INTER-OFFICE MEMO
TOWN OF HAMPTON
NEW HAMPSHIRE

Date: November 21, 2016

To: Fred Welch, Town Manager

CC: Chris Jacobs, PE – Director of Public Works

From: Jennifer Hale, PE – Deputy Director of Public Works JLH

Subj: Bicentennial Wall Preliminary Investigation Results

Summary:
The Department of Public Works has contracted the services of Tighe and Bond Inc. (T&B) to perform a surrounding condition assessment and complete an investigation into the structural stability related to the Bicentennial Park Seawall. The investigation included the review of historical documents, test pits and borings, concrete cores and analyzation, survey and the delineation of the resource areas including Highest Observable Tide Line (HOTL). T&B has completed wave analysis scenarios and compared elevations to FEMA flood elevations and the elevations of the surrounding terrain. In addition, visual observations were made during the High Tide Events during the week of November 7th to observe wave action and drainage patterns.

[Attached to this memorandum is a copy of the Hampton Beach L.B Station Seawall Repairs Plan dated June 1,1950 (Attachment A), Test Pit and Boring Location Plan and Logs (Attachment B), Concrete Analysis Report (Attachment C), Latest FEMA Flood Mapping (Attachment D) and Pictures of Runoff Conditions (Attachment E)].

Based on the preliminary information prepared by T&B, during storms, water is overtopping the seawall and causing erosion at the rear of the wall and in some cases concentrating and running along the beach area toward Route 1A. In addition, the NHDOT outfall pipe is broken which is causing further erosion in the area of the outlet. The erosion is caused by the runoff carrying the sand away as it flows behind the wall, toward Route 1A or back into the ocean.

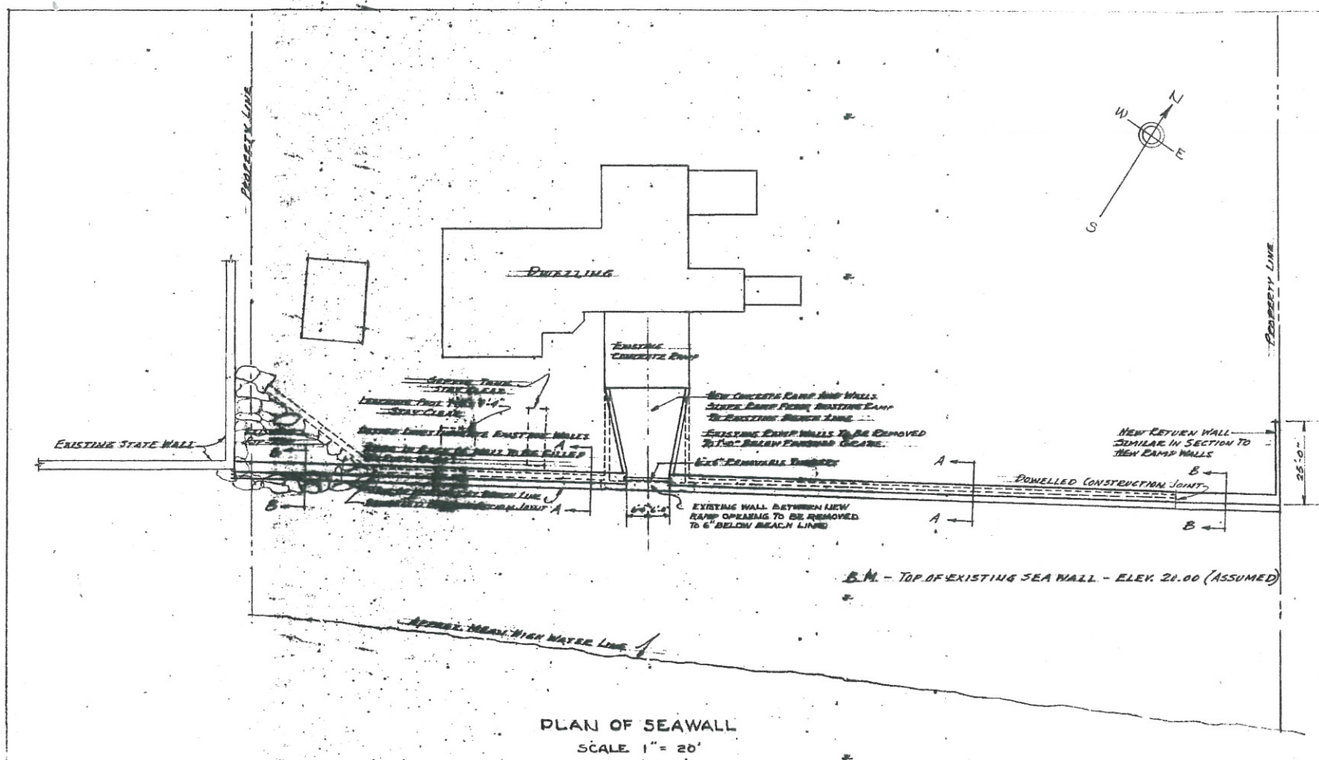
The seawall is comprised of two layers of concrete and inner layer that was the original wall, and an outer layer (or overlay) that was placed over the original wall. While the outer layer of concrete is considered satisfactory, the inner layer has Alkali Silica Reaction (ASR) which causes swelling and deterioration of the walls structural stability. In addition, test pits have revealed that the existing wall is minimally embedded with backfill that is all sand. The wall is not sitting on or connected to bedrock as the bedrock was found 10 feet to 16 feet below the sand. Based on these investigation results and wave alternative scenarios the existing seawall has a marginal

factor of safety for stability. There is potential that in extreme wave conditions there could be failure.

