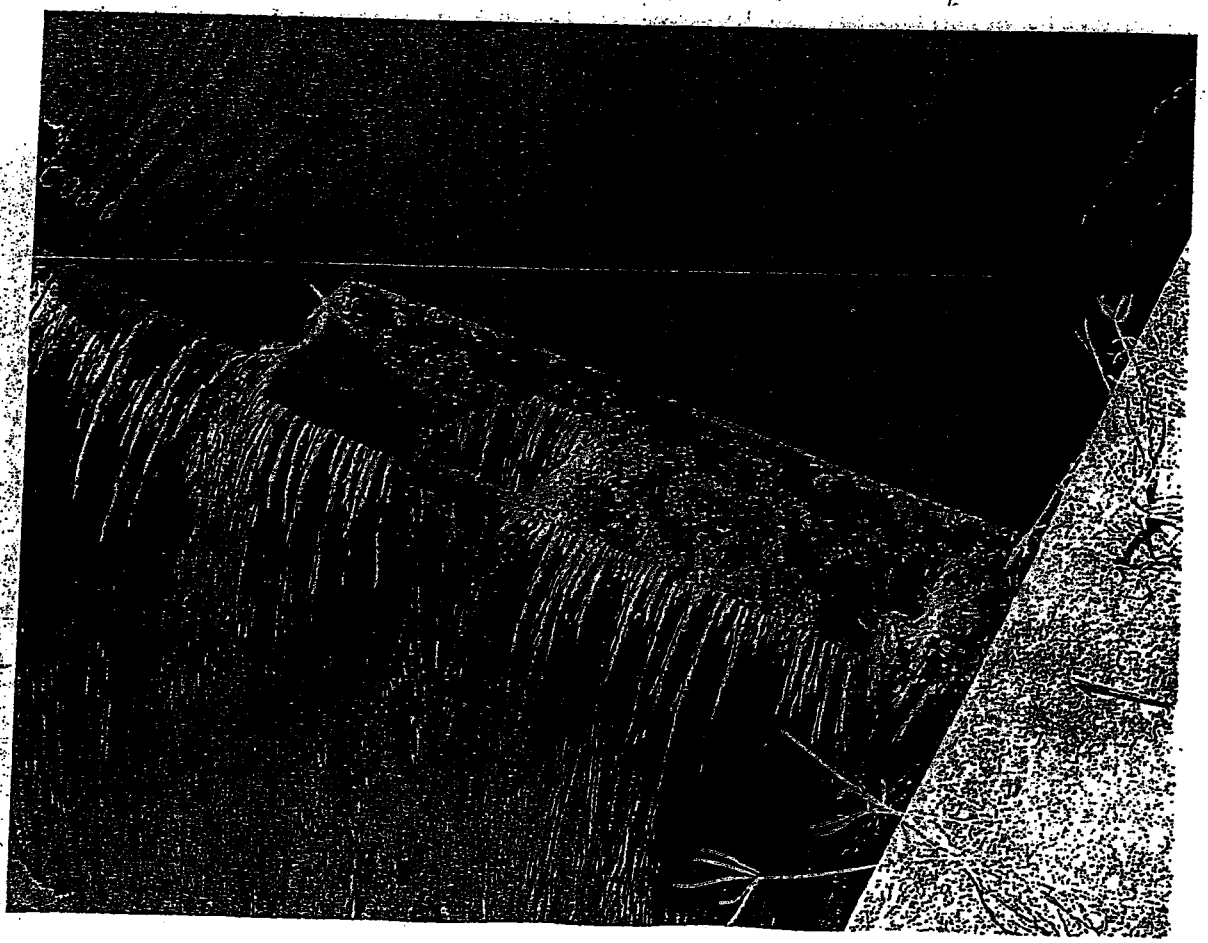
Since the remedial process is still in the early stages between all agencies involved there is no definitive agreement on how to proceed with a grant award towards this project. This should be better defined by spring of 2005.

Picture 1. Taylor River impoundment – upstream of dam (west side of I95) – August 2004

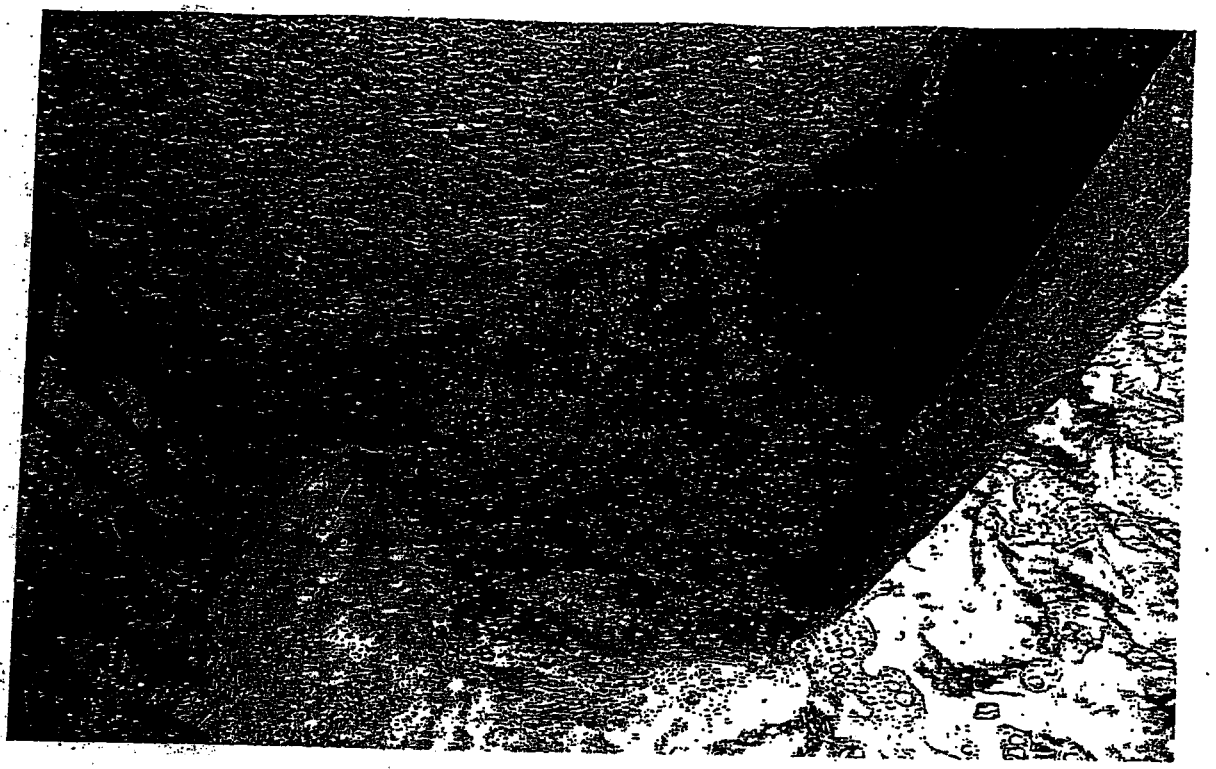
Picture 2. Taylor River fish ladder exit – West side of I95 – August 2004

Picture 3. Taylor River dam – water flowing through hole in dam alongside fish ladder entrance – November 2004.

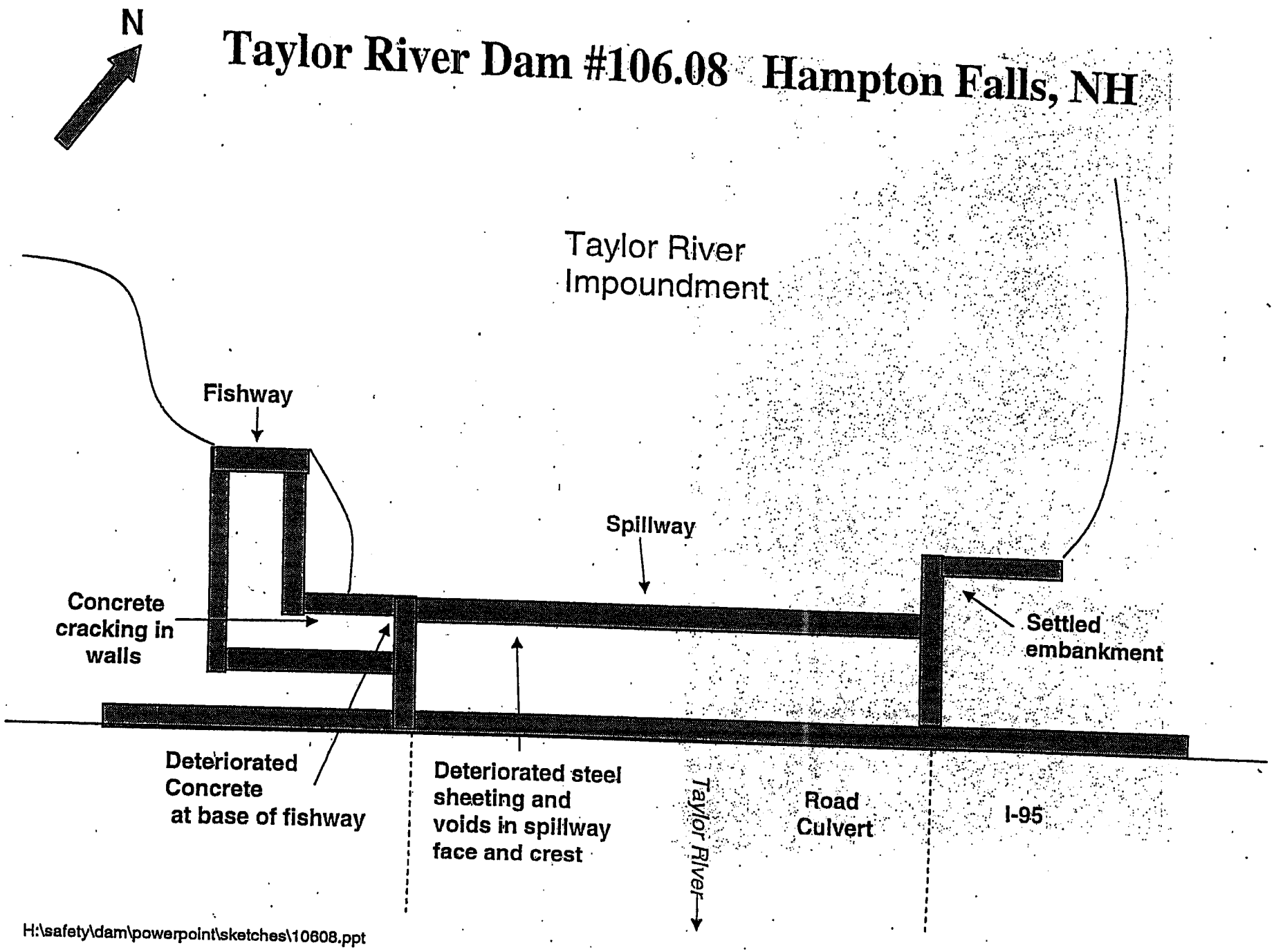
Picture 4. Taylor River dam – two holes on top lip of dam on opposite side of fish ladder entrance – November 2004.



