STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
16 STATE HOUSE STATION
AUGUSTA, MAINE
04333-0016

JOHN ELIAS BALDACCI
GOVERNOR

DAVID A. COLE
COMMISSIONER

September 1, 2010
Subject: **Kennebunk**
State Pin No: 015098.00
Amendment No. 1

Dear Sir/Ms:

Make the following changes to the bid documents:

In the Bid Book, after page 35, **ADD** the attached "BLASTING PROCEDURES ADJACENT TO THE UTILITY FACILITIES", 1 page undated.

In the Bid Book (page 131), **REMOVE** "SPECIAL PROVISION, SECTION 841, BOLLARD", one page dated August 2010 and **REPLACE** with the attached new "SPECIAL PROVISION, SECTION 841, BOLLARD", one page dated August 2010

NOTE: A memo titled "Summary of South Approach Sinkhole Issues" has been posted to the website for Kennebunk, PIN 015098.00. The address for the site is posted below; http://www.maine.gov/mdot/comprehensive-list-projects/015098.00.php

In the Plans, **REPLACE** the following Plan Sheets with the attached new Plan Sheets;

SHEET NUMBER 2 OF 48
SHEET NUMBER 5 OF 48
SHEET NUMBER 44 OF 48
SHEET NUMBER 45 OF 48

NOTE: Plan Sheets will be mailed/FedExed to those who purchased Plan Sheets in the quantity and size ordered.

Consider these changes and information prior to submitting your bid on September 8, 2010.

Sincerely,

Scott Bickford
Contracts & Specifications Engineer

Town: Kennebunk
Project: 15098.00
PIN: 15098.00

BLASTING PROCEDURES ADJACENT TO THE UTILITY FACILITIES

If the contractor plans to do any blasting in the area of the Utility facilities and structures, the Contractor shall use a seismograph to record the effects of the blasting on the facilities and structures, making available copies of the taped results to the utilities and the State. The Contractor shall make a visual and photographic inspection of the facilities and structures with a representative of the utilities and the State prior to blasting and after blasting. The Contractor shall submit to the State and Utilities a blasting procedure for approval, for any blasting. This approval may take up to 30 days. This will be discussed in greater detail at the preconstruction utility meeting.

1. Prior to the start of work, the Contractor shall furnish a plan and description of the proposed blasting operations for review by the Department's blasting expert and to each of the utilities. The plan and description shall include the details of the proposed blasting operations including the number, location, diameter and depth of holes, type and amount of explosives to be used, size and nature of charge per hold and per delay, timing and length of delays, blasting sequence, measures to be taken to retain debris (such as blasting mats), distance to existing Utility facilities and buildings from blast site and other information requested by the Department and utilities. The Contractor shall also provide proof that only a fully qualified, experienced and licensed blaster will direct and carry out the work. The Contractor shall have a blaster that is familiar and has a working knowledge of the latest edition of the Blasters' Handbook, especially with the chapter that deals with controlled blasting. This blaster shall also be familiar with the "State of Maine Office of State Fire Marshall Rules for the Manufacture, Transportation, Storage and Use of Explosives effective January 15, 1991" or the latest revision.

2. Regardless of the blasting procedure that is approved, if the Utility's designated representative determines that blasting is adversely affecting their facilities, property or operations, the Utilities reserve the right to terminate or suspend the operations of the Contractor until the Contractor has received the approval of the Utilities for any changes in procedures, materials, equipment or personnel deemed necessary by the Utilities to protect their operations, personnel and property.

3. The Contractor may use non-explosive demolition agent or other means to remove the existing ledge. The use of non-explosive demolition agent or other means will have to be approved by the Department of Transportation and the Utilities.

Kennebunk

15098.00

August 2010

SPECIAL PROVISIONS

SECTION 841

BOLLARD

Description. This work shall consist of furnishing and installing Granite bollards necessary to complete the work. All earth work, excavation, concrete and/or compacted backfill shall be incidental to the bollard.

Material Granite Bollards shall have a nominal size or 10" deep by 10" wide with a length of 7 feet. The granite shall be dense, sound, durable and resistant to weathering action. All granite shall be uniform in color and free from seams, cracks, starts, and other structural defects.

The finish on exposed surface of the stones shall be free from tool marks. Irregular projections shall be limited to a maximum of 3 inches for any one stone measured from the pitch line. Irregular depressions shall be limited to a maximum of 1 inch for any one stone measured from the pitch line.

All stones shall be finished so that no holes of portions of holes shall show on surfaces that will be exposed in the finished work.

Construction Granite Bollards shall be spaced and located as shown on the plans. Final locations shall be adjusted in the field.

Method of Measurement Bollards and all necessary incidentals to complete the work shall be paid for by each complete and accepted in place.

Basis of Payment The quantity of bollards will be paid for by the contract unit price for each installation. Such payment will be full compensation for all labor, excavation, backfill, tools, associated hardware, and any other incidentals necessary to complete the work.

Payment will be made under:

Pay Item		Pay Unit
841.48	Bollard	Each

ESTIMATED QUANTITIES

	ITEM NO	DESCRIPTION	QUANTITY	UNIT
		BRIDGE ITEMS - SECTION 1		
	201.23	REMOVING SINGLE TREE TOP ONLY	1	EA
	201.24	REMOVING STUMP	1	EA
	202.19	REMOVING EXISTING BRIDGE (2350 CY)	1	LS
	203.20	COMMON EXCAVATION	1250	CY
	203.20	COMMON EXCAVATION - SLUICEWAY REMOVAL	2200	CY
*	203.2312	HEALTH AND SAFETY PLAN	1	LS
*	203.24	COMMON BORROW	10	CY
	203.24	COMMON BORROW - SLUICEWAY REMOVAL	500	CY
	203.25	GRANULAR BORROW	1610	CY
*	203.25	GRANULAR BORROW - SLUICEWAY REMOVAL	300	CY
*	206.061	STRUCTURAL EARTH EXCAVATION - DRAINAGE MINOR STRUCTURES BELOW GRADE	10	CY
	206.07	STRUCTURAL ROCK EXCAVATION - DRAINAGE AND MINOR STRUCTURES	10	CY
	206.082	STRUCTURAL EARTH EXCAVATION - MAJOR STRUCTURES, PLAN QUANTITY	1900	CY
	206.092	STRUCTURAL ROCK EXCAVATION - MAJOR STRUCTURES	75	CY
	304.10	AGGREGATE SUBBASE COURSE-GRAVEL	940	CY
	403.207	HOT MIX ASPHALT, 19.0MM NOMINAL MAXIMUM SIZE	210	TON
	403.209	HOT MIX ASPHALT, 9.5MM NOMINAL MAXIMUM SIZE (SIDEWALKS, DRIVES, ISLANDS, AND INCIDENTALS)	50	TON
	403.210	HOT MIX ASPHALT, 9.5MM NOMINAL MAXIMUM SIZE	295	TON
	403.213	HOT MIX ASPHALT, 12.5MM NOMINAL MAXIMUM SIZE, BASE	140	TON
	409.15	BITUMINOUS TACK COAT, APPLIED	106	GAL
	502.21	STRUCTURAL CONCRETE, ABUTMENTS AND RETAINING WALLS	865	CY
	502.261	STRUCTURAL CONCRETE ROADWAY AND SIDEWALK SLAB ON CONCRETE BRIDGES (175 CY)	1	LS
	502.31	STRUCTURAL CONCRETE APPROACH SLAB (35 CY)	1	LS
	502.49	STRUCTURAL CONCRETE CURBS AND SIDEWALKS (50 CY)	1	LS
	502.56	CONCRETE FILL	260	CY
	503.12	REINFORCING STEEL, FABRICATED AND DELIVERED	64800	LB
	503.13	REINFORCING STEEL, PLACING	64800	LB
	503.30	CORROSION RESISTANT REINFORCING SYSTEM, FABRICATED AND DELIVERED	850	LB
	503.31	CORROSION RESISTANT REINFORCING SYSTEM, PLACING	850	LB
	508.14	HIGH PERFORMANCE WATERPROOFING MEMBRANCE (517 SY)	1	LS
	510.12	SPECIAL DETOUR 28 FOOT ROADWAY WIDTH VEHICULAR AND PEDESTRIAN SEPARATED	1	LS
	511.07	COFFERDAM (ABUTMENT NO. 1)	1	LS
	511.07	COFFERDAM (ABUTMENT NO. 2)	1	LS
	511.07	COFFERDAM (SLUICEWAY REMOVAL)	1	LS
	511.08	COFFERDAM SPECIAL: TEMPORARY EARTH SUPPORT STRUCTURE (LAFAYETTE BUILDING)	1	LS
	511.08	COFFERDAM SPECIAL: TEMPORARY EARTH SUPPORT STRUCTURE (MOUSAM RIVER IMPOUNDMENT)	1	LS
	511.08	COFFERDAM SPECIAL: TEMPORARY EARTH SUPPORT STRUCTURE (RELOCATED ELEC. VAULT)	1	LS
	512.081	FRENCH DRAINS (215 LF)	1	LS
	514.06	CURING BOX FOR CONCRETE CYLINDERS	1	EA
	515.21	PROTECTIVE COATING FOR CONCRETE SURFACES (515 SY)	1	LS
	523.52	BEARING INSTALLATION	14	EA
	523.5401	LAMINATED ELASTOMERIC BEARINGS, FIXED	7	EA
	523.5402	LAMINATED ELASTOMERIC BEARINGS, EXPANSION	7	EA
	525.61	EXISTING GRANITE WALL REPAIR	1	LS
	526.301	TEMPORARY CONCRETE BARRIER TYPE 1 (110 LF)	1	LS
	526.323	TEXAS CLASSIC RAIL (295 LF)	1	LS
	527.303	ENERGY ABSORBING SYSTEM (ET-PLUS)	1	EA
	535.61	PRESTRESSED STRUCTURAL CONCRETE I-GIRDERS (651 LF)	1	LS
	603.175	18" RCP CLASS III	22	LF
	603.179	18" CULVERT PIPE OPTION III	104	LF
	604.072	CATCH BASIN TYPE A1-C	6.4	EA
	604.15	MANHOLE	1	EA
	604.16	ALTERING CATCH BASIN TO MANHOLE	1	EA
	604.18	ADJUSTING MANHOLE OR CATCH BASIN TO GRADE	2	EA
	604.23	STEP	11	EA
	605.13	18 INCH UNDERDRAIN TYPE C	80	LF
	606.1721	BRIDGE TRANSITION - TYPE 1	1	EA
	606.353	REFLECTORIZED FLEXIBLE GUARDRAIL MARKER	2	EA
	607.25	REMOVE AND RESET CHAIN LINK FENCE	24	LF
	607.421	SCREENING FENCE	110	LF
	608.253	MASONRY PAVER WITH TRUNCATED DOME	76	SF
	609.11	VERTICAL CURB TYPE 1	375	LF
	609.12	VERTICAL CURB TYPE 1 - CIRCULAR	2	LF
	609.13	VERTICAL BRIDGE CURB TYPE 1	195	LF
	609.237	TERMINAL CURB TYPE 1 - 7 FOOT	11	EA
	610.08	PLAIN RIPRAP	29	CY
	615.07	LOAM	20	CY
	618.1301	SEEDING METHOD NUMBER 1 - PLAN QUANTITY	3.5	UN
	618.15	TEMPORARY SEEDING	0.5	LB
	619.1201	MULCH - PLAN QUANTITY	4.5	UN
	620.58	EROSION CONTROL GEOTEXTILE	12	SY
*	621.043	EVERGREEN TREE 6'-8' B&B GROUP A	12	EA
*	621.053	EVERGREEN TREE 10'-12' B&B GROUP B	1	EA
*	621.101	STARTER GROUNDCOVER PLUGS 2 1/4" PEAT POTS/PLUGS GROUP B	600	EA
*	621.121	SMALL DECIDUOUS TREES 5'-6' MULTISTEM GROUP B B&B	3	EA
*	621.273	MEDIUM DECIDUOUS TREES 2"-2 1/2" CAL B&B GROUP B	8	EA
*	621.281	MEDIUM DECIDUOUS TREES 2 1/2"" - 3"" CAL B&B GROUP C	6	EA
*	621.409	DWARF EVERGREENS 30"-36" GROUP C	18	EA
*	621.499	BROADLEAF EVERGREENS 30"-36"	24	EA
*	621.540	DECIDUOUS FLOWERING SHRUB 18" - 24" GROUP C CONT.	12	EA
*	621.541	DECIDUOUS FLOWERING SHRUB 18" - 24" GROUP C CONT.	42	EA
*	621.546	DECIDUOUS FLOWERING SHRUB 2" - 3" GROUP A CONT.	12	EA
*	621.553	DECIDUOUS FLOWERING SHRUB GROUP 3' - 4' SHRUB FORM CONT.	9	EA
*	621.710	HERBACEOUS PERENNIALS GROUP A 1 GAL CONT.	124	EA
*	621.80	ESTABLISHMENT PERIOD	1	LS

ESTIMATED QUANTITIES

	ITEM NO	DESCRIPTION	QUANTITY	UNIT
	626.11	PRECAST CONCRETE JUNCTION BOX	10	EA
	626.21	METALLIC CONDUIT (2")	85	LF
	626.22	NON-METALLIC CONDUIT (3" &4")	950	LF
	626.31	18" FOUNDATION	8	EA
	627.733	4" WHITE OR YELLOW PAVEMENT MARKING LINE	1300	LF
	627.75	WHITE OR YELLOW PAVEMENT & CURB MARKING	970	SF
	627.76	TEMPORARY PAVEMENT MARKING LINE, WHITE OR YELLOW	1	LS
	627.77	REMOVING EXISTING PAVEMENT MARKINGS	470	SF
*	629.05	HAND LABOR, STRAIGHT TIME	80	HR
*	631.10	AIR COMPRESSOR (INCLUDING OPERATOR)	40	HR
*	631.11	AIR TOOL (INCLUDING OPERATOR)	40	HR
*	631.12	ALL-PURPOSE EXCAVATOR (INCLUDING OPERATOR)	80	HR
*	631.13	BULLDOZER (INCLUDING OPERATOR)	10	HR
*	631.172	TRUCK-LARGE (INCLUDING OPERATOR)	40	HR
*	631.18	CHAIN SAW RENTAL (INCLUDING OPERATOR)	20	HR
*	631.32	CULVERT CLEANER (INCLUDING OPERATOR)	10	HR
	634.16	HIGHWAY LIGHTING	1	LS
	637.071	DUST CONTROL	1	LS
*	639.18	FIELD OFFICE TYPE A	1	EA
	642.183	GRANITE STEPS	1	LS
	643.711	TEMPORARY TRAFFIC SIGNAL MODIFICATION: ROUTE 1/WATER STREET	1	LS
	652.30	FLASHING ARROW BOARD	2	EA
	652.312	TYPE III BARRICADE	20	EA
	652.33	DRUMS	50	EA
	652.34	CONES	50	EA
	652.35	CONSTRUCTION SIGNS	1050	SF
	652.36	MAINTENANCE OF TRAFFIC CONTROL DEVICES	427	CD
	652.38	FLAGGERS	1600	HR
	652.41	PORTABLE CHANGEABLE MESSAGE SIGN	2	EA
	656.75	TEMPORARY SOIL EROSION AND WATER POLLUTION CONTROL	1	LS
	659.10	MOBILIZATION	1	LS
	841.48	BOLLARDS	9	EA
		TOWN ITEMS - SECTION 2		
	608.15	BRICK SIDEWALK WITH BITUMINOUS BASE	390	SF
		FAIRPOINT ITEMS - SECTION 3		
	806.671	FIBERGLASS CONDUIT SYSTEM - 4" DIA.	2200	LF
	890.01	SPECIAL WORK #1 - TELEPHONE SYSTEM	1	LS
		KENNEBUNK LIGHT & POWER ITEMS - SECTION 4		
	890.021	SPECIAL WORK #2 - KENNEBUNK LIGHT AND POWER CONDUIT SYSTEM	1	LS