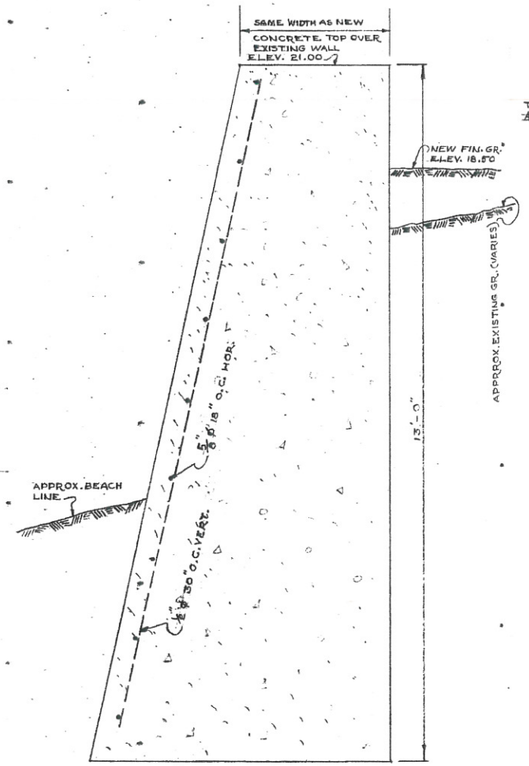
Based on the preliminary information, there are alternatives for repair (that wouldn't using the existing wall as a structural component) or options for full replacement options. It is estimated that it could take 6-9 months to design and permit a selected solution. T&B is refining those options now as to the recommended height of the wall, potential funding sources and permitting constraints. They are also preparing cost estimated associated with their recommendations.

In the meantime, the Department recommends that we retain T&B to continue monitoring the stability of the wall on a weekly basis and directly after large storm events and provide a written report of their findings. We also recommend that this memorandum be forwarded to the Board of Selectman and that we look at funding solutions for the design, permitting and potentially construction for the March 2017 Ballot.

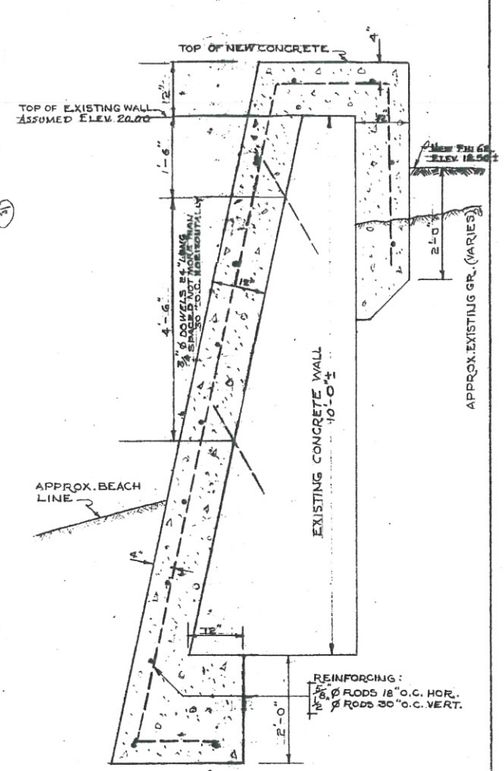
Please let us know if there are any questions or concerns.



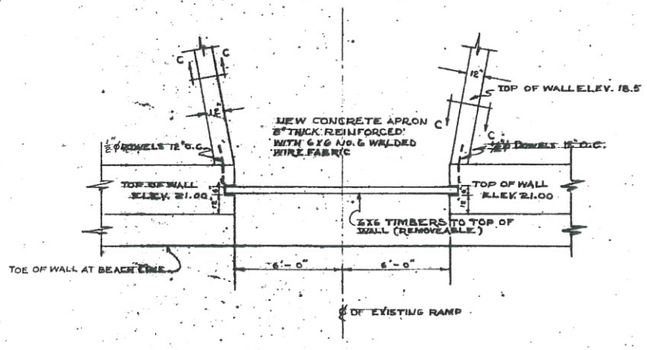
PLAN OF SEAWALL
SCALE 1" = 20'



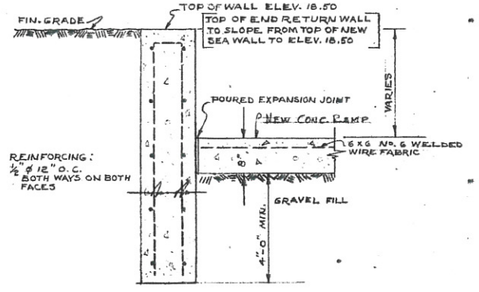
SECTION B-B
SCALE 3/4" = 1'-0"



SECTION A-A
SCALE 3/4" = 1'-0"



PLAN OF WALL AT RAMP
SCALE 1/4" = 1'-0"



SECTION C-C
SCALE 3/4" = 1'-0"

REVISION	DATE	APPD.	BY

U. S. COAST GUARD — FIRST DISTRICT — BOSTON MASS.

CIVIL ENGINEERING

DESIGNED -
DRAWN - W.P.JR.
TRACED -
CHECKED - J.C.R.

HAMPTON BEACH L.B.STATION
HAMPTON BEACH N.H.