Picture 5. Taylor River fish ladder – deterioration at entrance of fish ladder – August 2004.



Taylor River Dam #106.08 Hampton Falls, NH



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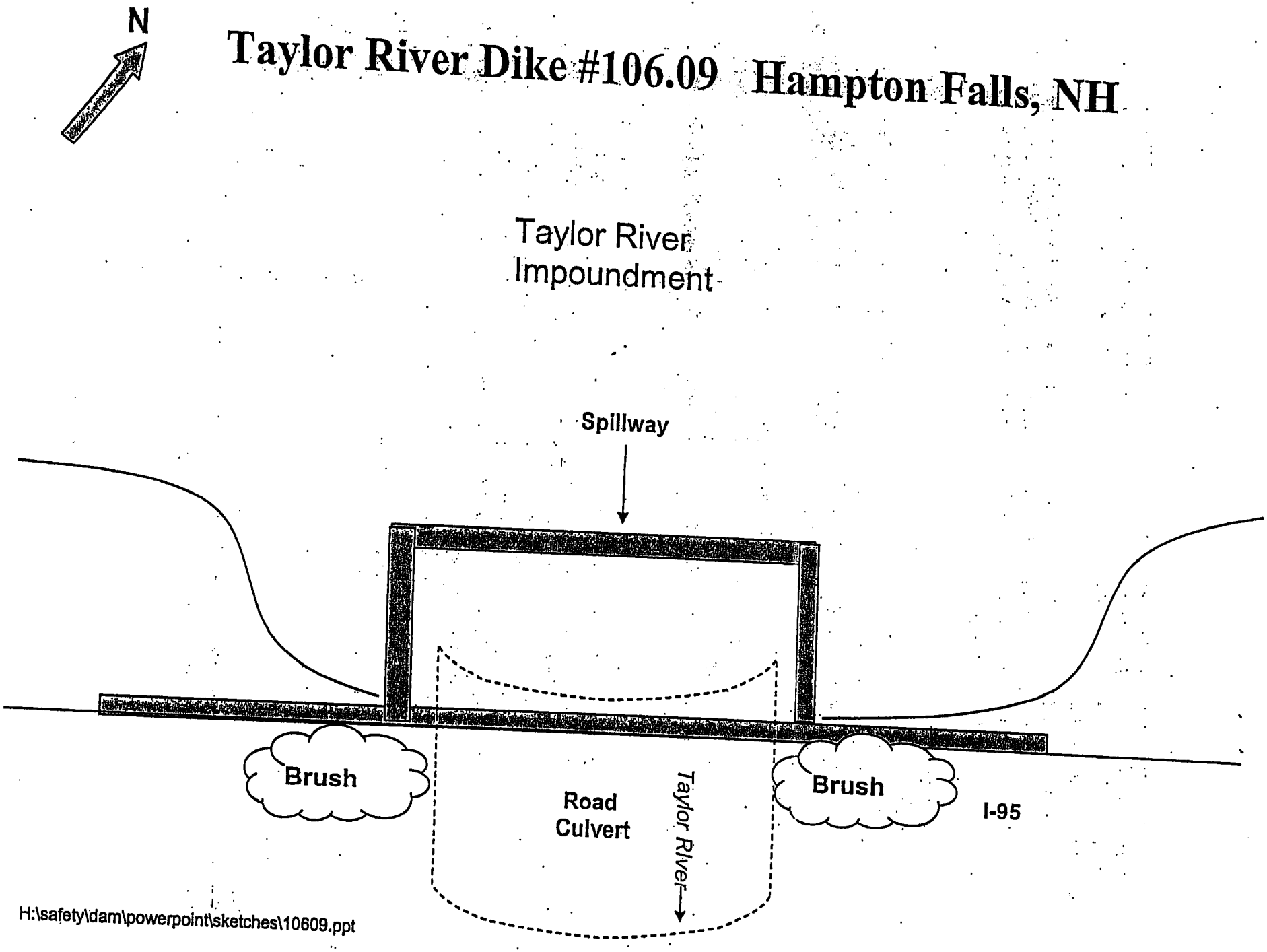
Taylor River Dike #106.09 Hampton Falls, NH



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January 5, 2005

STATE OF NEW HAMPSHIRE
DEPARTMENT OF TRANSPORTATION
BUREAU OF HIGHWAY DESIGN

CONFERENCE REPORT

PROJECT: Statewide Culvert Repairs
IM-X-000S(397)
13408
(Various locations throughout the state on Interstate and Turnpike systems)

DATE OF CONFERENCE: January 4, 2005

LOCATION OF CONFERENCE: Aeronautics Conference Room

ATTENDED BY:

NHDOT	NHDES	NH Fish and Game
K. Nyhan	Ted Diers, NH Coastal Program	Cheri Patterson, Marine Fisheries
W. Brooks	Jen Drociak, NH Coastal Program	
. Hauser	Grace Levergood, Dam Bureau	

SUBJECT: Hampton over-flow structure at the Taylor River outlet

NOTES ON CONFERENCE:

Mr. Brooks provided some background information on the project highlighting the statewide culvert inspection that was done under an earlier contract with Louis Berger Group. He noted that the current contract was intended to address the culverts that were in the worst condition and in need of immediate repair. He noted that the scope of work for this project was to slip-line the existing 6'-1" high x 8'-10" wide steel plate pipe-arch culvert with a smooth interior plastic pipe at a cost of about $200,000. Mr. Brooks noted that the Department has considered the culvert structure to be a separate structure apart from the Bridge and dam 300' north of the culvert. It was noted that NHDES considers the Taylor River outlet to consist of two structures, the dam and the overflow structure, each having an identifying number.

Mr. Brooks noted that Turnpikes has reviewed the structures and recognizes their current poor condition. The existing bridge consists of driven steel sheet piling 15' wide, 10' high with a concrete deck. The dam is immediately upstream of the bridge, also being constructed of driven sheet piling, and is integrated with the bridge structure. There is also a fish ladder that is part of the dam structure, allowing for migration of fish from the salt water to fresh water river networks. Turnpikes has noted that the dam has undergone repairs in the past, correcting corrosion problems.

Ms. Patterson noted that the dam connected to the bridge structure is in very poor condition having many leaks and holes. She stated that the leakage of the dam has undermined the fish ladder, causing concrete spawling. Ms. Levergood stated that the recent inspection report has not been sent to Turnpikes t, but will indicate the dam to be in very poor condition and in need of major repairs in the near future. Mr. Diers indicated that NHDES has some money and is seeking additional funding for a comprehensive study of the Taylor River watershed and would like to address the dam and fish ladder to improve fish passage through the structure(s). It was noted that NH F&G and DES are planning on bringing experts in fish passage to conduct a preliminary study over the next couple months, a study which will help to identify the potential alternatives to look at in a more comprehensive analysis." Ms. Levergood noted that the

hydrologic model indicated that the secondary pipe-arch may not be necessary with a redesign of the dam structure. It was requested that the Department consider delaying performing work on this culvert until a design for the new dam structure is known and possibly divert the current project funds to this end. Mr. Brooks noted that addressing the dam would likely require also addressing the bridge structure, which would require much more work and funding than is currently available. Mr. Hauser noted that the Ten Year Plan did not currently have a project dedicated to replacing the bridge. He also noted that a considerable amount of the cost would be for traffic control. Mr. Brooks agreed to review the possibility of an interim treatment to the culvert, lasting up to five years to allow for completion of the study. This may save much of the original project cost. Mr. Brooks will discuss this again with Turnpikes and Project Development once the dam inspection report is available. Mr. Brooks noted that if the study revealed a larger project, including complete bridge replacement then replacing the culvert may be necessary. It was agreed that it would be desirable to save the cost of the culvert repair if replacing the other structures is imminent.

Submitted by:

Wayne Brooks

Wayne Brooks
Consultant Supervisor

WPB/wpb/

Noted by: W. Hauser WH, K. Nyhan KN, T. Diers TD
cc: K. Cota, J. Moore, M. Pillsbury, H. Goodwin
S:\STATEWID\13408\CONFRPTS\102004.DOC

Type of Action
✓ Regular Inspection
___ Follow-up Inspection
___ Post-const. Inspection
Other_____

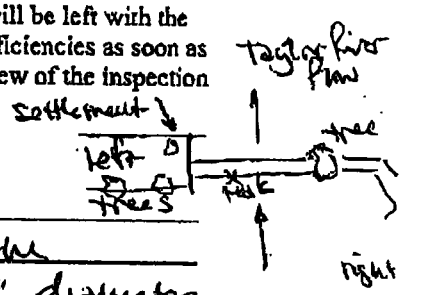
NH Department of Environmental Services
29 Hazen Drive
PO Box 95
Concord, NH 03302-0095
(603) 271-3406
web site: www.des.state.nh.us

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

SITE INSPECTION FORM

Dam Name: Taylor River Pond Dam #: 106.06 Town: Hampton Falls
Date: 7/2/04 Owner: Fran Rice

The following is a listing of findings and, if appropriate, recommendations based upon the evaluation associated with the above referenced dam. The owner or his/her representative should implement the recommendations listed on this form, which are aimed at improving the safety of the dam. This form, a copy of which will be left with the owner or owner's representative, is intended to make dam owners aware of easily correctible deficiencies as soon as an inspection is carried out. More formal compliance notices may be issued after a detailed review of the inspection notes and photographs has been made.