* UNDETERMINED LOCATIONS

GENERAL NOTES (Sluiceway Demolition)

1. An abandoned sluiceway is located west of Abutment 1. The sluiceway is believed have been 14 feet wide by 6 feet deep based on historical accounts. The 14-foot wide sluiceway was most likely located within the area bounded by Sta. 14+25 to 14+51 at 25' Lt. and Sta. 14+37 to 14+60 at 26' Rt. The bottom of the sluiceway is believed to be between 17 and 21 feet below existing ground surface. The actual depth and lateral extent of the sluiceway excavation will be determined by the Geotechnical Engineer during removal.

2. For bid purposes, the sluiceway removal limits should be assumed to be a 14-foot wide area within the limits defined above, extending from 25' Lt. to 26' Rt. and from the ground surface to a depth of 21 feet. The removal may also include soil and/or voids adjacent to the sluiceway structure as defined by the Geotechnical Engineer.

3. Temporary excavation support systems and additional excavation are anticipated to be required to achieve removal within the assumed limits. For bid purposes, assume 70-foot long temporary earth support structures will be installed at 25' Rt. and 25' Lt.

4. Removal of abandoned sluiceway shall include sluiceway structural elements (wood, metal or other), nearby undocumented abandoned piping, debris and fill materials within the excavation area.

5. Excavation work shall be conducted under the observation of the Geotechnical Engineer. Sluiceway remnants, fill and other materials within the removal limits shall be removed to expose naturally deposited soil or rock as determined by the Geotechnical Engineer. Excavated material shall become the property of the Contractor.

6. Backfill for the excavation shall consist of Maine DOT 703.19 Granular Borrow for Underwater Backfill below elevation 35. Estimated quantities for required common excavation for removal of the abandoned sluiceway are informational only and represent the approximate minimum quantity required to remove sluiceway and replace with common and granular borrow. Additional excavation for the Contractor's convenience or to comply with backsloping requirements will not be paid for directly, but will be considered incidental to the related excavation. Additional excavation beyond the limits described above, if directed by the Geotechnical Engineer or Resident based on observations made during the Work, will be paid for in accordance with Section 109.7 - Equitable Adjustments to Compensation.

7. Additional sinkhole information and recent geophysical data is presented in the geotechnical memorandum titled "Summary of South Approach Sinkhole Issues, Kennebunk Bridge," dated August 24, 2010, which may be accessed at the MaineDOT web address.

8. See next sheet for additional General Notes.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BH-1509(800)X

PIN
PIN 15098.00

HIGHWAY PLANS

PROJ. MANAGER	$PROJMANAGER		
DESIGN-DETAILED	RWH		
CHECKED-REVIEWED	-----		
DATE	8/30/2010		
BY	MPC		

SIGNATURE

P.E. NUMBER

DATE

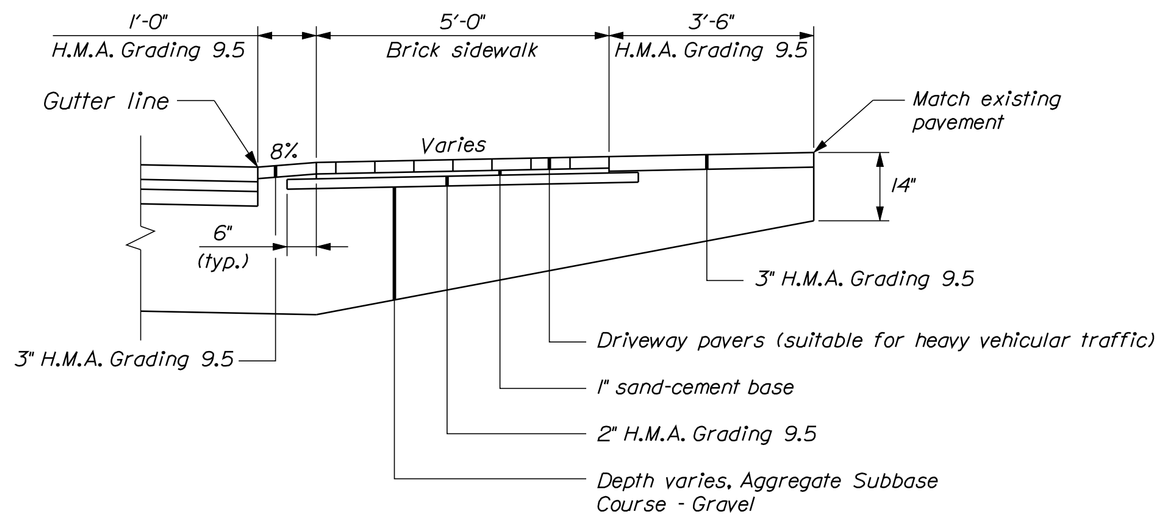
KENNEBUNK BRIDGE
MOUSAM RIVER
KENNEBUNK YORK COUNTY