SEAWALL REPAIRS

CHIEF OF SECTION - J. A. Sinclair

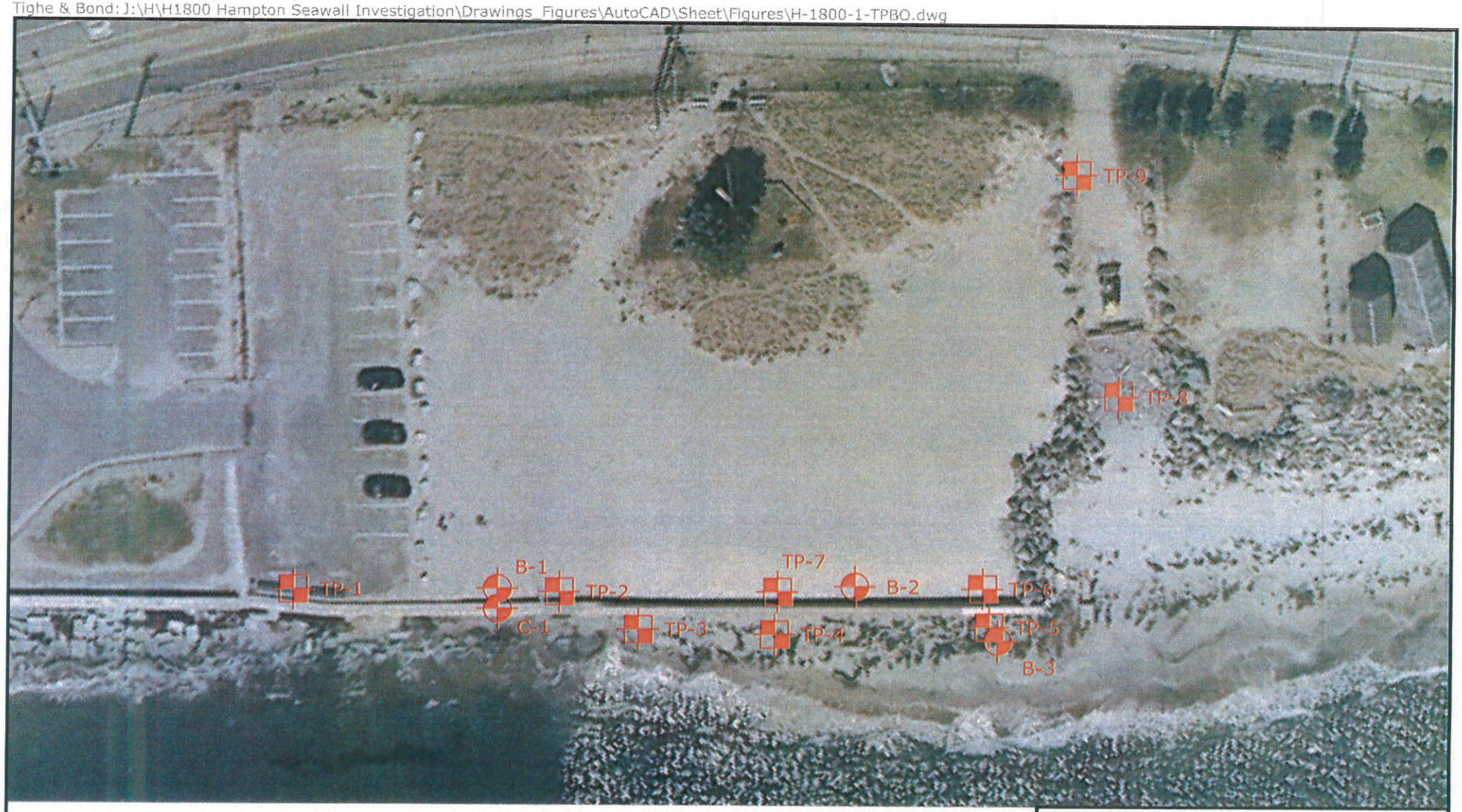
APPROVED — DATE JUNE 13, 1960
U.S.C.G. CHIEF OF DIVISION

C. G. DRAWING NO. 4408

SCALE AS SHOWN — SHEET 1 OF 1

ATTACHMENT A

Last Saved: 10/10/2016
Plotted On:Nov 21, 2016-11:22am By: TPD
Tighe & Bond: J:\H\H1800 Hampton Seawall Investigation\Drawings_Figures\AutoCAD\Sheet\Figures\H-1800-1-TPBO.dwg



LEGEND

B-1 BORING LOCATION

TP-1 TEST PIT LOCATION

50 0 25 50

SCALE: 1"=50'

N

BICENTENNIAL PARK SEAWALL
HAMPTON, NEW HAMPSHIRE

SUBSURFACE INVESTIGATION
LOCATION PLAN

DATE:	11/21/2016
SCALE:	AS SHOWN
FIGURE:	1 OF 1

Tighe&Bond
Engineers | Environmental Specialists

ATTACHMENT B

Tighe&Bond
Engineers | Environmental Specialists

Project: Bicentennial Park Seawall Investigation
Location: Hampton, NH
Client: Town of Hampton

Boring No. **B-1**
Page 1 of 1
File No. H-1800-1
Checked by: D. Brogan

Drilling Co.: New England Boring Contractors
Foreman: M. Soucy
T&B Rep.: T. Donovan
Date Start: 10/13/16 End: 10/13/16
Location See Exploration Location Plan
GS. Elev. 13.1' Datum: NAVD88

	Casing	Sampler
Type	HSA	Split Spoon
I.D./O.D.	4.25"/8.25"	1-3/8"/2"
Hammer Wt.		140#
Hammer Fall		30"
Other		Safety Hammer