Inspection Findings & Recommendations:

Remove trees and brush
① Brush and trees on left abutment of dam
2 trees measured greater than 12" diameter
Tree along downstream face of dam to the left of lowlevel gate

② Leakage noted in several locations along upstream spillslab - water migrating beneath concrete slab through stonework - unable to maintain normal pool level in pond.

③ Left abutment and earth interface has settled and eroded.

④ Concrete cap on spillway is cracked and deteriorated

⑤ Please complete an operation and maintenance plan and submit to DES - refer to guidelines.

⑥ Exercise lowlevel gate (infill)
⑦ Sediment - build up in impoundment.

⑧ In place of repairs consider dam removal - contact Stephanie Lindloff at #271-3406 funding may be available.

Owner/Owner Representative:_____ Form left w/Owner/Rep?: (yes) no

DES Inspector: Grace Leversgood Please contact Inspector with any questions.

Distribution: WHITE – File YELLOW – Owner/Rep. PINK - Inspector

Idy'lwr River Road Dam H106.06 11-24-04 02C

	FILE	REVIEW
DA =	9.75 mi²	8.47 mi²
HT =	14 ft	
LENGTH =	125 ft	
SA =	6.3 AC	6.3 AC

Wasta10.apr

AO issued 10/28/92

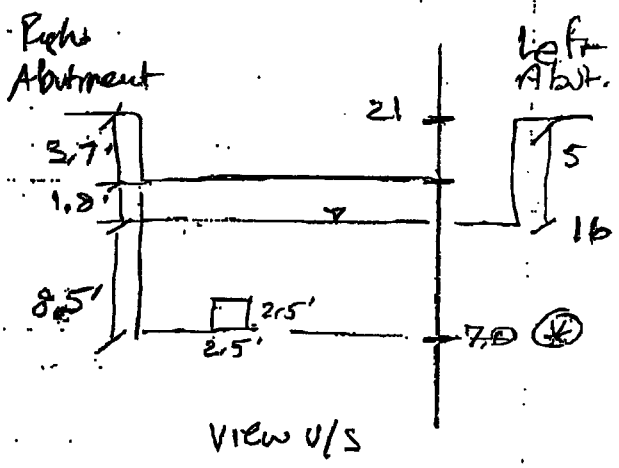
COO issued 6/3/98

Q50 = 903 cfs
432 cfs → Potters
Qdesh = 2165 cfs

HydroCAD ver 6.0
492 cfs in
463 cfs out
pk elev = 18.17'

OUTLETS

1 - 52' w x 5' h spillway
1 - 10' w x 3.7' h spillway
1 - 2.5' x 2.5' low level gate

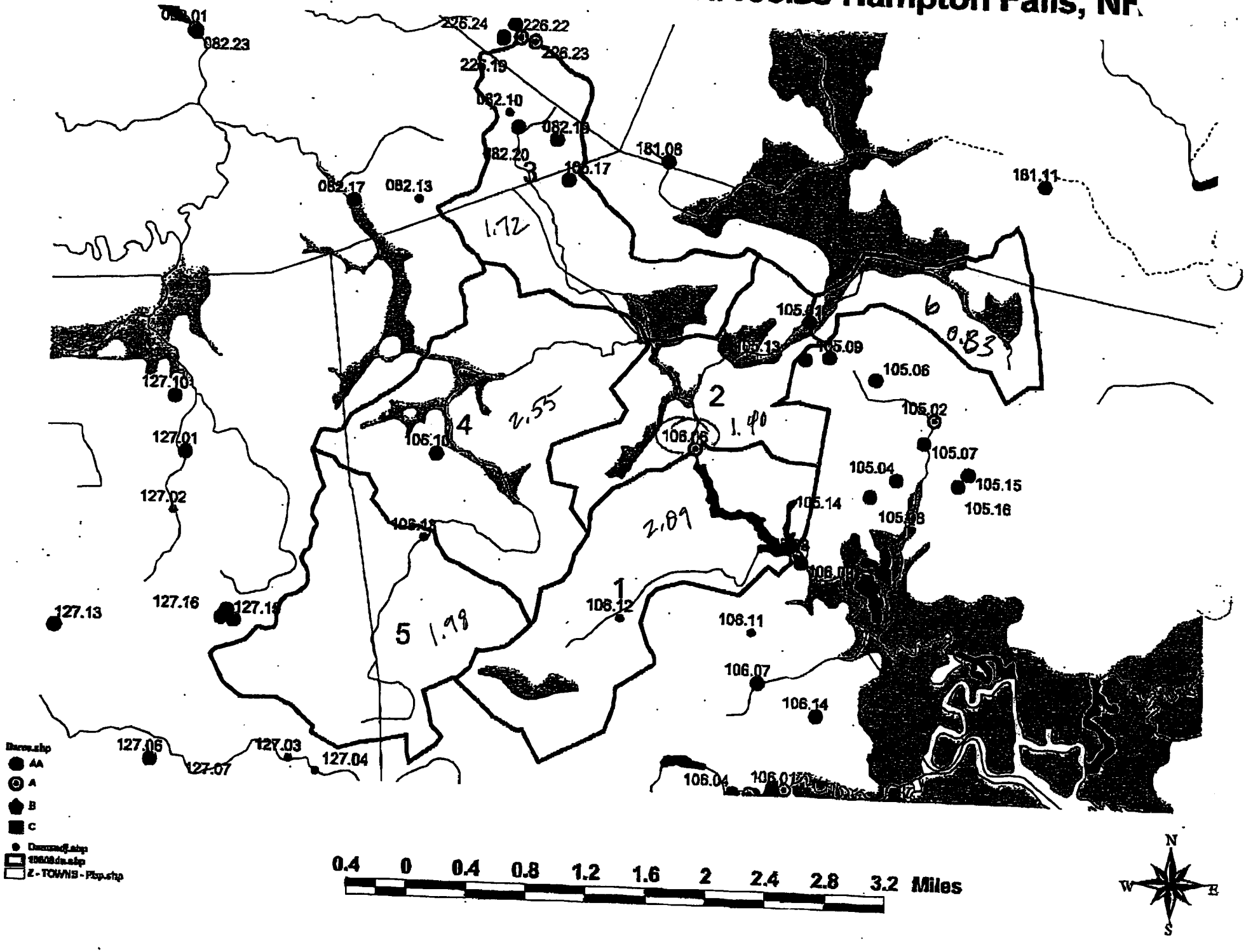


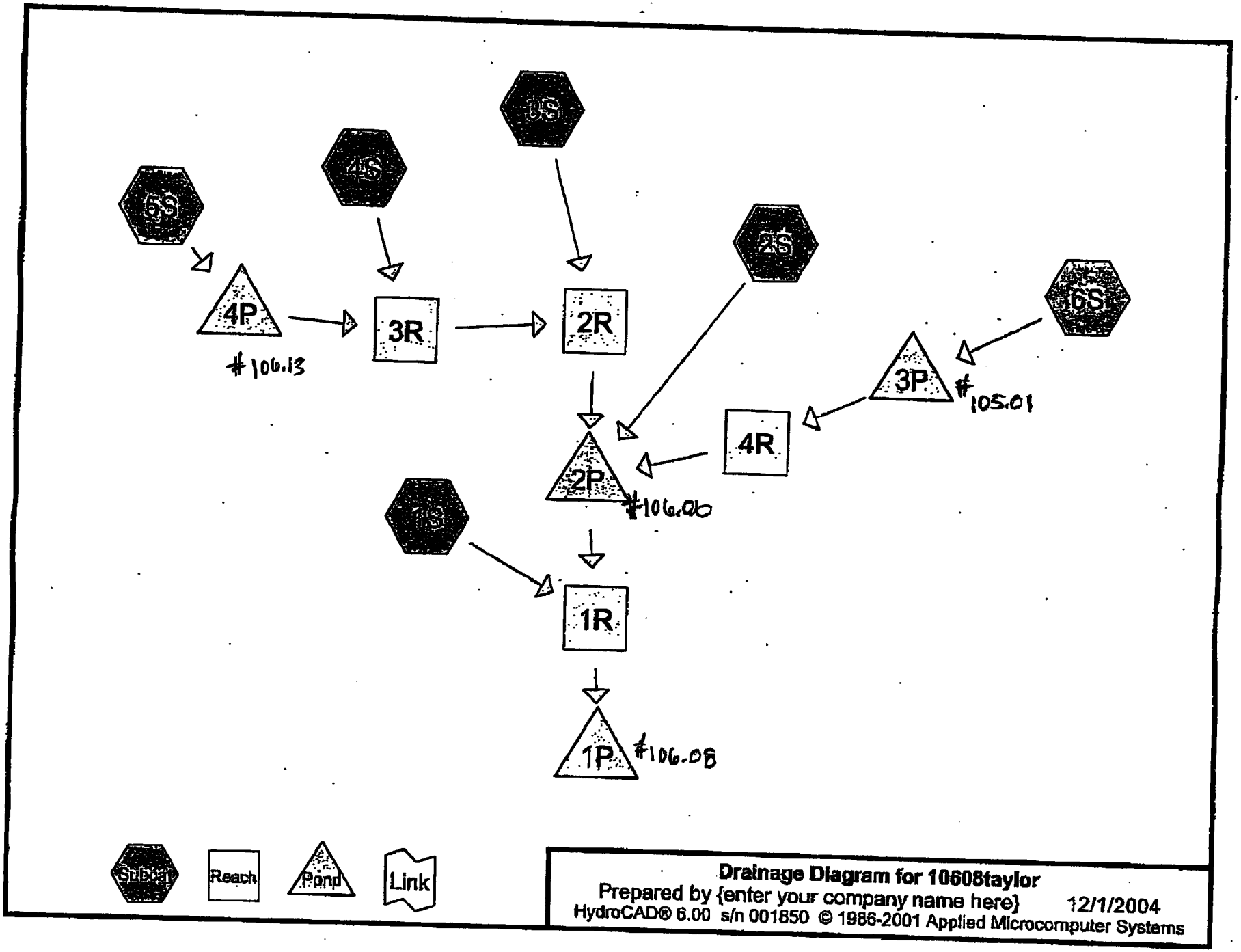
STORAGE	ELEV	SA	AC-FT	FILE
MAX	21	10	10(5) + 18.7 = 68.7	60.8
PERM	16	6.3	0.33(9) 6.3 = 18.7	20.8
BOT	7	0		