ESTIMATED QUANTITIES AND GENERAL NOTES

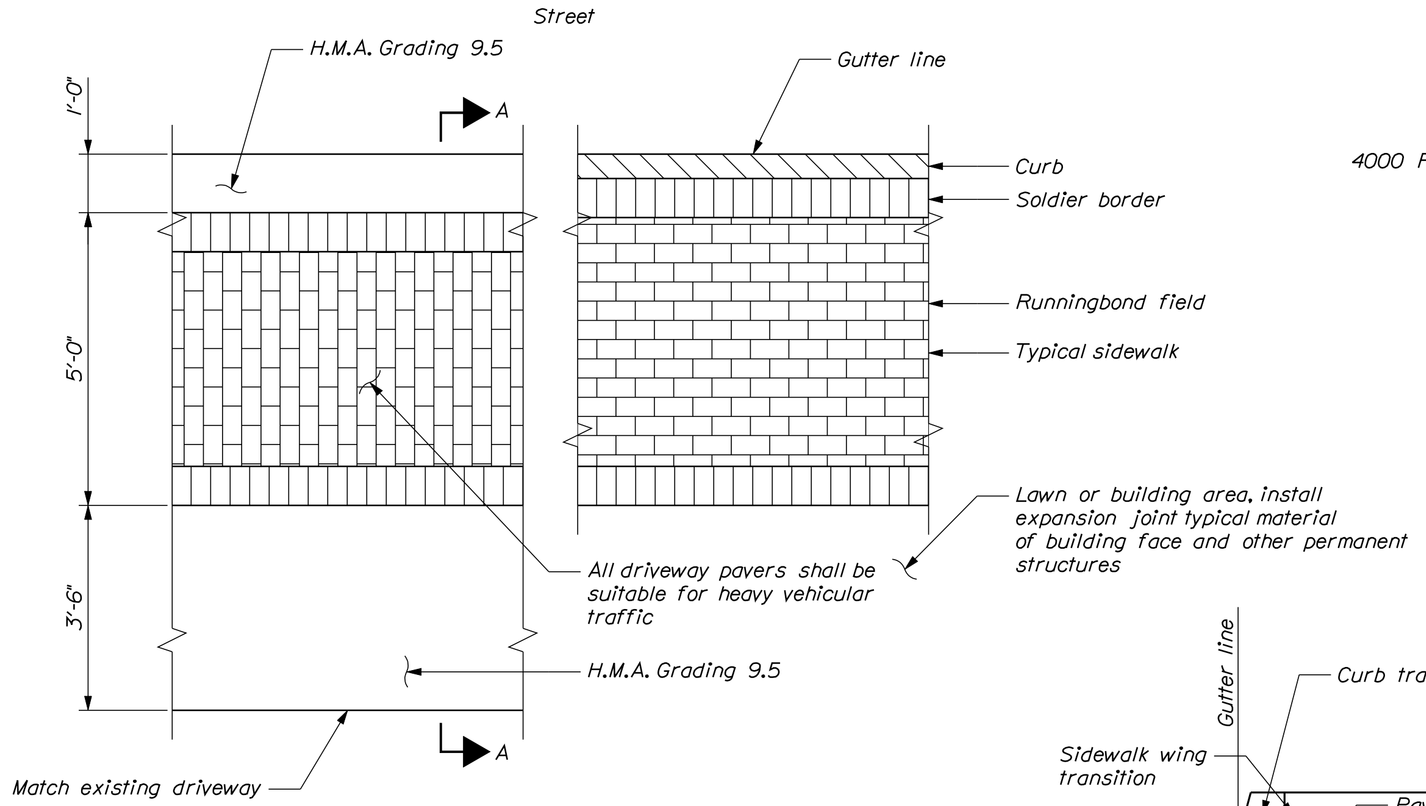
SHEET NUMBER

2

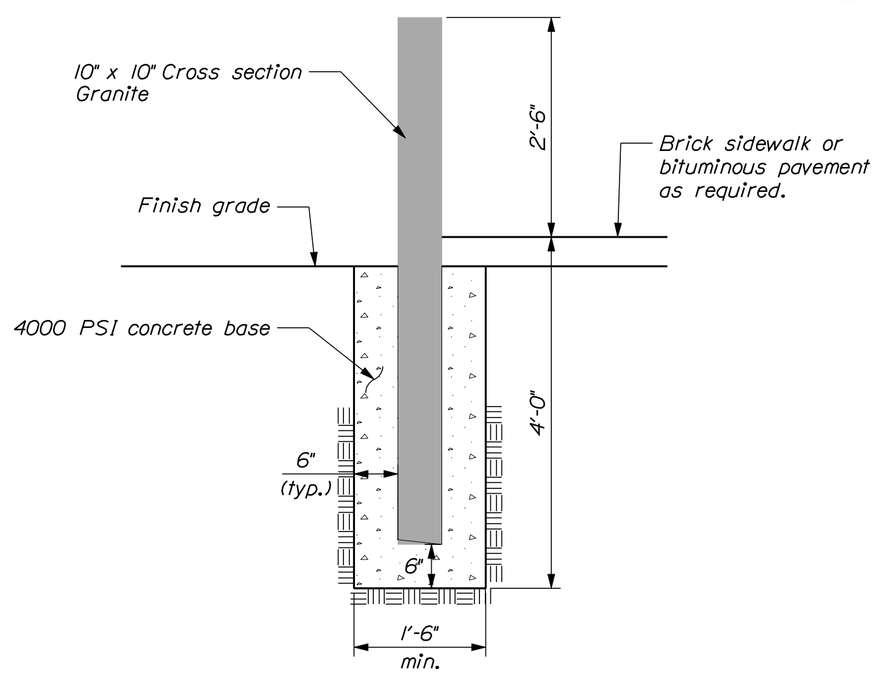
OF 48



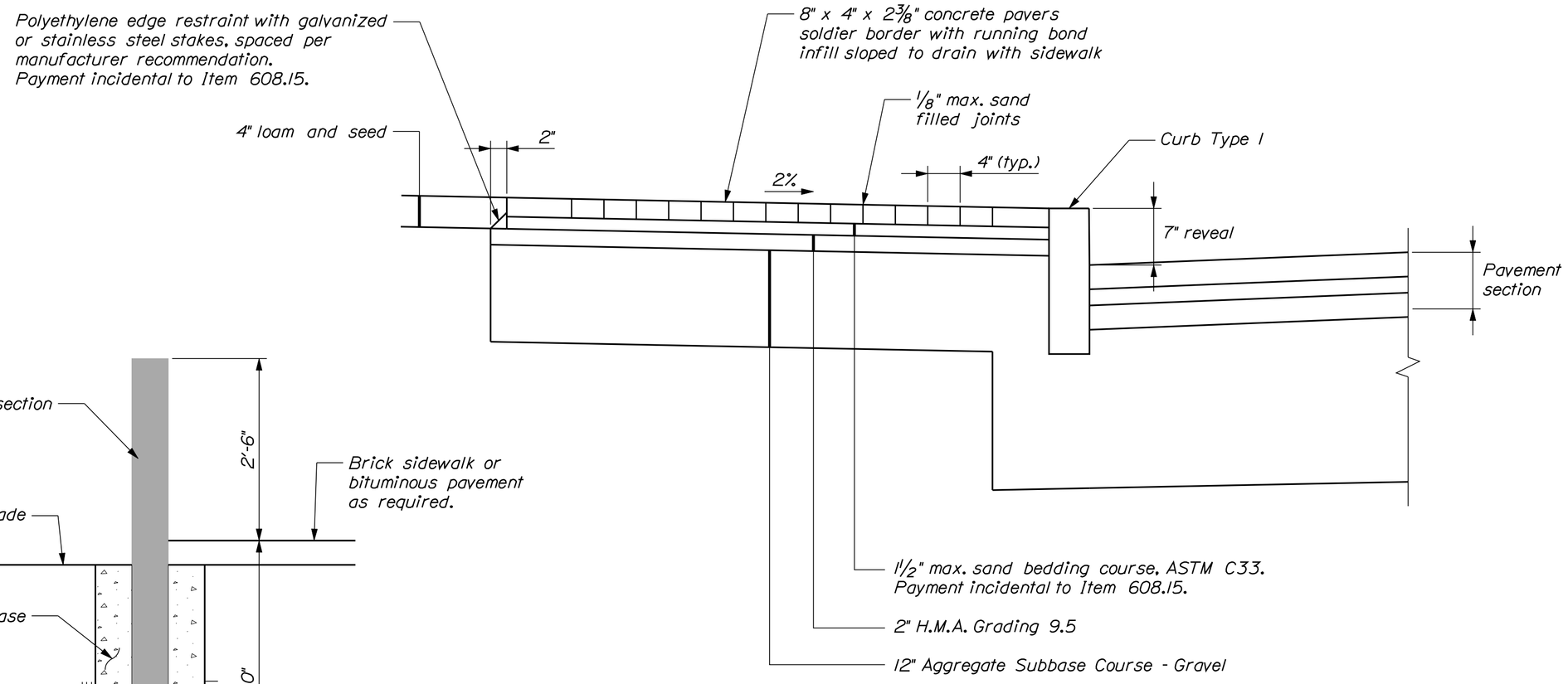
SECTION A-A
N.T.S.



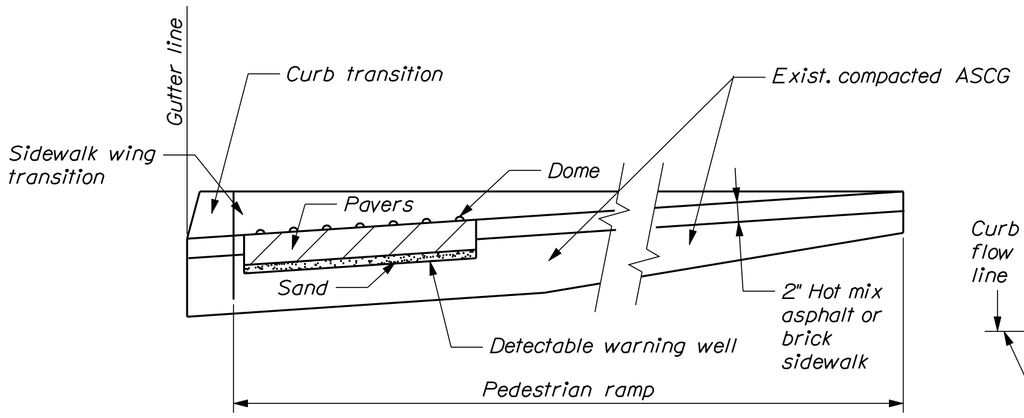
BRICK SIDEWALK DRIVEWAY CROSSING
N.T.S.