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
See Note 1				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec. (in)	Sample Depth (ft.)	Blows Per 6"	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1/12	0-2	1-2	Very loose, tan, fine SAND, trace Gravel			
				2-3				
		S-2/15	2-4	27-7	Medium dense, light brown, fine to medium SAND, trace Gravel			
				6-6				
5								
10		S-3/17	10-12	4-4	Loose, dark brown, fine SAND, trace Silt	SAND	1	
				5-6				
15		S-4/12	15-17	2-3	S-4: Loose, light gray, fine SAND, trace Silt			
		S-4A/5		2-5	S-4A: Loose, dark brown, fine to medium SAND, trace Silt			
20								
		S-5/11	20-22	7-6	S-5: Medium dense, dark brown, fine SAND, trace Silt			
		S-5A/11		4-9		20.9'		
					S-5A: Very stiff, gray-blue, Clayey SILT, trace Gravel, trace fine Sand	Clayey SILT		
					Bottom of Exploration at 23' due to auger refusal			
25								
30								

Notes:
1. Groundwater observed at a depth of 10' during drilling.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

Tighe&Bond
Engineers | Environmental Specialists

Project: Bicentennial Park Seawall Investigation
Location: Hampton, NH
Client: Town of Hampton

Boring No. **B-2**
Page 1 of 1
File No. H-1800-1
Checked by: D. Brogan

Drilling Co.: New England Boring Contractors
Foreman: M. Soucy
T&B Rep.: T. Donovan
Date Start: 10/13/16 End: 10/13/16
Location See Exploration Location Plan
GS. Elev. 13.3 Datum: NAVD88

	Casing	Sampler
Type	HW	Split Spoon
I.D./O.D.	4"/4.5"	1-3/8"/2"
Hammer Wt.		140#
Hammer Fall		30"
Other		Safety Hammer

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
See Note 1				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec. (in)	Sample Depth (ft.)	Blows Per 6"	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1/17	0-2	2-2	Loose, tan to brown, fine SAND			
				4-6				
		S-2/5	2-4	13-9	Medium dense, brown, fine SAND, trace Gravel			
				7-4				
5						SAND		
		S-3/11	9-11	9-5	Medium dense, brown, fine to medium SAND, trace Gravel		1	
10				5-6				
		S-4/0	14-16	9-8	No Recovery			
15				7-9				
						17.5'		
		S-4/1"	19-21	3-3	Loose, dark gray, GRAVEL and SILT & CLAY, trace fine Sand	GRAVEL and SILT & CLAY		
20				6-7				
						22.5'		
		S-5/16	24-26	17-15	Dense, orange-brown, fine SAND and SILT	SAND and SILT		
25				23-31				
						27.5'		
		S-6/2	29-29.2	50/2"	Dark gray, GRAVEL, some coarse Sand, trace Silt & Clay	GRAVEL		
30					Bottom of Exploration at 29.2'			

Notes:
1. Groudnwater observed at a depth of 10' during drilling.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

Tighe&Bond
Engineers | Environmental Specialists

Project: Bicentennial Park Seawall Investigation
Location: Hampton, NH
Client: Town of Hampton

Boring No. **B-3**
Page 1 of 1
File No. H-1800-1
Checked by: D. Brogan

Drilling Co.: New England Boring Contractors
Foreman: M. Soucy
T&B Rep.: T. Donovan
Date Start: 10/13/16 End: 10/13/16
Location See Exploration Location Plan
GS. Elev. 3.6 Datum: NAVD88

	Casing	Sampler
Type	HW	Split Spoon
I.D./O.D.	4"/4.5"	1-3/8"/2"
Hammer Wt.		140#
Hammer Fall		30"
Other		Safety Hammer

Groundwater Readings

Date	Time	Depth	Casing	Sta. Time
See Note 1				

Depth (ft.)	Casing Blows Per Ft.	Sample No. / Rec. (in)	Sample Depth (ft.)	Blows Per 6"	Sample Description	General Stratigraphy	Notes	Well Construction
		S-1/10	0-2	2-3	Medium dense, light gray, fine SAND		1	
				8-21				
		S-2/8	2-4	4-4	Loose, brown, medium to coarse SAND, some Gravel	SAND		
				3-4				
5								
						6.5'		
		S-3/10	9-11	5-5	Medium dense, dark orange-brown, fine SAND and SILT, little Organics	SAND and SILT		
10				6-7				
						12.5'		
						Silty CLAY		
		S-4/10	14-15.3	7-9	Light gray, Silty CLAY, little Gravel, little Organics, trace fine Sand			
15				50/3"		15.3'	2	
					Hard, very slightly weathered, slightly fractured, gray, fine grained SCHIST, shallow to moderately dipping joints	BEDROCK		
20		C-2/60	17-22					
					RQD = 82%			
					Bottom of Exploration at 22'			
25								
30								

Notes:
1. Groundwater observed at a depth of 1' during drilling.
2. Split-spoon refusal at 15.3'. Drilled approximately 2' into rock before beginning rock core. Cored bedrock from 17-22'.

Proportions Used

TRACE (TR.)	0 - <10%
LITTLE (LI.)	10 - <20%
SOME (SO.)	20 - <35%
AND	35 - <50%

Density/Consistency

VERY LOOSE	0-4	VERY SOFT	<2
LOOSE	4-10	SOFT	2-4
MEDIUM DENSE	10-30	MEDIUM	4-8
DENSE	30-50	STIFF	8-15
VERY DENSE	>50	VERY STIFF	15-30
		HARD	>30

Dr. DAVID GRESS, Ph.D.,
Consulting Engineer
14 Sewall Road
Portsmouth, New Hampshire 03801
603-661-0121

November 1, 2016

Mr. Duncan Mellor, P.E.
Principal Coastal Engineer
Tighe & Bond
177 Corporate Drive
Portsmouth, NH 03801

Re: Hampton Sea Wall
Dear Mr. Mellor:
As per your request and authorization I have completed the evaluation and testing of the Hampton Sea Wall concrete cores. The report follows:

Laboratory Testing

Two cores and various pieces of core borings were pickup at the offices of Tighe & Bond located at 177 Corporate Drive, Portsmouth, New Hampshire. Figure 1 shows the original concrete after it was coated with a low viscosity clear epoxy and wrapped in plastic wrap to assure penetration. This core was impregnated with epoxy to assure it would hold together when cut and polished for laboratory investigation. Several miscellanies pieces of the old concrete are shown in Figure 2. Figure 3 shows a core with both the old concrete on the left end as well as the overlay concrete on the right side.