Brown Rd D/S Bridge 250' d/s 2 - 12' w x 12.5' h openings
INV = 14'

(*) BA = 6.5 m USGS map = 21.3'

Drainage Area for Taylor Pond Dam #106.06 Hampton Falls, NH




5S
4S
3S
2S
6S
1S
4P
#106.13
3R
2R
3P
#105.01
4R
2P
#106.06
1R
1P
#106.08
Subcat
Reach
Pond
Link
Drainage Diagram for 10608taylor
Prepared by {enter your company name here}
12/1/2004
HydroCAD® 6.00 s/n 001850 © 1986-2001 Applied Microcomputer Systems

Pond 2P: Taylor River Pond Dam #106.06

Inflow	=	492.32 cfs @	20.00 hrs,	Volume=	202.941 af
Outflow	=	463.40 cfs @	20.00 hrs,	Volume=	181.177 af, Atten= 6%, Lag= 0.0 min
Primary	=	463.40 cfs @	20.00 hrs,	Volume=	181.177 af

Routing by Stor-Ind method, Time Span= 5.00-20.00 hrs, dt= 0.05 hrs

Starting Elev= 16.00' Storage= 19.000 af
Peak Elev= 18.17' Storage= 40.705 af (21.705 af above starting storage)
Flood Elev= 21.00' Storage= 69.000 af (50.000 af above starting storage)
Plug-Flow detention time= 77.0 min calculated for 161.638 af (80% of inflow)

Elevation (feet)	Cum.Store (acre-feet)
7.00	0.000
16.00	19.000
21.00	69.000

Primary OutFlow (Free Discharge)
1=Broad-Crested Rectangular Weir
2=Broad-Crested Rectangular Weir

#	Routing	Invert	Outlet Devices
1	Primary	16.00'	**52.0' long x 3.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4
			Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.9
2	Primary	17.80'	**10.0' long x 3.0' breadth Broad-Crested Rectangular Weir**
			Head (feet) 0.20 0.40 0.60 0.80 1.00 1.20 1.40 1.60 1.80 2.00 2.50 3.00 3.50 4
			Coef. (English) 2.44 2.58 2.68 2.67 2.65 2.64 2.64 2.68 2.68 2.72 2.81 2.92 2.9

Pond 2P: Taylor River Pond Dam #106.06

Elevation (feet)	Primary (cfs)	Elevation (feet)	Primary (cfs)
7.00	0.00	14.80	0.00
7.15	0.00	14.95	0.00
7.30	0.00	15.10	0.00
7.45	0.00	15.25	0.00
7.60	0.00	15.40	0.00
7.75	0.00	15.55	0.00
7.90	0.00	15.70	0.00
8.05	0.00	15.85	0.00
8.20	0.00	16.00	0.00
8.35	0.00	16.15	7.37
8.50	0.00	16.30	21.45
8.65	0.00	16.45	40.89
8.80	0.00	16.60	64.77
8.95	0.00	16.75	90.26
9.10	0.00	16.90	118.10
9.25	0.00	17.05	148.12
9.40	0.00	17.20	180.46
9.55	0.00	17.35	215.33
9.70	0.00	17.50	254.11
9.85	0.00	17.65	295.37
10.00	0.00	17.80	336.55
10.15	0.00	17.95	385.15
10.30	0.00	18.10	437.40
10.45	0.00	18.25	493.12
10.60	0.00	18.40	552.26
10.75	0.00	18.55	614.69
10.90	0.00	18.70	681.13
11.05	0.00	18.85	750.78
11.20	0.00	19.00	823.69
11.35	0.00	19.15	894.66
11.50	0.00	19.30	968.46
11.65	0.00	19.45	1,044.80
11.80	0.00	19.60	1,126.73
11.95	0.00	19.75	1,214.19
12.10	0.00	19.90	1,304.84
12.25	0.00	20.05	1,405.06
12.40	0.00	20.20	1,522.66
12.55	0.00	20.35	1,645.79
12.70	0.00	20.50	1,774.63
12.85	0.00	20.65	1,870.00
13.00	0.00	20.80	1,967.26
13.15	0.00	20.95	2,065.38
13.30	0.00		
13.45	0.00		
13.60	0.00		
13.75	0.00		
13.90	0.00		
14.05	0.00		
14.20	0.00		
14.35	0.00		
14.50	0.00		
14.65	0.00		

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Water Resources
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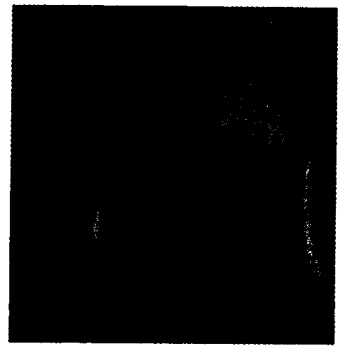
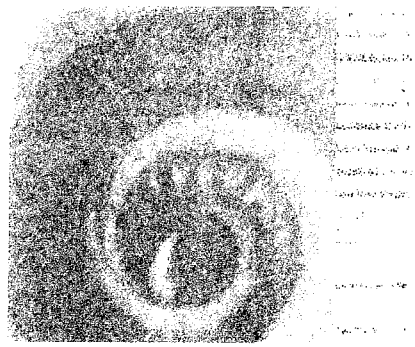




Appendix E

NHDES Water Well Data

Table E1. 'Water Well Data, Wells in NHGS GIS System and Within 1/4-Mile of Pond
Input to Feasibility Study
Replacement or Removal of the Taylor River Dam
Hampton and Hampton Falls, New Hampshire

WRB#	LIC#	WELL#	ELEV	LAT	LONG	DECMINY	DECMINX	LOCENT	LOCACC	LNAME	ST#	ROAD	ROAD2	TOWN	MAP
105.0004	141	310	60	425643	705215	4256.718575	7052.216494	1	4	SCANLON	103	TIMBER SWAMP RD	99999	HAMPTON	119
105.0005	315	106	17	425615	705202	4256.247793	7052.000706	1	1	FINCKE	99999	PRESCOTT LN	99999	HAMPTON	105
105.0006	177	675	39	425623	705203	4256.395855	7052.026350	1	1	RJ LAVIN CO	99999	CAMPBELL DR	99999	HAMPTON	99999
105.0014	177	343	40	425623	705217	4256.390496	7052.252377	1	4	LAMSON	246	TOWLE FARM RD	99999	HAMPTON	99999
105.0025	177	740	62	425626	705200	4256.445431	7051.975516	1	1	RJ LAVIN CO	99999	CAMPBELL DR	99999	HAMPTON	99999
105.0042	177	988	48	425624	705201	4256.397944	7051.985991	1	1	R J LAVIN CO	99999	CAMPBELL DR	99999	HAMPTON	99999
105.0046	177	44	54	425623	705158	4256.393857	7051.943022	1	1	R J LAVIN CO	99999	CAMPBELL DR	99999	HAMPTON	99999
105.0052	177	131	68	425626	705158	4256.430651	7051.928877	1	1	LAVIN	99999	CAMPBELL DR	99999	HAMPTON	99999
105.0060	406	2469	13	425611	705211	4256.195617	7052.150827	1	1	WHITESIDE	99999	HICKORY LN	99999	HAMPTON	99999
105.0064	406	2163	40	425620	705219	4256.340033	7052.281834	1	2	BRADLEY	254	TOWLE FARM RD	99999	HAMPTON	169
105.0077	243	108	13	425614	705215	4256.238199	7052.223097	1	2	WHITESIDE	99999	HICKORY LN	99999	HAMPTON	170
105.0100	177	691	21	425616	705221	4256.276848	7052.321858	1	2	PAUL	286	TOWLE FARM RD	99999	HAMPTON	169
105.0161	177	1088	65	425628	705224	4256.471738	7052.372681	1	2	STICHNEY	151	TIMBER SWAMP RD	99999	HAMPTON	154
105.0169	406	99999	13	425612	705211	4256.205984	7052.150245	1	2	OGRADY	99999	99999	99999	HAMPTON	170
106.0027	644	12585	40	425559	705228	4255.991765	7052.434206	1	4	R W BRIDLE	49	BROWN RD	99999	HAMPTON FALLS	5
106.0097	177	928	44	425622	705257	4256.376212	7052.917942	1	2	ROMONOSKI	27	OLD STAGE RD	99999	HAMPTON FALLS	5
106.0214	1236	9759	40	425628	705258	4256.469155	7052.934015	1	2	MURPHY	26	OLD STAGE RD	99999	HAMPTON FALLS	5
106.0249	1	4835	31	425630	705247	4256.506708	7052.756968	1	1	NORTHWAY BUILDERS	99999	OLD STAGE RD	99999	HAMPTON FALLS	99999
106.0251	3	02925	13	425612	705234	4256.205000	7052.537000	5	52	PARISH	99999	TOWLE FARM RD	99999	HAMPTON FALLS	99999
106.0252	177	1094	33	425558	705226	4255.965035	7052.400921	1	2	TUCKER	99999	BROWN RD	99999	HAMPTON FALLS	5
106.0257	1236	99999	45	425600	705246	4256.009324	7052.737764	1	2	RYBINSHI	99999	BROWN RD	99999	HAMPTON FALLS	5
106.0266	364	364-010223RT1	18	425621	705239	4256.351249	7052.620252	1	2	GREEN & CO	8	BATHCELDER DR	0	HAMPTON FALLS	5
106.0267	364	364-011002TW3	19	425623	705239	4256.394907	7052.627313	1	2	GREEN & CO	99999	GOVERNORS RIDGE RD	0	HAMPTON FALLS	5
106.0270	364	364-010605TW5	17	425629	705241	4256.494751	7052.658079	1	1	GREEN & CO	99999	GOVERNORS RIDGE RD	0	HAMPTON FALLS	99999
106.0281	177	1220	23	425553	705226	4255.896267	7052.397995	1	2	MIST DEVEL	99999	BROWN RD	99999	HAMPTON FALLS	5
106.0282	177	1849	34	425557	705237	4255.963191	7052.581746	1	2	MORGADO	60	BROWN RD	99999	HAMPTON FALLS	5
106.0288	177	1920	38	425559	705229	4255.994708	7052.454311	1	2	JARRAD PATTON	53	BROWN RD	99999	HAMPTON FALLS	5
106.0312	225	03334	99999	99999	99999	4255.867000	7052.336000	5	52	WILLOW RIVER FARM LLC	99999	BROWN RD	99999	HAMPTON FALLS	99999
106.0313	225	03336	99999	99999	99999	4256.191000	7052.494000	5	52	RIVER WILLOW FARM LLC	99999	TOWLE FARM RD	99999	HAMPTON FALLS	99999
106.0317	1085	99999	10	425609	705228	4256.152110	7052.428543	1	2	JARROD PATTON	9	TOWLE FARM RD	99999	HAMPTON FALLS	5
106.0322	364	030715RT2	45	425620	705259	4256.344714	7052.958002	1	2	GREEN AND CO	23	OLD STAGE RD	0	HAMPTON FALLS	5
106.0336	1085	118-2004	99999	99999	99999	4256.467000	7052.700000	5	52	VANDERELS	37	OLD STAGE RD	99999	HAMPTON FALLS	99999
106.0342	1236	99999	15	99999	99999	4255.919000	7052.220000	5	52	AMBERWOOD REALITY CORP	99999	MARSTON RD	0	HAMPTON FALLS	99999