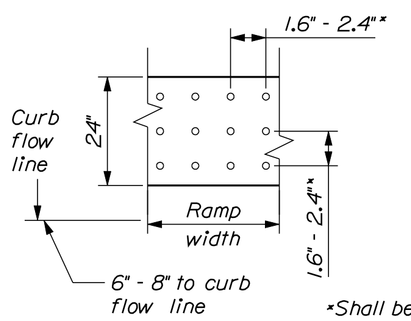
GRANITE BOLLARD
N.T.S.



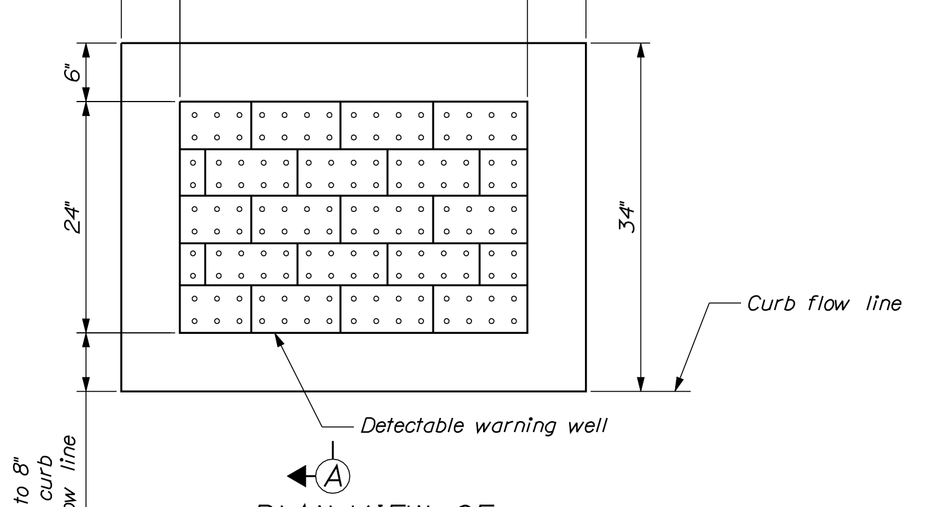
BRICK SIDEWALK TYPICAL SECTION
N.T.S.



SIDE SECTION VIEW OF DETECTABLE WARNING, WELL, CURB, AND GUTTER



PLAN VIEW



PLAN VIEW OF DETECTABLE WARNING AND WELL

BRICK SIDEWALK NOTES:
1. Brick sidewalks shall be Concrete Harborline Brick of Cumberland Blend color placed in a running bond with soldier border pattern.

2. Brick sidewalks within driveways shall be Concrete Hollandstone suitable for heavy vehicular traffic of Cumberland Bond color placed in a running bond with soldier border pattern rotated 90° from sidewalks.

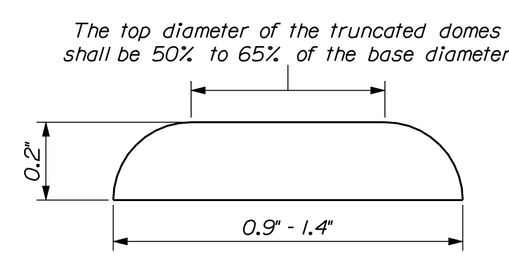
3. Finishes for paving stone:
   Top: Thermal
   Sides: Sawn
   Pencil round top outside edges abutting concrete pavers.

4. Brick sidewalk patterns to match Town of Kennebunk Main Street Reconstruction Project. Coordinate with Resident and Town.

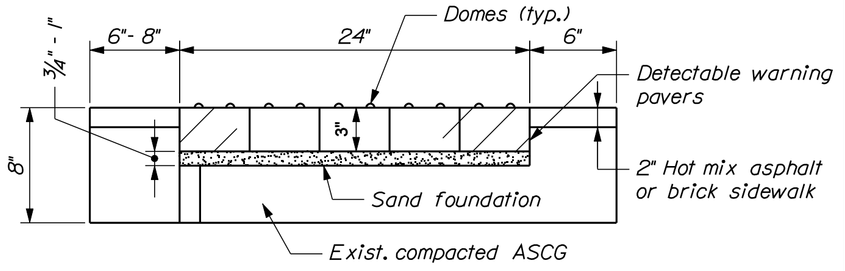
NOTE:
1. All detectable warning areas shall start 6" from the flow line of the curb and be 24" in depth and cover the complete width of the ramp area only.

2. Detectable warnings required at street crossings & intersections.

3. See Special Provision 608, Masonry Paver With Truncated Dome, for construction requirements.



ELEVATION VIEW



SECTION A-A

DETECTABLE WARNING DETAILS
N.T.S.

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION
BH-1509(800)X
PIN 15098.00
BRIDGE NO. 2431
BRIDGE PLANS

PROJ. MANAGER	$PROJMANAGER	BY	DATE	
DESIGN-DETAILED	RWH	MPC	07/10	
CHECKED-REVIEWED	RWH	DGE	07/10	SIGNATURE
DESIGN2-DETAILED2	$designer2$	$detailer2$	$proj date2$	
DESIGN3-DETAILED3	$designer3$	$detailer3$	$proj date3$	P.E. NUMBER
REVISIONS 1	------		$revdate1$	
REVISIONS 2	------		$revdate2$	
REVISIONS 3	$revision3$		$revdate3$	DATE
REVISIONS 4	$revision4$		$revdate4$	
FIELD CHANGES	$fieldchange$		$fielddate$	

KENNEBUNK BRIDGE
MOUSAM RIVER
KENNEBUNK YORK COUNTY

SPECIAL DETAILS

SHEET NUMBER
5
OF 48

Filename: REGION 1 Username: D.M.Hanks Date: July 2010

1 — TRUCK DETOUR AHEAD — 48" x 48"

2 — MAIN ST. / BRIDGE CLOSED / RTE 1 KENNEBUNK — 36" x 60" / 48" x 96" (Turnpike)

3 — ALL BUSINESS ACCESS OPEN — 18" x 36" / 30" x 60" (Turnpike)

4 — TRUCK DETOUR NORTH 1 — 18" x 24" / 12" x 24" / 24" x 24" / 15" x 21"