Petrographic analysis

The epoxied core of the original concrete was cut and polished for viewing under a binocular microscope. Figure 4 shows the polished section. The aggregate is a gravel from a glacial deposit as noted by the rounded particles. The aggregates are mostly igneous and very siliceous

ATTACHMENT C

in nature. The maximum aggregate size is approximately 1". The aggregate size distribution is well distributed and as placed the concrete appears to have been of reasonable quality well compacted with no signs of bleeding. There are significant cracking throughout the section with massive deposits of gel within the paste as well as the aggregate. Several aggregate particles are literally jacked apart showing massive expansion has occurred within the concrete. Such expansion is consistent with Alkali Silica Reaction (ASR). Several reaction rims, often related to the leaching of Silica from the aggregates at the paste aggregate interface, are visible. This is another potential sign of ASR. This concrete is extremely distressed.

The old and original concrete interface is shown on Figure 5. The older concrete is on the top of the polished section. There are no apparent signs of ASR in the older concrete or the overlay. It was surprising that the bond between the old and overlay concrete was intact! This may be an anomaly and exists intact only at this particular location. It is likely the stress caused by expansion of the old ASR concrete was dissipated by adjacent cracks. The overlay concrete is also a glacial aggregate but has been processed by crushing as noted by its high angularity. The mineralogy appears also to be igneous in nature and siliceous as well. The maximum aggregate size is approximately ¾". The aggregate size distribution is reasonably good. There are no tell tail observations indicating the concrete was not of good quality when placed.

Uranyl Acetate Dihydrate viewed under UV light

Alkali silica reaction produces a gel rich in silica. A test used to visually identify silica gel was conducted on a cut but unpolished section. The section tested was the mirror image of the polished section presented in Figure 4. The selected cut section was coated with a solution of Uranyl Acetate Dihydrate then viewed under ultraviolent light. If present the silica in ASR gel glows greenish-yellow under the presence of ultraviolent light.

Figure 6 shows the cut section coated with a solution of Uranyl Acetate Dihydrate under ultraviolet light (see left photograph). For comparison the polished mirror image is shown on

the right side of the photographs. The greenish-yellow glow shows the presence of ASR gel. The gel appears to be everywhere throughout the section. The gel is apparent between cracked aggregate particles and within the paste. This is a classic case of ASR.

Summary and Conclusions

Testing of the Hampton Sea Wall original concrete showed the presence of classic ASR. The concrete is extremely distressed as shown by the single core evaluated. Visually the core of overlay concrete did not appear to have any materials relayed distress and seems to have had reasonable quality when placed.

It is recommended any proposed repair of the Hampton Sea Wall not structurally rely on the use of the old ASR concrete. Trying to bond to or structurally attach to this ASR concrete is not recommended. On the other hand, enveloping the old concrete with an independent structural skin is highly recommended as a viable method of economically extending the life of the Hampton Sea Wall.

Respectfully submitted,

David Gress

Figure 1 Hampton Sea Wall original concrete core after coated with clear low viscosity Epoxy