Table E1. 'Water Well Data, Wells in NHGS GIS System and Within 1/4-Mile of Pond
Input to Feasibility Study
Replacement or Removal of the Taylor River Dam
Hampton and Hampton Falls, New Hampshire

WRB#	PARCEL	DCOMP	USE	RSN	TYPE	TOTD	BDKD	CASING	YTM	YTD	YTQ	SWL	DMEAS	OB	HF	HF_BEFORE	GROUTED	NOTE
105.0004	0	12-OCT-1986	1	1	1	230.00	11.00	20.00	3	0.50	30.00	8.00	99999	4	99999	99999	99999	99999
105.0005	9	30-SEP-1986	1	1	1	335.00	53.00	71.00	3	0.50	18.00	15.00	31685	12	99999	99999	99999	YL
105.0006	0	31-JUL-1987	1	1	1	340.00	5.00	21.00	3	99999.00	100.00	99999.00	99999	3	99999	99999	99999	99999
105.0014	99999	17-OCT-1985	1	1	1	400.00	9.00	21.00	3	99999.00	4.50	99999.00	99999	12	99999	99999	99999	99999
105.0025	8	26-OCT-1987	1	1	1	400.00	10.00	20.00	3	99999.00	3.50	99999.00	99999	4	99999	99999	99999	99999
105.0042	0	15-MAR-1989	1	1	1	140.00	10.00	21.00	3	99999.00	30.00	99999.00	99999	4	99999	99999	99999	99999
105.0046	0	21-JUL-1989	1	1	1	140.00	20.00	34.00	3	99999.00	20.00	99999.00	99999	14	99999	99999	99999	99999
105.0052	0	11-DEC-1989	1	1	1	300.00	2.00	17.00	3	99999.00	8.00	99999.00	99999	4	99999	99999	99999	99999
105.0060	0	08-AUG-1992	1	1	1	182.00	40.00	52.00	3	0.75	4.00	99999.00	99999	4	99999	99999	99999	YL
105.0064	2	22-JUL-1991	1	2	1	382.00	9.00	20.00	3	0.85	2.00	99999.00	99999	1	99999	99999	99999	99999
105.0077	2	25-MAY-1994	1	2	1	506.00	54.00	66.50	99999	3.00	4.00	7.00	34479	4	99999	99999	99999	YL
105.0100	7	30-MAY-1995	1	1	1	400.00	40.00	51.00	3	0.50	3.00	99999.00	99999	4	99999	99999	99999	99999
105.0161	2	25-SEP-1998	1	1	1	220.00	23.00	40.00	3	0.50	7.00	99999.00	99999	2	99999	99999	99999	99999
105.0169	8	06-OCT-1999	1	1	1	60.00	31.00	50.00	3	1.00	30.00	9.00	36439	4	99999	99999	99999	99999
106.0027	54	25-JUN-1985	1	1	1	300.00	45.00	59.00	3	3.00	1.50	99999.00	99999	3	99999	99999	99999	YL
106.0097	0	04-OCT-1988	1	1	1	400.00	24.00	40.00	3	99999.00	2.00	99999.00	99999	12	99999	99999	99999	99999
106.0214	0	01-OCT-1997	1	2	1	340.00	17.00	33.00	3	1.00	7.00	99999.00	99999	4	99999	99999	99999	YL
106.0249	99999	21-SEP-2000	1	1	1	140.00	19.00	41.00	3	1.00	25.00	99999.00	99999	123	99999	99999	99999	99999
106.0251	99999	15-JUL-2000	1	1	1	623.00	35.00	71.00	3	1.00	12.00	10.00	36723	3	0	2	99999	99999
106.0252	54	26-MAY-2000	1	1	1	120.00	12.00	20.00	3	0.50	25.00	99999.00	99999	4	99999	99999	99999	99999
106.0257	11	10-AUG-2000	1	2	1	220.00	51.00	60.00	3	1.00	7.50	20.00	36760	3	99999	99999	99999	YL
106.0266	0	20-FEB-2001	1	1	1	140.00	10.00	24.00	3	0.50	20.00	5.00	36942	4	99999	99999	99999	99999
106.0267	0	25-SEP-2001	1	1	1	420.00	10.00	25.00	1	99999.00	8.00	15.00	37159	24	99999	99999	99999	DEVELOPED BY SURGING
106.0270	0	06-JUN-2001	1	1	1	240.00	15.00	30.00	3	0.50	10.00	12.00	37048	4	99999	99999	99999	99999
106.0281	6	20-AUG-2001	1	1	1	440.00	11.00	20.00	3	0.50	3.50	99999.00	99999	3	99999	99999	99999	99999
106.0282	8	11-JUN-2002	1	1	1	340.00	25.00	40.00	3	0.50	8.50	99999.00	99999	3	99999	99999	99999	99999
106.0288	0	31-OCT-2002	1	1	1	320.00	23.00	40.00	3	0.50	15.00	99999.00	99999	3	99999	99999	99999	99999
106.0312	99999	12-SEP-2003	1	1	1	240.00	12.00	40.00	3	1.00	60.00	99999.00	99999	24	99999	99999	99999	99999
106.0313	99999	14-SEP-2003	1	1	1	410.00	9.00	40.00	3	1.00	50.00	99999.00	99999	3	99999	99999	99999	YL
106.0317	0	23-AUG-2003	1	1	1	550.00	11.00	30.00	3	0.50	16.00	99999.00	99999	4	99999	99999	99999	99999
106.0322	0	03-JUL-2003	1	1	1	420.00	12.00	30.00	3	0.75	12.00	12.00	37805	24	99999	99999	99999	99999
106.0336	99999	18-OCT-2004	1	2	1	220.00	30.00	50.00	3	0.50	15.00	20.00	38279	12	99999	99999	99999	YL
106.0342	0	19-NOV-2004	1	1	1	500.00	20.00	40.00	3	0.50	30.00	99999.00	99999	13	99999	99999	99999	YL

Table E2. Water Well Data, Wells in NHGS Database but Not in GIS System, Within 1/4-Mile of Pond
Input to Feasibility Study
Replacement or Removal of the Taylor River Dam
Hampton and Hampton Falls, New Hampshire

WRB#	LIC#	WELL#	ELEV	LAT	LONG	DECMINY	DECMINX	LOCENT	LOCACC	FNAME	LNAME	ST#	ROAD	ROAD2
105.0035	406	1181								T	SCANLON	$NULL	CAMPBELL DR	$NULL
105.0039	364	831881								B	DELLECHIAIE	$NULL	CAMPBELL DR	$NULL
105.0111	177	732								$NULL	STATE OF NH LIQUOR STORE	$NULL	RTE 95 NORTH	$NULL
105.0130	1424	95-77								A	CORMIER	$NULL	$NULL	$NULL
105.0151	1236	9751								$NULL	DINERO DEVEL	$NULL	$NULL	$NULL
105.0177	370	$NULL	76	425730	705124	7051.372034	4257.508911	1	1	$NULL	NH STATE LIQUOR STORE	$NULL	RTE 95	$NULL
105.0228	1808	1808-7								$NULL	BLEY REATY	$NULL	SOMERWOOD RD	SOMERWOOD
105.0239	1236	$NULL								$NULL	SUMMERWOOD	$NULL	TIMBERSWAMP RD	SUMMERWOOD
106.0048	141	279								M	BURNETT	$NULL	$NULL	$NULL
106.0166	1236	5								$NULL	GREAT WOODS POST & BEAM	$NULL	$NULL	$NULL
106.0255	1236	$NULL								DICK	ROBINSON	$NULL	BROWN RD	$NULL
106.0268	364	364-011002TW4								$NULL	GREEN & CO	$NULL	GOVERNORS RIDGE RD	GOVERNORS RIDGE
106.0287	364	364-020411RT2								$NULL	GREEN & CO	$NULL	BROWN RD	GOVERNORS RIDGE SUBDIV
106.0293	364	364-020821RT3								$NULL	GREEN & CO	$NULL	BROWN RD	GOVERNORS RIDGE SUBDIV
106.0330	1085	79-2004								$NULL	WASSON DEVELOPERS	$NULL	MARSTON RD	$NULL
106.0338	1085	122-2004								$NULL	KEVIN ODONNELL	$NULL	MARSTON RD	$NULL
106.0339	1	1-8393								$NULL	OPEN MEADOW HOMES	6	MARSTON RD	$NULL
106.0344	1236	$NULL								T.	MCGRATH	18	OLD STAGE RD	$NULL