5 — TRUCK DETOUR NORTH 1

6 — TRUCK DETOUR NORTH 1

7 — TRUCK DETOUR NORTH 1

8 — END DETOUR NORTH 1

9 — TRUCK DETOUR SOUTH 1

10 — TRUCK DETOUR SOUTH 1

11 — TRUCK DETOUR SOUTH 1

12 — TRUCK DETOUR SOUTH 1

13 — END DETOUR SOUTH 1

14 — TRUCK DETOUR SOUTH 1

15 — TRUCK DETOUR SOUTH 1

16 — END DETOUR SOUTH 1 / NORTH 1

17 — TRUCK DETOUR TO SOUTH 1 SOUTH

18 — TRUCK DETOUR TO NORTH 1 95 USE NORTH

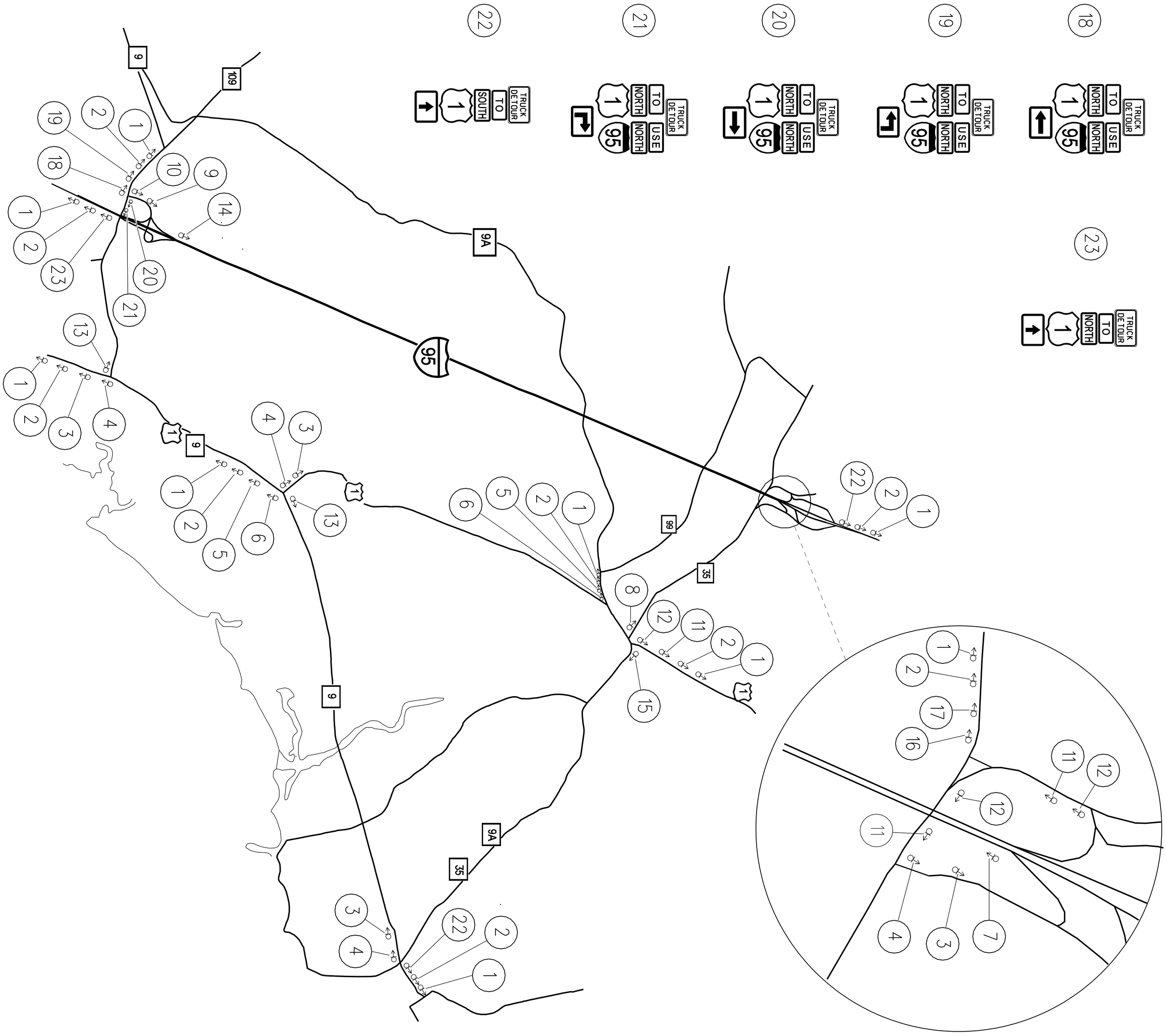
19 — TRUCK DETOUR TO NORTH 1 95 USE NORTH

20 — TRUCK DETOUR TO NORTH 1 95 USE NORTH

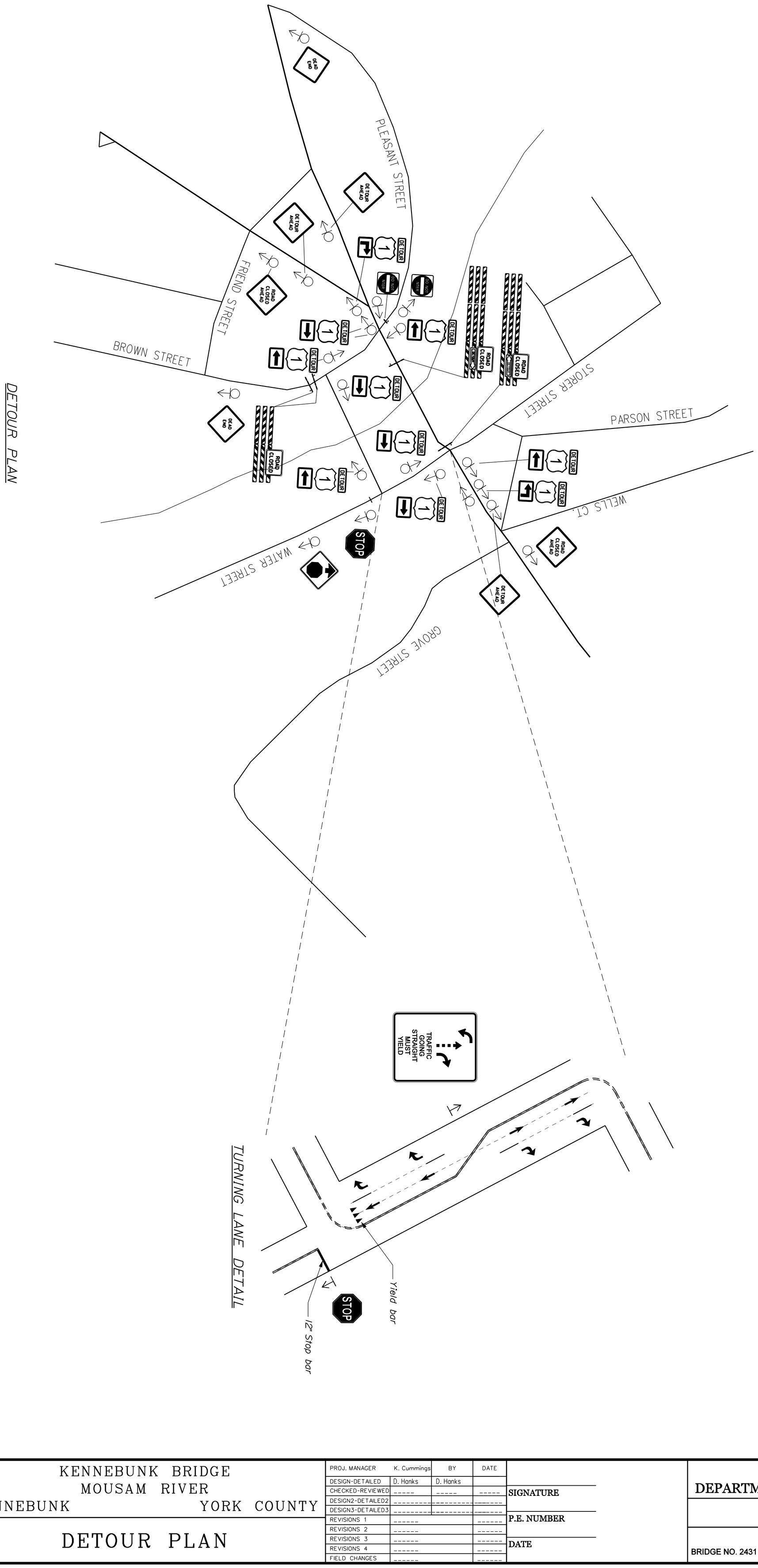
21 — TRUCK DETOUR TO NORTH 1 95 USE NORTH

22 — TRUCK DETOUR TO SOUTH 1

23 — TRUCK DETOUR TO NORTH 1



SHEET NUMBER	KENNEBUNK PIN 15098.00		STATE OF MAINE DEPARTMENT OF TRANSPORTATION
44 OF 48	TRUCK DETOUR PLAN	D. Hanks D. Hanks	BH-1509(800)X
			BRIDGE NO. 2431 PIN 15098.00 BRIDGE PLANS



DETOUR PLAN

DETOUR NOTES

1. The Contractor shall stripe double yellow centerline through the detour. The layout will be approved by the Resident.
2. The Contractor shall stripe stop bars, lane lines and arrows. The layout will be approved by the Resident.