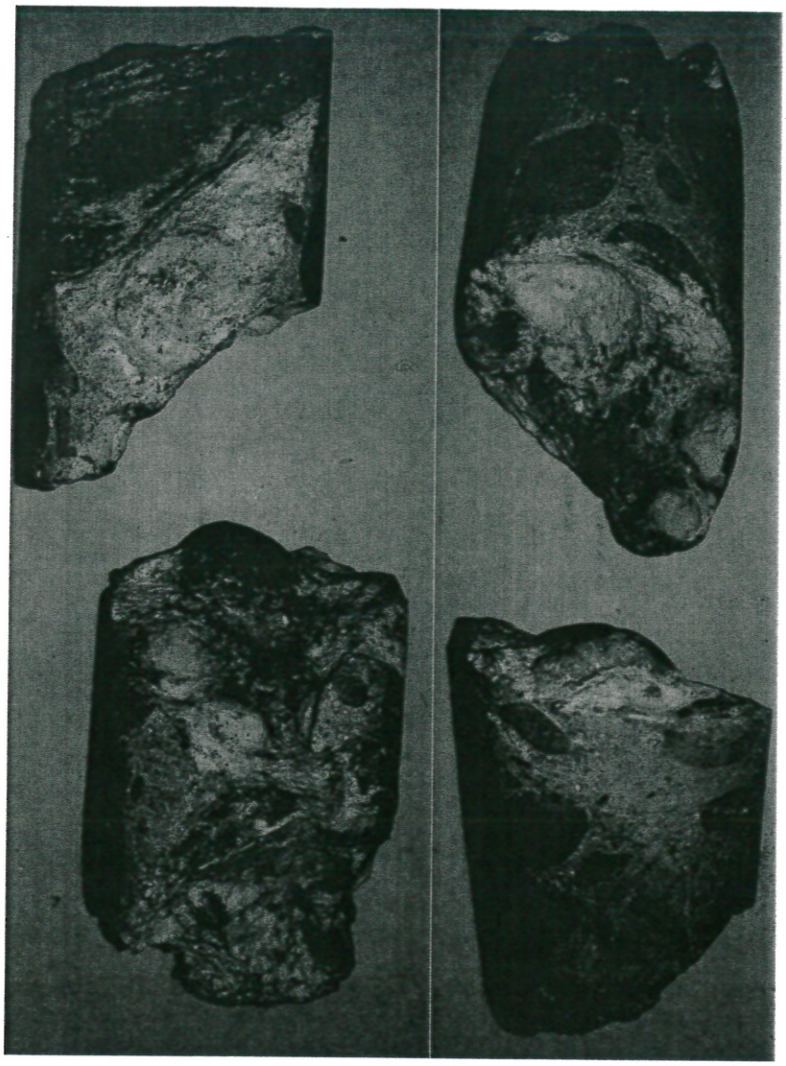


Figure 2 Hampton Sea Wall original concrete core pieces

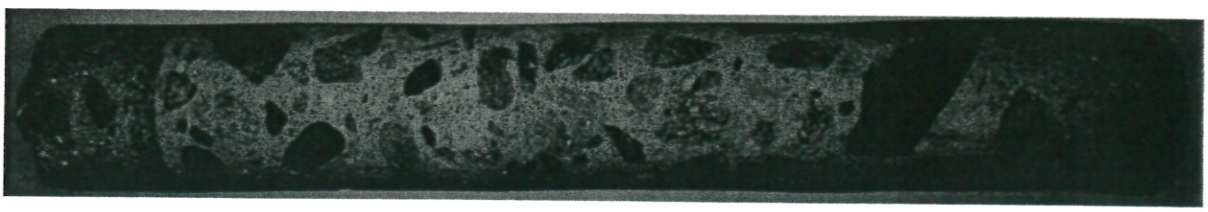


Figure 3 Hampton Sea Wall concrete core with old concrete (left side) and overlay concrete (right)

Figure 4 Hampton Sea Wall original concrete cut and polished section

Figure 5 Hampton Sea Wall cut and polished section showing old (top) and overlay concrete (bottom)