Table E2. Water Well Data, Wells in NHGS Database but Not in GIS System, Within 1/4-Mile of Pond
Input to Feasibility Study
Replacement or Removal of the Taylor River Dam
Hampton and Hampton Falls, New Hampshire

WRB#	TOWN	MAP	PARCEL	DCOMP	USE	REASON	TYPE	TOTD	BDKD	CASING	YTM	YTD	YTQ	SWL	DMEAS	OB	HF	HF_BEFORE	GROUTED	NOTE
105.0035	HAMPTON	$NULL	LOT 2	29-JUN-1988	1	1	1	442	10	20	3	3	0.25			12	$NULL		$NULL	$NULL
105.0039	HAMPTON	$NULL	$NULL	30-AUG-1988	1	1	1	180	5	20	3		20	8	31-AUG-1988	4	$NULL		$NULL	$NULL
105.0111	HAMPTON	$NULL	$NULL	06-SEP-1995	4	1	1	400	41	51	3	0.5	15			1	$NULL		$NULL	$NULL
105.0130	HAMPTON	$NULL	$NULL	31-OCT-1995	1	1	1	300	20	41	3	0.5	4	10	01-NOV-1995	1-4	$NULL		$NULL	YL
105.0151	HAMPTON	$NULL	$NULL	01-MAR-1997	1	1	1	200	80	92	3	1	20			3	$NULL		$NULL	YL
105.0177	HAMPTON	$NULL	$NULL	10-SEP-1997	1	1	1	545	35	60	3	2	30	32	11-SEP-1997	2-4-2	$NULL		$NULL	$NULL
105.0228	HAMPTON	$NULL	LOT 42-43	07-JAN-2005	1	1	1	220	26	40	3	0.5	8	4	07-JAN-2005	14-24	$NULL		$NULL	$NULL
105.0239	HAMPTON	$NULL	LOT 7	19-JUL-2005	1	1	1	500	39	60	3	0.5	7			2	$NULL		$NULL	$NULL
106.0048	HAMPTON FALLS	$NULL	$NULL	01-JAN-1986	1	1	1	130	45	60	3	0.5	15	10		4	$NULL		$NULL	$NULL
106.0166	HAMPTON FALLS	$NULL	$NULL	23-JUN-1994	1	1	1	345	80	115	$NULL	0.5	8			4	$NULL		$NULL	YL
106.0255	HAMPTON FALLS	$NULL	$NULL	25-SEP-2000	1	1	1	220	35	49	3	1	10	10	04-OCT-2000	4	$NULL		$NULL	YL
106.0268	HAMPTON FALLS	$NULL	2	26-SEP-2001	1	1	1	140	37	51	3	0.5	20	20	26-SEP-2001	24	$NULL		$NULL	$NULL
106.0287	HAMPTON FALLS	$NULL	LOT 8	10-APR-2002	1	1	1	155	30	51	3	0.5	20	4	10-APR-2002	24	$NULL		$NULL	$NULL
106.0293	HAMPTON FALLS	$NULL	SUBLOT 6	06-AUG-2002	1	1	1	420	29	45	3	0.5	9	35	06-AUG-2002	12	$NULL		$NULL	$NULL
106.0330	HAMPTON FALLS	$NULL	3	02-AUG-2004	1	1	1	460	4	40	3	0.5	30			4	$NULL		$NULL	YL
106.0338	HAMPTON FALLS	$NULL	14	14-OCT-2004	1	1	1	200	70	75	3	0.5	30	20	15-OCT-2004	4	$NULL		$NULL	$NULL
106.0339	HAMPTON FALLS	$NULL	LOT 16	29-OCT-2004	1	1	1	180	15	41	3	1	25	5	02-NOV-2004	3	$NULL		$NULL	$NULL
106.0344	HAMPTON FALLS	$NULL	$NULL	12-MAY-2005	1	1	1	500	14	28	3	1	6			12	$NULL		$NULL	YL

Table E3. Data for Community/Public Water Wells
Input to Feasibility Study
Replacement or Removal of the Taylor River Dam
Hampton and Hampton Falls, New Hampshire

PWS ID	MASTER ID	SYSTEM NAME	ADDRESS	TOWN	SYSTEM ACTIVE	SOURCE ACTIVE	SYSTEM TYPE	SOURCE TYPE	WELL TYPE	RECORD SOURCE WATER TYPE	POPULATION SERVED
1056030-001	52988	EMPLOYEE BENEFIT PLAN ADMN	263 DRAKESIDE RD	HAMPTON	I	A	P	G	BRW	SG	100
1053010-001	14912	FOUR SEASONS MOBILE HOME PARK	120 MARY BATCHELDER RD	HAMPTON	A	I	C	G	BRW	SG	55
1053010-002	14912	FOUR SEASONS MOBILE HOME PARK	120 MARY BATCHELDER RD	HAMPTON	A	A	C	G	BRW	SG	55
1053020-001	53818	HEMLOCK HAVEN	HAVEN RD	HAMPTON	A	A	C	G	BRW	SG	207
1053020-003	53818	HEMLOCK HAVEN	HAVEN RD	HAMPTON	A	A	C	G	BRW	SG	207
1056040-001	52989	STATE LIQUOR STORE #73	INTERSTATE 95 SOUTH, PO BOX 1993	HAMPTON	I	A	P	G	BRW	SG	20
1053030-001	52992	TAYLOR RIVER ESTATES	TOWLE FARM RD	HAMPTON	A	A	C	G	BRW	SG	90
1053030-002	52992	TAYLOR RIVER ESTATES	TOWLE FARM RD	HAMPTON	A	A	C	G	BRW	SG	90

Abbreviations:

A = Active
I = Inactive
P = Non-transient, non-community system (e.g., schools, hospitals, businesses)
C = Community system
G = Groundwater source
BRW = Bedrock well
SG = Groundwater, non-purchased

Reference: NHDES "One Stop Program GIS" website, March, 2007

USER'S GUIDE FOR WELL COMPLETION REPORT DATA SUMMARIES [rev. 12/08/2005]

Attribute	Explanation	Data Type, Codes and Definitions	Data Entry Conventions
LICENSE_NUMBER	Well driller's license number	Number (10)	driller's license no.
WELL#	Well # Assigned by Driller	Text (14)	sequence no.
WRB#	Water Resources Board I. D. number	Text (10)	[3-digit numeric town code]-[4-digit sequence no.] town code must include leading zeros
ELEV	Elevation	Number (5)	in feet above sea level
LATITUDE	Latitude	Number (8,2)	6 digit number for degrees, minutes, and seconds with leading zeros included (Datum:NAD27)
LONGITUDE	Longitude	Number (8,2)	6 digit number for degrees, minutes, and seconds with leading zeros included (Datum:NAD27)
LOCENT	Entity responsible for determining location	Number (5) 1 = NHDES staff 2 = USGS 3 = EPA 4 = Subcontractor 5 = Water well contractor	
LOCACC	Estimate of the relative Accuracy of coordinate values	Number (5) 1 =location self-reported by the facility or well owner, plotted on a 7.5-minute quadrangle, and hand-scaled	

Attribute	Explanation	Data Type, Codes and Definitions
LOCACC (continued)	Estimate of the relative Accuracy of coordinate values	2 = Location derived by remote desktop GIS methods 21 - Location derived by remote desktop GIS methods, utilizing digital orthophotography, digital tax maps, etc. Polygons representing discrete parcels were navigated to on an individual basis and the well placement determined by the GIS technician utilizing the best available information 22 - Location derived by remote desktop GIS methods, well placement automated utilizing the polygon centroid of the parcel 3 = field-verified location, plotted on a 15-minute quadrangle, and digitized. 4 = field-verified location, plotted on 7.5-minute quadrangle, and digitized. 5 = location based on autonomous global positioning satellite readings. 51 - located while selective availability was still active (before May 02, 2000) 52 - located after selective availability was turned off (on or after May 02, 2000) 59 - unable to identify datum / system settings 6 = location based on differential global positioning satellite readings collected at a site offset from the wellhead. 61 - located while selective availability was still active (before May 02, 2000) 62 - located after selective availability was turned off (on or after May 02, 2000) 7 = location based on differential global positioning satellite readings collected at a site offset from the wellhead with a correction for the offset applied. 71 - located while selective availability was still active (before May 02, 2000) 72 - located after selective availability was turned off (on or after May 02, 2000) 8 = location based on differential global positioning satellite readings collected at the wellhead. 81 - located while selective availability was still active (before May 02, 2000) 82 - located after selective availability was turned off (on or after May 02, 2000) 9 = unknown.