SHEET NUMBER 45 OF 48

KENNEBUNK BRIDGE
MOUSAM RIVER
KENNEBUNK YORK COUNTY

DETOUR PLAN

PROJ. MANAGER	K. Cummings	BY	DATE
DESIGN-DETAILED	D. Hanks	D. Hanks	
CHECKED-REVIEWED	_____	_____	_____
DESIGN2-DETAILED2	_____	_____	_____
DESIGN3-DETAILED3	_____	_____	_____
REVISIONS 1	_____		_____
REVISIONS 2	_____		_____
REVISIONS 3	_____		_____
REVISIONS 4	_____		_____
FIELD CHANGES	_____		_____

SIGNATURE

P.E. NUMBER

DATE

STATE OF MAINE
DEPARTMENT OF TRANSPORTATION

BH-1509(800)X

BRIDGE NO. 2431 PIN 15098.00 BRIDGE PLANS

MEMORANDUM

TO: Laura Krusinski, P.E.
Maine Department of Transportation

COPY: Donald Ettinger, P.E.
HNTB Corporation

FROM: Andrew R. Blaisdell, P.E., Project Manager
Christopher L. Snow, P.E., Senior Project Manager
James V. Errico, P.E., Senior Principal
GZA GeoEnvironmental, Inc. (GZA)

DATE: August 24, 2010

FILE NO.: 09.0025597.10

SUBJECT: Summary of South Approach Sinkhole Issues
Kennebunk Bridge
Maine DOT PIN 15098.00
Kennebunk, Maine

This memorandum presents the results of GZA GeoEnvironmental's (GZA's) sinkhole evaluation work for the approach embankment southwest of the Kennebunk Bridge over the Mousam River in Kennebunk, Maine.

Our work was completed in accordance with contract GCA No. U1210060627, GZA Work Plan Dated March 30, 2010, Contract Modification 2 Work Plan, dated June 29, 2010, and the attached Limitations contained in Appendix A. GZA previously prepared a Final Geotechnical Design Report (GDR) for the project dated August 6, 2010.

This report was prepared by Jennifer R. Baron under the supervision of Andrew R. Blaisdell, P.E., and Christopher L. Snow, P.E.

BACKGROUND

The roadway along the northerly and southerly approaches to the existing bridge has a documented history of sinkhole formation and partial repair. GZA presented preliminary seepage considerations in Section 5.1 of our August 6, 2010 GDR. In GZA's opinion, the sinkholes have resulted from piping of granular materials within the embankment, likely combined with the deterioration and/or collapse of historic buried structures. Previous sinkholes have been repaired by filling the holes with granular material, grouting voids at depth, surficial compaction and replacement of pavement.

Observations have indicated that historical sinkholes in the northerly approach have been related to piping of granular soil through the existing stone masonry abutments and wingwalls. Therefore, it is expected that the new concrete abutment and wingwalls constructed with weep

holes and french drains will limit or remove the potential for future seepage issues and sinkholes at the northerly approach (northeast of the proposed Abutment 2). However, sinkholes have been documented at the southerly approach beyond the limits of the proposed bridge structure and associated excavation. Therefore, it is GZA's opinion that additional work is warranted during bridge construction to limit the potential for future sinkholes at the southerly approach.

GZA has compiled and reviewed the available information and collected additional geophysical data, as described herein. The contents of this memorandum represent the data collected and reviewed by GZA relevant to sinkhole development in the approach embankment south of the proposed Abutment 1 (herein referred to as South Approach). This information has been used by the design team to review the planned approach to seepage mitigation, as described on Sheet 2 of the Contract Documents (General Notes, Sluiceway Demolition).

AVAILABLE SINKHOLE INFORMATION

HISTORICAL DATA REVIEW

GZA completed a historical review of available data to develop an understanding of seepage and sinkhole issues and remediation efforts in the South Approach to estimate the location and extent of historic buried structures. A number of sources were used to develop the history and location information including: historical accounts; interviews with local officials; photographs; public records; and recent subsurface investigations. A summary of these findings is presented below and in the attached **Table 1** and **Figure 1**. Specific references for the collected information are presented in **Table 1**. Please note that the information presented in **Table 1** and **Figure 1** includes interpretation by GZA of records and accounts by others and is limited by the quality of the information used to develop the interpretations. Variations will exist between GZA's interpretations and the field conditions. The information used to develop **Table 1** is compiled in general chronological order in **Appendix B**, with Sanborn Fire Insurance Maps provided at the end of the appendix.

RELEVANT TEST BORINGS

A sequence of wood and voids was encountered between depths of about 11 and 20 feet in three of the borings drilled at the South Approach, including one boring drilled in 2010 under the direction of GZA (boring BB-KMR-301) and two borings drilled in 2004 under the direction of R.W. Gillespie and Associates (borings B2 and B5). Details of these drilling programs are presented in GZA's August 6, 2010 GDR. The approximate locations of borings B2 and B5 and surveyed as-drilled location of boring BB-KMR-301 are presented on **Figure 1**, and logs of these test borings are presented in **Appendix C**. Refer to the GDR for additional test boring data for the project.

PREVIOUS GEOPHYSICAL SURVEY

In 2004, the Town of Kennebunk hired NDT Corporation of Worcester, Massachusetts to complete a ground penetrating radar (GPR) survey to assess the presence and extent of soil settlement indicative of developing sinkholes. Additional details of the GPR survey are presented in GZA's August 6, 2010 GDR. A report of the 2004 NDT Corporation GPR survey is included in **Appendix D**.

CURRENT GEOPHYSICAL SURVEY

To further understand the existing conditions in the area surrounding the abandoned sluiceway, geophysical surveys were conducted at the South Approach to assess the extent of existing buried structures and other voids or irregularities in the embankment that could contribute to seepage issues. Both GPR and multichannel analysis of surface waves (MASW) methods were used in the survey. GPR data was collected along a series of traverses spaced one-foot apart, parallel to the roadway centerline. MASW data was collected along four traverses parallel to the roadway centerline, including two in each traffic lane.

Hager-Richter Geosciences, Inc. (H-R) of Salem, New Hampshire provided GPR and MASW survey services. Their work was completed on July 29 and 30, 2010. A report prepared by H-R containing the 2010 geophysical results is included in **Appendix E**.

RECENT SITE RECONNAISANCE

Following preliminary review of historical data, GZA conducted an on-site interview with Michael Claus, P.E., of the Kennebunk Public Works Department on June 29, 2010. Mr. Claus provided clarification on the timeline and location of sinkhole-related events that have occurred since 2004. The information provided by Mr. Claus is included in **Table 1**. During this reconnaissance, GZA observed approximately 6 inches of sag in the granite curb along the northwest side of Route 1, the approximate limits of which are shown on **Figure 1**. According to Mr. Claus, the curb was installed around 1960.

GZA also requested information regarding the existing dam from Kennebunk Light & Power District. The information provided (a recent inspection report) did not contribute to the seepage evaluation.

SUMMARY OF FINDINGS

GZA interpreted the historical and recent data identified in **Table 1** and **Figure 1** and contained in the appendices to generate the following summary of findings.