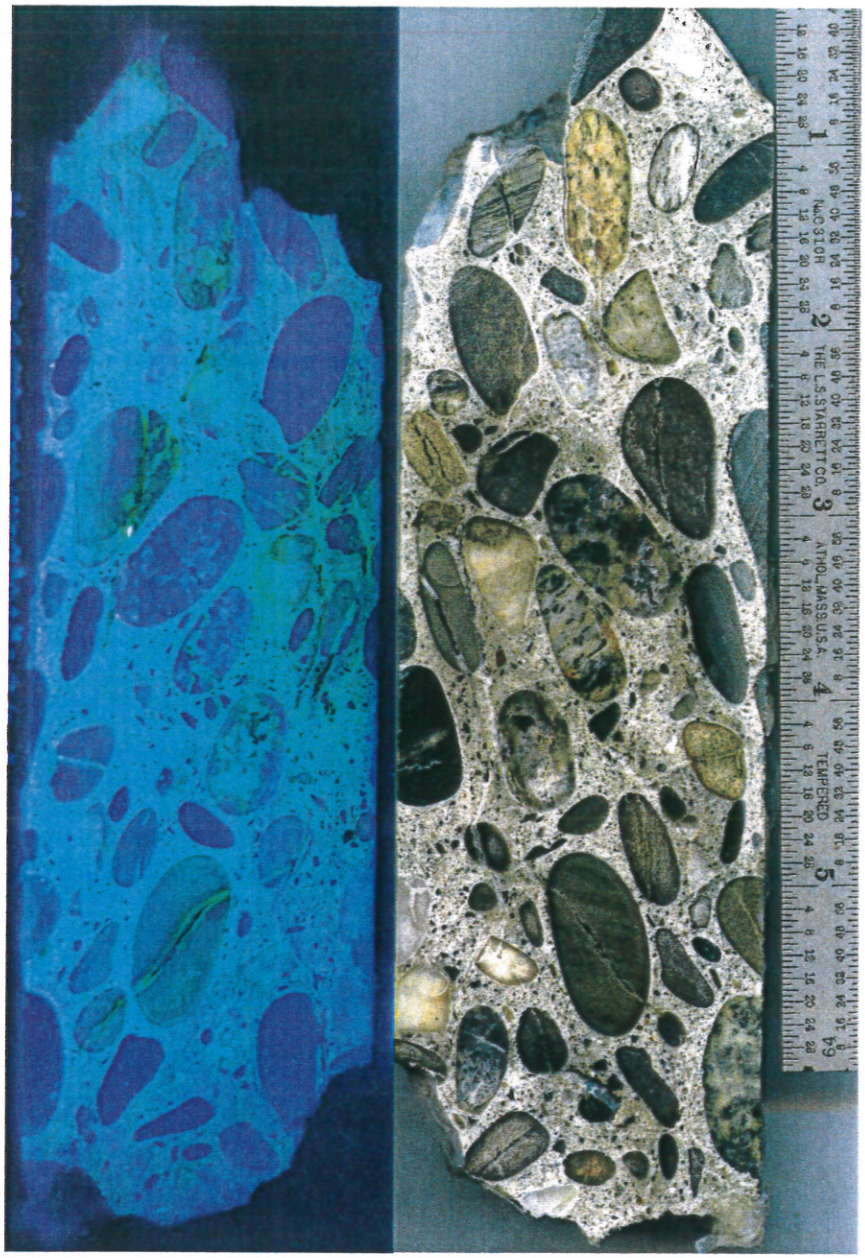
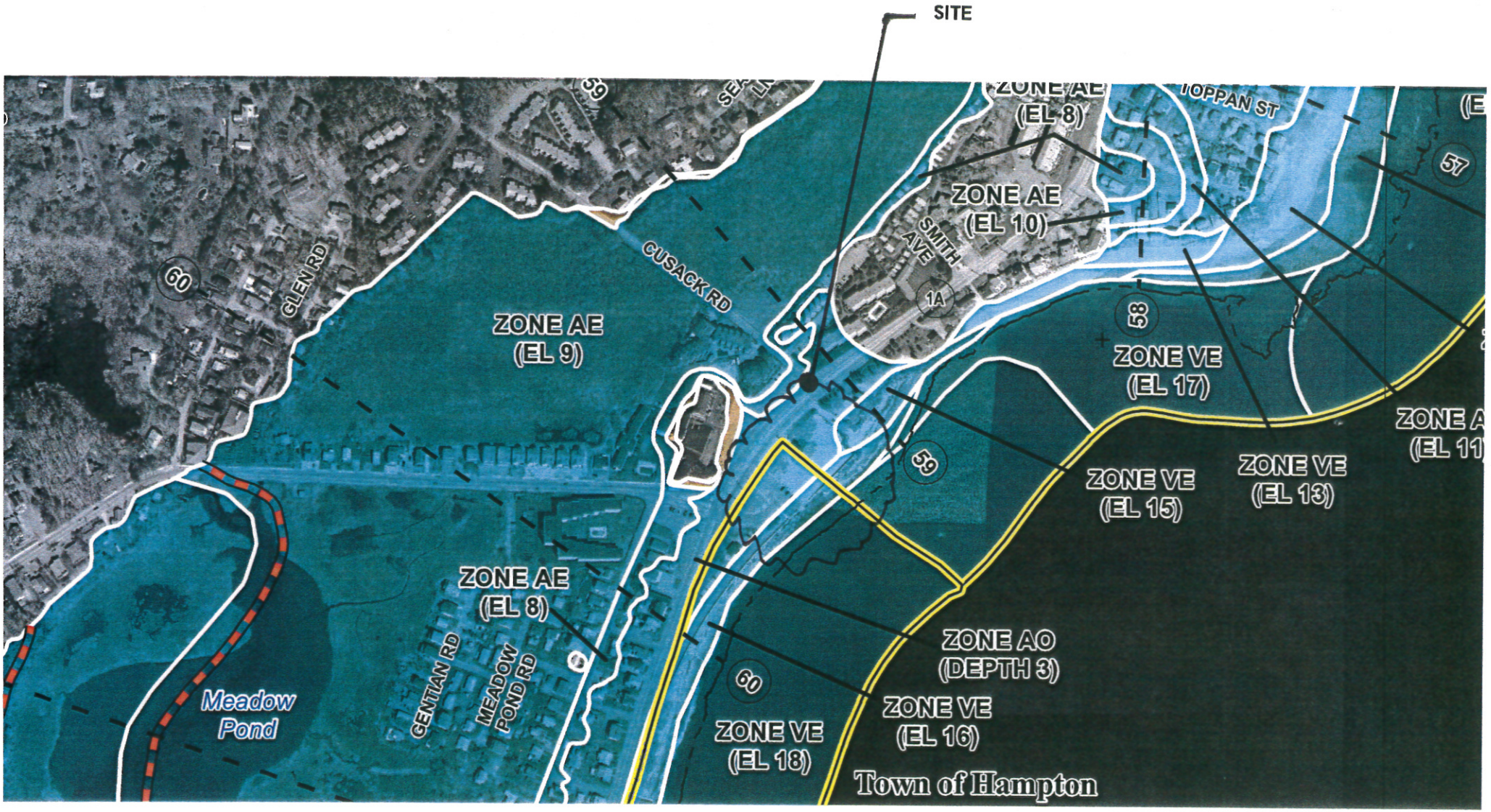


Figure 6 Hampton Sea Wall original unpolished concrete coated with Uranyl Acetate and under Ultraviolent Light (see left side). Right side is polished mirror image under normal light


SITE
ZONE AE
(EL 8)
TOPPAN ST
ZONE AE
(EL 10)
SMITH AVE
1A
CUSACK RD
GLEN RD
60
59
57
58
ZONE AE
(EL 9)
ZONE VE
(EL 17)
ZONE VE
(EL 15)
ZONE VE
(EL 13)
ZONE AE
(EL 11)
ZONE AE
(EL 8)
GENTIAN RD
MEADOW POND RD
Meadow Pond
ZONE AO
(DEPTH 3)
ZONE VE
(EL 16)
ZONE VE
(EL 18)
Town of Hampton

The parsonage shares were to be laid out in the first three divisions —one share in each of them.

A committee was chosen to complete the arrangement by ascertaining who were the lawful owners of the commons, and assigning to each one his proportion,—the committee to be upon oath. They were also authorized to employ some surveyor not belonging to the town —Mr. Wade being preferred. The committee chosen, were: Lieut. Jonathan Marston, Sergt. Joseph Taylor, Simon Marston, Capt. Joshua Wingett, Lieut. Benjamin Hilliard.

Soon after the survey of the common lands had been completed, there was a meeting of the proprietors of the "Five Divisions" (October 26, 1722), at which they authorized the committee previously appointed for the laying out of these divisions, to determine the rights of claimants, and "to settle men in their rights." It was considered important, also, as each division had been empowered to manage and order its own affairs, that some rule should be established, to which all the divisions should conform, in calling their meetings. It was therefore voted that the owners of ten shares in any division should have power to warn a meeting of the proprietors of that division, and that all votes passed at such a meeting should "stand good in all respects," and such votes as the proprietors should order to be placed upon the Town or the Commoners' Records, should be entered there by the town clerk—"they paying y^{e} fee"—and any entry thus made, was to be regarded as a good and sufficient record.