Attribute	Explanation	Data Type, Codes and Definitions	Data Entry Conventions
FNAME	First name of well owner	Text (15)	first initial of homeowner
LNAME	Well Owner, etc.	Text (26)	last name for individuals; complete name for contractors or companies (consult "dictionary" for accepted abbreviations)
ST_NUMBER	Street Number	Text (4)	street number where well is located
ROAD	Address of well location	Text (40)	street name or reference point (consult "dictionary" for accepted abbreviations)
ROAD2	Address of well location	Text (40)	other street name if applicable
TOWN	Town in which well is located	Text (45)	complete name of town (no abbreviations allowed)
MAP	Map page number as recorded on the town's tax map	Text (10)	varies according to the coding system in use by a particular town; prefix BLK- indicates block #
PARCEL	Parcel identifier as recorded the town's tax map	Text (12)	varies according to the coding system in use by a particular town
DCOMP	Date well was completed	Date	8-digit format dd-mon-yyyy with leading zeros included

Attribute	Explanation	Data Type, Codes and Definitions	Data Entry Conventions
USE	Proposed use of well	Text (1) 0=other 1=domestic 2=small community water supply 3=municipal 4=commercial 5=industrial 6=agricultural 7=institutional 8=test/exploration 9=abandoned	
REASON	Reason for constructing well	Text (1) 0=other 1=new 2=replace existing 3=deepen existing 4=provide additional supply 5=monitoring (water level measurement or water quality sampling) 6=stratigraphic observation only	
TYPE	Type of well	Text (1) 0=other 1=drilled in bedrock 2=drilled in gravel 3=dug 4=auger hole (any uncased hole) 5=driven point 6=wash well 7=undifferentiated	

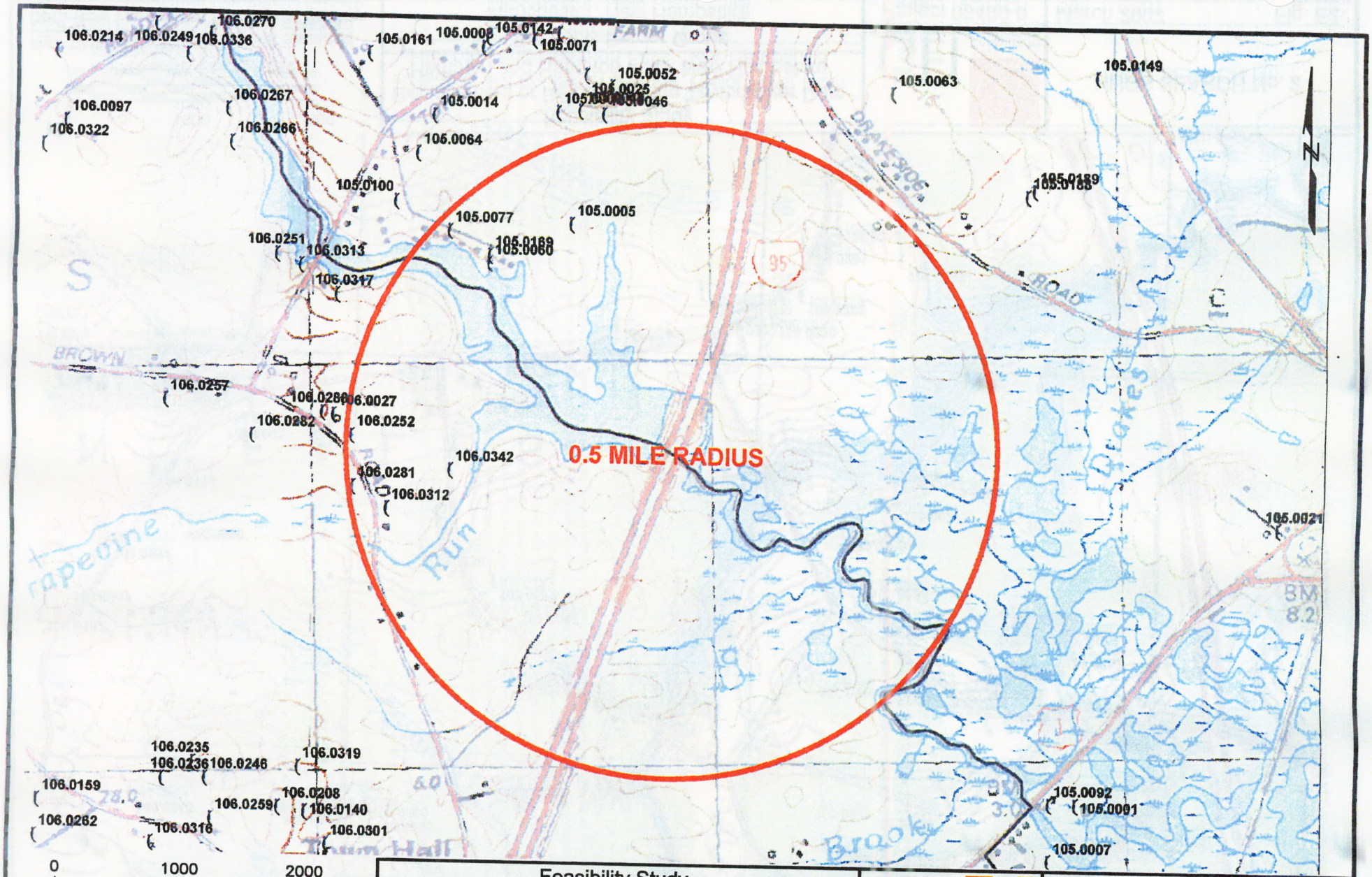
Attribute	Explanation	Data Type, Codes and Definitions	Data Entry Conventions
TOTD	Total depth of well	Number (6,2)	in feet below land surface datum
BDKD	Depth to bedrock	Number (6,2)	in feet below land surface datum
CASING	Total length of casing installed in well	Number (6,2)	in feet
YTM	Yield test method	Text (1) 1=bailed 2=pumped 3=compressed air	
YTD	Yield test duration	Number (8,2)	in hours
YTQ	Discharge	Number (8,2)	in gallons per minute
SWL	Static water level	Number (8,2) 0 = overflowing 1 = at ground level	in feet below land surface datum
DMEAS	Date static water level was measured	Date	8-digit format dd-mon-yyyy with leading zeros included
OB	Type of overburden material	Text (16) 0=exposed bedrock 1=sand 2=gravel 3=till 4=clay 5=mixed 6=other	Codes are entered layer by layer in the sequence reported in the **WELL LOG;** successive layers are separated by a hyphen (for example, 12-4 indicates a sand and gravel layer overlying a clay layer; mixed is used if 1 through 4 are recorded on the same line; if "6" is used, an explanation is included as a comment under the attribute **NOTE)**

Attribute	Explanation	Data Type, Codes and Definitions	Data Entry Conventions
HYDRO_FRACT	Hydrofractured	Text (1) Y="Yes" Null Value (-0-)="No" or not reported	
HF_YIELD_BEFORE	Yield before hydrofracturing	Number (8,2)	in gallons per minute
GROUTED	Grouted	Text (1) Y="Yes" Null Value (-0-)="No" or not reported	
NOTE	Special notes	Text (36) YL=yield log SN=screen information GP=gravel pack DD=drawdown measurements DL=detailed log HF=hydrofracture CM=comments NC=non conforming well location	

"CM:" is used to explain any attribute coded as "other" [ie., CM:USE(0)=fire protection]

THE FOLLOWING ADDITIONAL CONVENTIONS APPLY AS NOTED:

1) no periods are permitted to follow abbreviations within text fields, except in the case of NAME where a period is required after the first initial
2) any attribute coded as "other" must be explained by means of a comment under NOTE; however, the code for any attribute can be qualified using a comment expressed in the standard format CM:attribute(code)=explanation as illustrated above
3) the 2-character NOTE codes must always be given in the order listed above and separated by a single space whenever multiple codes are needed (ie. SN GP and not GP SN)



REFERENCE: Well locations obtained from New Hampshire Geological Survey.

Feasibility Study
Replacement or Removal of the Taylor River Dam
Hampton and Hampton Falls, New Hampshire

The Louis Berger Group
Manchester, New Hampshire

GEI Consultants

Project 06400-0

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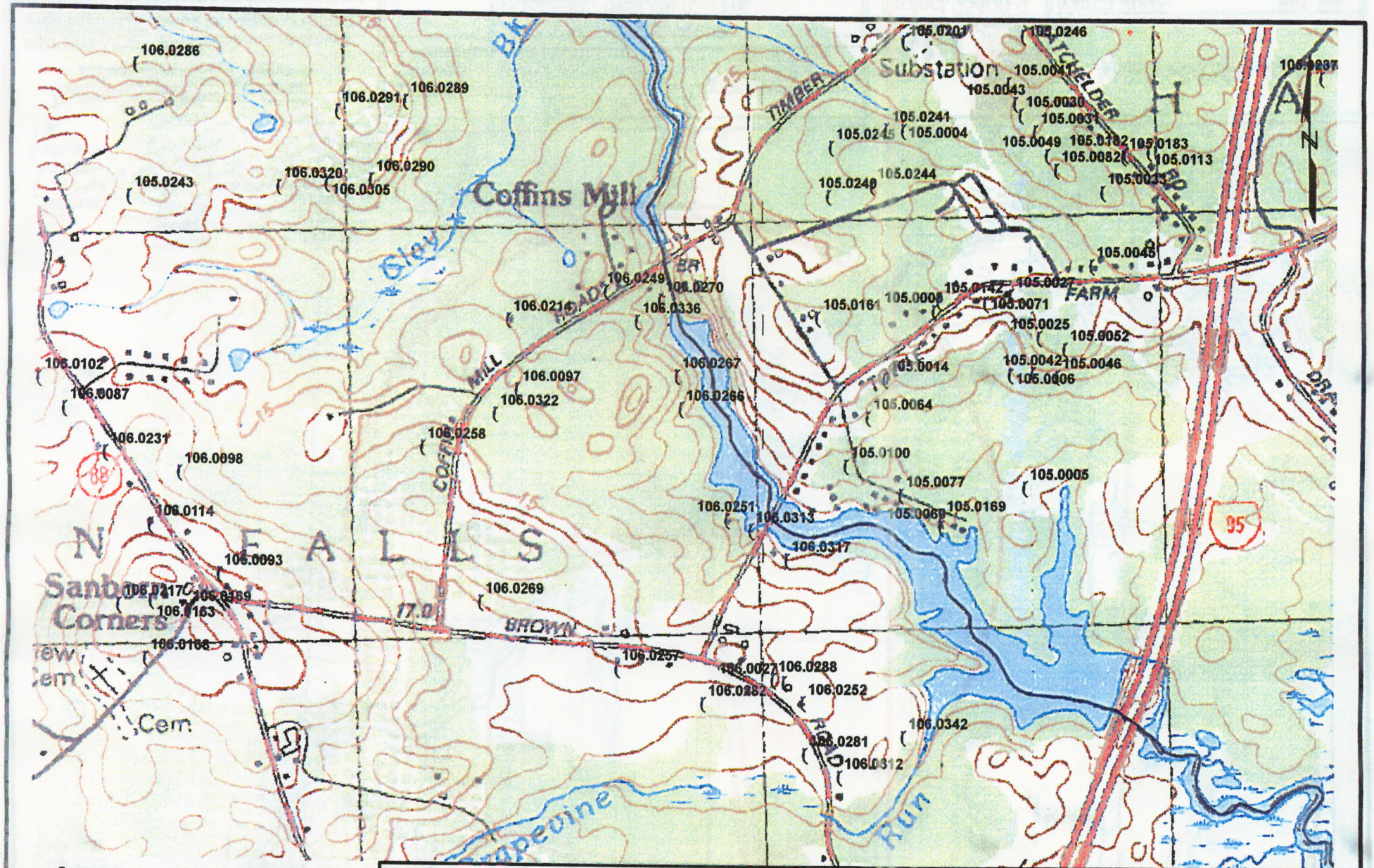
March 2007

Fig. E1

064000-03 djm 3/20/07



REFERENCE: Well locations obtained from New Hampshire Geological Survey.