"THE CHESTNUT COUNTRY."

This year, the town of Chester was incorporated. With few exceptions, the grantees were non-residents, more than half of them being of Hampton and Hampton Falls. As early as October, 1719, "The Society for Settling the Chestnut Country," composed mostly of Hampton men, began to keep records, called later, "The Town Book" and "The Duplicate Book," the latter of which was in custody of Capt. Joshua Wingate, at Hampton, at whose house many of the proprietors' meetings were held. Capt. Henry Sherburne and Dr. Edmund Toppan were, a few years later, chosen a committee, to compare the two books, and see that they exactly agreed. In 1720, a grant of the township was obtained, and in 1722, Chester was given full town privileges, the grantees gradually selling their rights to settlers.

HIGH TIDE; THE MEADOW POND CREATED.

A great storm, attended with a very uncommon tide, was experienced in New England, on the 24th of February, 1723, an account of

Bonus Reading

which is given by Dr. Cotton Mather and quoted by Mr. Coffin, in these words: "An unusual high tide, higher by twenty inches than was ever known before At the same time, the sea at Hampton broke over its banks for some miles together, and continued running for several hours." Dr. Holmes adds, that at Hampton it "inundated the marshes for many miles." Regarding the date, Dr. Holmes writes: "He (Mather) probably used the old style, which protracted the year to 25th March. I have therefore inserted the article under 1724."[1] With this opinion, Mr. Drake disagrees, and says: "I think, had that been the case, Mather would have written 1723-4. Besides, I find no allusion to the matter in some News-papers consulted, printed then in Boston. Again, Dr. Mather says it was on 'the Lord's day,' and Lord's day did not happen on Feb. 24th, 1724, but it does fall on the 24th, of 1723." Had Mr. Drake looked a little farther, he would have found one contemporary paper, *The Boston News-Letter*, which contained an account of the storm. This paper may be seen to-day in the library of the Massachusetts Historical Society. The communication begins as follows: "Feb. 25, 1723. Yesterday, being the *Lord's Day*, the *Water* flowed over our Wharffs and into our Streets to a very surprising height. They say the *Tide* rose 20 *Inches* higher than ever was known before. The *Storm* was very strong at *North-east*." The date is therefore conclusively fixed as February 24, O. S. or, according to present reckoning, March 7, 1723.

The importance of establishing the date will be seen by the results in Hampton; for the tradition about this wonderful tide and its ravages is substantially as follows:

Inside of the banks of sand which lay along the shore, and served as barriers against encroachments of the ocean, was a large tract of low, swampy land, extending southward from Nut Island, a mile or more. This tract, known as Huckleberry Flats, was dotted over with hassocks, on which grew huckleberry bushes and alders. The spaces between the hassocks were usually wet, though covered with grass, whose numberless roots closely intertwined, together with the grass itself, formed a sort of mat, resting on the soft mud beneath, on which a man might walk, though the grassy mat trembled at every step taken. Through this tract flowed a large brook, or rivulet, called Nilus.[2]

At the time of the storm, the hassocks, filled with the roots of the bushes, the spaces between them, with their net-work of grass-roots,

[1] Holmes' Annals, I: 534.

[2] Charles M. Lamprey, Esq., who owns land in this tract of meadow, has found stumps of trees, deeply embedded in the mud, furnishing proof that the land was once wooded.

2

and the mud and water beneath, were firmly frozen to a considerable depth. The severity of the storm and the extraordinary height of the tide gave such force to the waves, that they swept away the sand-banks on the shore, and the whole of the tract described and hundreds of acres of salt-marshes were inundated. The surging waters soon found a way under the thick, hard-frozen crust on the flats, and raising and breaking up a large portion of it, bore the fragments along with the current, over the marshes, till they found a resting place, or were swept into the ocean.

When the storm had ceased and the flood subsided, a large part of the swampy tract that has been described had become a POND, covering several acres. Into this pond, the brook Nilus flowed; but southerly of the pond, where it had run nearer the seashore, passing below the end of the causeway, as it now is, and the road to Great Boar's Head, about thirty or forty rods, and then turning to the west into the marshes, where traces of the "old river" are still seen, the brook had been filled up with *debris*, so that an outlet was made by digging a wide ditch from the pond to the river below. This outlet is called the *Eel-ditch*.

About the first of March, a boat with three men and a boy—their names not given—coming from the Piscataqua river to Hampton, was driven off to sea, and one of the men perished with the cold. The others succeeded in reaching the land on the third day, running their boat ashore upon our beach. The boat was lost. Those on board saved their lives, but were all of them much frozen.[1]

THUNDER STORMS.

The year 1727 is noted for its thunder storms and its earthquake. Two instances of danger to life and yet of escape from injury, by lightning, are related of Hampton people, by the Rev. Mr. Gookin.

"A little after break of day [April 10], a thunder storm came over this town. At first the thunder was but low, and seemed to be at a distance; but all at once came on an amazing clap; the lightning then fell upon the house of Mr. Edward Shaw. It took off all that part of the chimney which was above the roof, and broke down all the fore part of the chimney in the northeast end of the house till it came to the chamber hearth. In the lower room of that end of the house, where the man's mother [Mrs. Esther Shaw, 82 years old] and one of her grandchildren lodged, it took a small table, within four feet

[1] *Boston Gazette*, March 9, 1724.

3