Feasibility Study
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Manchester, New Hampshire

GEI Consultants

NHGS SEARCH No. 2

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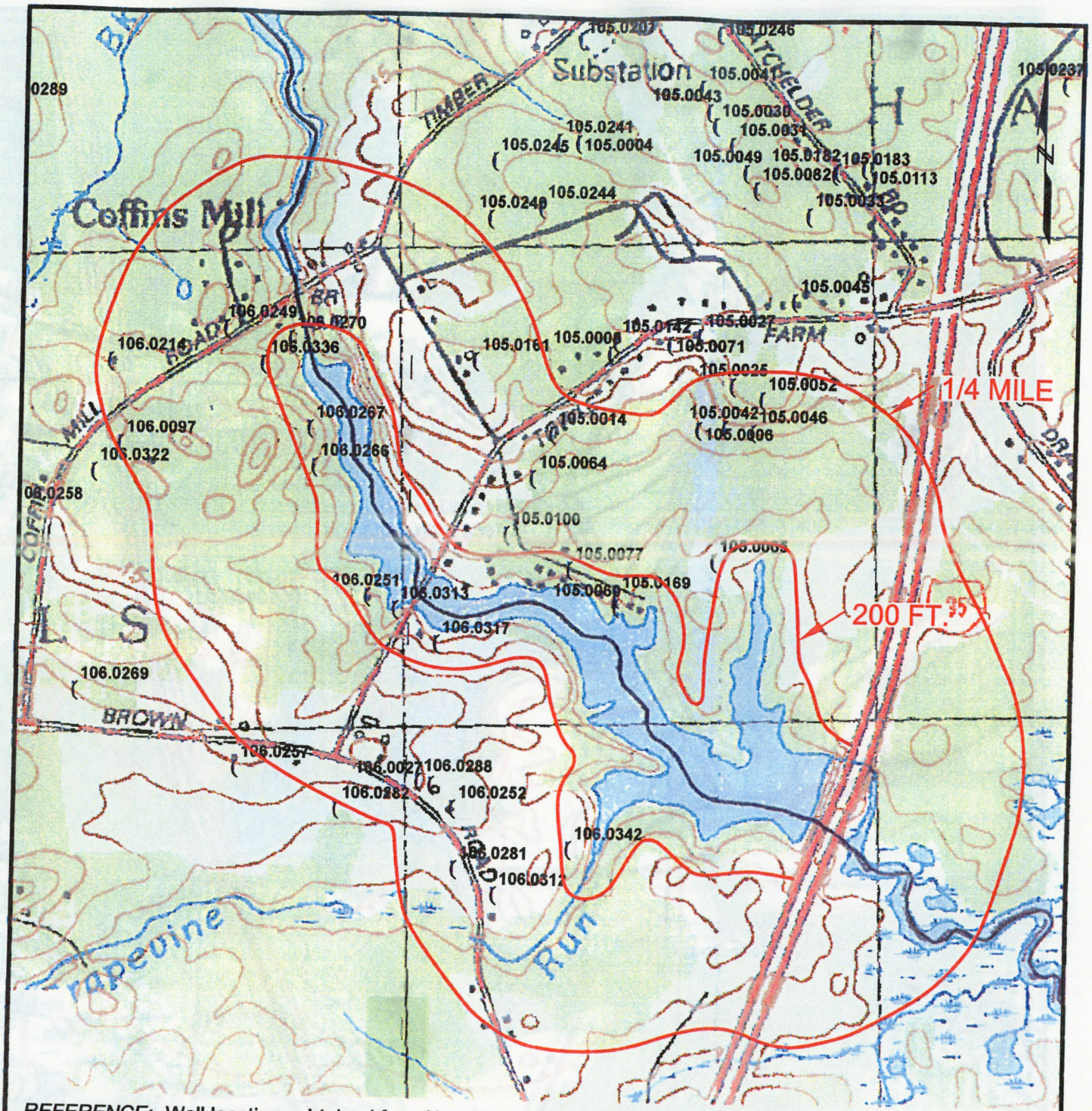
064000-0 3/20/07



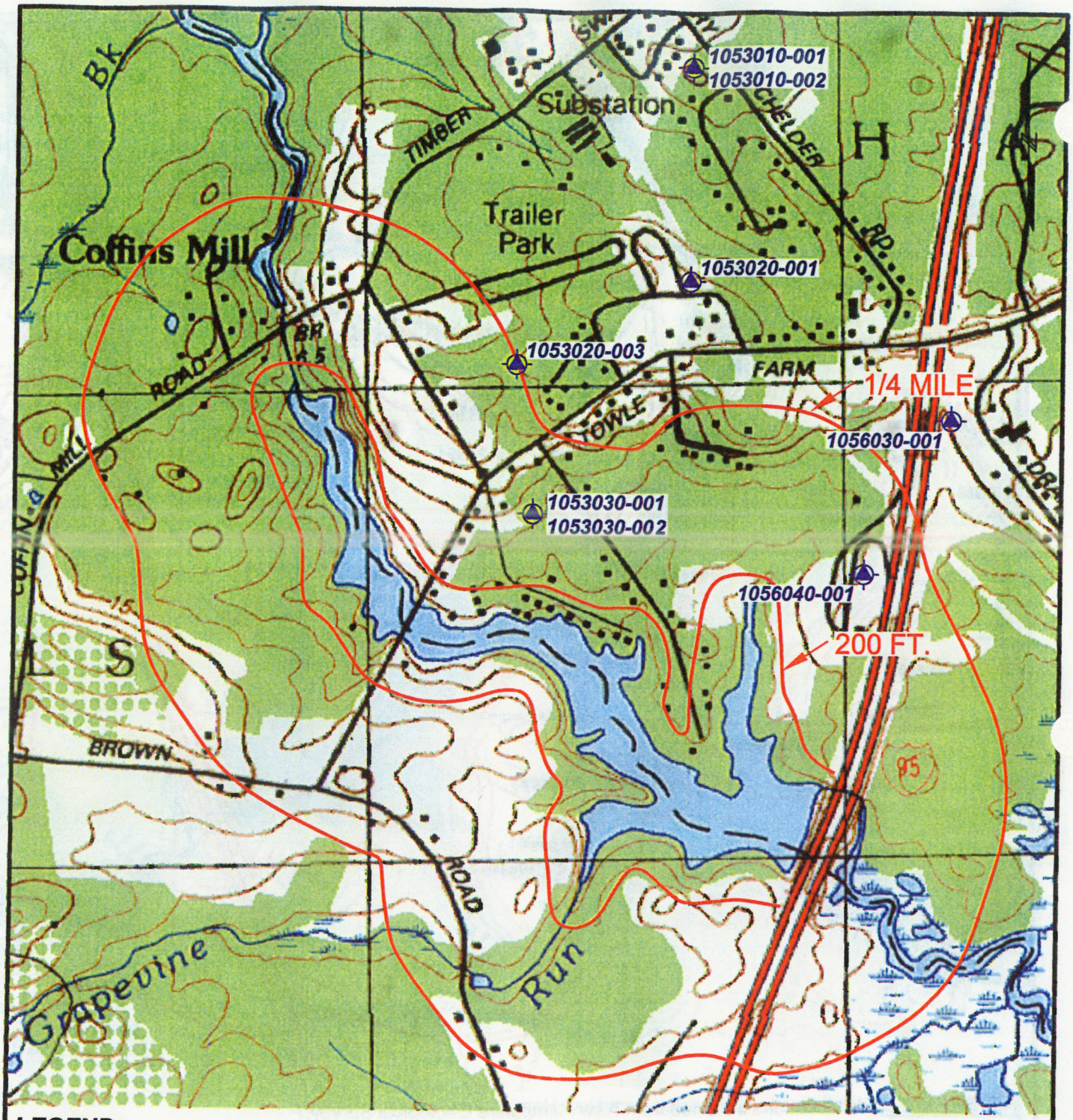
REFERENCE: Well locations obtained from New Hampshire Geological Survey.

0 1000 2000

APPROXIMATE SCALE, FEET

Feasibility Study Replacement or Removal of the Taylor River Dam Hampton and Hampton Falls, New Hampshire	GEI Consultants	WATER WELLS IN GIS SYSTEM WITHIN 1/4 MILE OF POND
The Louis Berger Group Manchester, New Hampshire	Project 06400-0	March 2007 Fig. E3

064000-03 djm/ptc 3/20/07



LEGEND:

COMMUNITY/PUBLIC WELL

NOTES:

1. USGS BASE MAP FROM MAPTECH, INC. "TERRAIN NAVIGATOR 2002."
2. WELL LOCATIONS FROM NHDES "One-Stop Program GIS" WEBSITE.

0 1000 2000

APPROXIMATE SCALE, FEET

Feasibility Study Replacement or Removal of the Taylor River Dam Hampton and Hampton Falls, New Hampshire	GEI Consultants	COMMUNITY/ PUBLIC WELL LOCATIONS
The Louis Berger Group Manchester, New Hampshire	Project 06400-0	March 2007 Fig. E4

064000-07 djm/ptc 3/20/07