- An abandoned sluiceway is located west of Abutment 1. The sluiceway, constructed around 1850, is believed to have been 14 feet wide by 6 feet deep.
- Three test borings have encountered sequences of wood and voids at depth intervals that coincide with historical accounts of the abandoned sluiceway. The bottom of the sluiceway was apparently encountered between 18 and 20 feet below the existing ground surface in the test borings. Some portions may be shallower or deeper within the roadway alignment. The distance between encountered wood layers and/or thickness of apparent voids supports a 6-foot high sluiceway.
- Based on the available data, the 14-foot wide sluiceway was most likely located within the area bounded by Sta. 14+25 to 14+51 at 25’ Lt. and Sta. 14+37 to 14+60 at 26’ Rt. In GZA’s opinion, the practical limits of removal are from 25’ Lt. to 26’ Rt. These plan limits are shown on **Figure 1**.
- The sluiceway was reportedly filled in 1929. No additional information regarding the fill material or the extent of sluiceway filled is available.
- Groundwater seepage flow from the upstream dam or other up-gradient areas is believed to be one of the factors that has influenced the loss of ground and sinkhole formation.

Subsurface stormwater flow from abandoned utilities has also likely contributed to the piping.

- A number of sinkhole related remediation activities have been documented in the area, including the construction of a concrete wall to cut off upstream end of the sluiceway from the river in 1936, plugging and/or removing abandoned utilities and rerouting drainage along Brown Street in 2004 and 2005, and numerous efforts to repair sinkholes in and around the South Approach spanning from 1940 through 2006. The most recent remediation effort included drilling holes through the top of the sluiceway and pumping about 40 to 50 cubic yards of flowable fill in 2006. Significant events and subsequent repairs are further documented in **Table 1** and shown on **Figure 1**. The repeated occurrence of sinkholes and settlement issues indicate that past repair efforts may not have been successful in remediating the sinkhole potential. In addition, field notes and photographs from the 2004 and 2005 sinkhole repair efforts indicate that voids have been left in the approach fill where utilities were undermined.
- Data generated from the geophysical survey in 2004 do not identify likely sluiceway limits. However, the GPR results were indicative of settlement or filled sinkholes in the vicinity of the sluiceway. These areas are identified on **Figure 1**.
- Data from the 2010 GPR geophysical work was unable to provide data below depths of 3 to 10 feet due to limited signal penetration. The 2010 MASW results indicated persistent areas of low shear wave velocity material (anticipated loose soil) between depths of about 6 and 14 feet in the expected vicinity of the sluiceway. It is believed that the shear wave velocity of the sluiceway materials may not have contrasted enough with the low velocity material between depths of 6 and 14 feet to be detected. Therefore, the sluiceway limits could not be inferred from the recent geophysical data, and the historical information summarized above was judged to be the best available to estimate the probable sluiceway limits.

RECOMMENDATIONS

GZA considered several alternatives to mitigate the sinkhole potential, including overexcavation and replacement (as presented in Contract Documents), grouting to fill voids and/or densify loose soil, and partial excavation and replacement. It is GZA's opinion that the available data do not adequately define the vertical and lateral extent of voids and abandoned structures such that a grouting or partial excavation option would be viable. Therefore, the potential effectiveness of these methods would be uncertain, and there would be potential for future seepage-related issues to occur. Therefore, it is GZA's opinion that the sluiceway demolition concept of overexcavation and replacement in the General Notes on Sheet 2 of the project documents is the most appropriate alternative.

We recommend that an Addendum be issued to the project documents to update the notes and pay items based on the information contained herein. The recommended modifications to include in the Addendum are listed below, with new note text underlined:

1. **Note 1** – Modify second and third sentences as follows: "The sluiceway <u>is</u> believed to <u>have been</u> 14 feet wide by 6 feet deep based on historical accounts<u>. The 14-foot wide sluiceway was most likely located within the area bounded by Sta. 14+25 to 14+51 at 25' Lt. and Sta. 14+37 to 14+60 at 26' Rt.</u> The bottom of the sluiceway is believed to be between 17 and <u>21</u> feet below the existing ground surface."

2. **Note 2** – Modify as follows: "For bid purposes, the sluiceway removal limits should be assumed to be a 14-foot wide area within the limits defined above, extending from 25' Lt. to 26' Rt. and from the ground surface to a depth of 21 feet. The removal may also include loose soil and/or voids adjacent to the sluiceway structure as defined by the Geotechnical Engineer."

3. **Note 3** – Add a second sentence as follows: "For bid purposes, assume 70-foot long temporary earth support structures will be installed at 25' Rt. and 25' Lt."

4. **Note 7** – Change current Note 7 to Note 8 and add the following: "Additional sinkhole information and recent geophysical data is presented in the geotechnical memorandum titled, "Summary of South Approach Sinkhole Issues, Kennebunk Bridge," dated August 24, 2010, which may be accessed at the MaineDOT web address."

CLOSURE

We trust this provides the required information. If you have any questions or require additional information, please feel free to contact Christopher Snow at (207) 358-5118.

Attachments: Table 1 – Summary of Available Historical Sinkhole Related Information
Figure 1 – Historical and Subsurface Data – Estimated Sluiceway and Sinkhole Locations
Appendix A – Limitations
Appendix B – Historical Sinkhole Data, Accounts and Photographs
Appendix C – Logs of Test Borings
Appendix D – 2004 Geophysical Investigation Report
Appendix E – 2010 Geophysical Investigation Report

P:\09 Jobs\0025500s\09.0025597.10\Report\Sinkholes\FINAL 25597.10 Hist Review Memo_r082410.docx

TABLE

Table 1 – Summary of Available Historical Sinkhole Related Information, South Approach
Kennebunk Bridge Over the Mousam River
MaineDOT PIN 15098.00

Date(s)[1]	Event[2]	Description/Comments
Historical Data / Early Records, 1942 and earlier		
1850 +/-	Flumes constructed[1, 14]	Per Gilpatric historical account, Mousam Manufacturing Co. was believed to have built a large head flume and two other flumes, 14' by 6' and 6'by 6' around the 1850s. They were constructed of oak timber planks and puddled between with blue clay, as described in the following quote from Gilpatric: "From the head flume there was another extending under the street in to the Mill Yard and nearly down to boiler room of the Griffin & Reed Mill. This was 14 ft wide and 6 ft high. A smaller one 6x6 ft carried the water to the wheel." Later accounts reference Leatheroid to have taken "about one-third of the basement [of the Griffin & Reed Mill]…in the corner of the boiler room a bleach room was built…" Bleach/Boiler room indicated on **Figure 1** for reference of flume orientation.
Unknown	Sketch from MaineDOT Archive[2]	The larger flume is closer to Brown St. intersection. An 8" water main is shown tying into the upstream end of the flume from the dam. The smaller flume near the river, just behind the abutment, meets roadway just south of the stone wingwall at southwest corner of bridge. Approximate flume locations identified from sketch and shown on **Figure 1** (30 foot tie from approximate end of west wing wall).
1929	Flume Filled[3]	Per hand-written notes, states 14' by 6' dimensions and construction details listed above. No additional details.
9/25/1936	Construct concrete wall to cut off flume[4]	State Highway Commission paid the town for construction of a concrete wall "to cut off the old flume that goes under the road and backfill." Indicates the dam wall will be extended to level of sidewalk and the lot will be graded. Property was purchased by Mr. Parsons.
7/12/40	Sinkhole (Newspaper)[5, 14]	Circular pit 16' deep, 8' by 12' at top, broader at bottom, created by a cave-in behind the Shell gas station (filling station shown on 1942 Sanborn map at corner of Brown Street and Route 1). Article references historical account by Gilpatric and 14' by 6' flume at location of cave-in.
1941-1942	Settlement issues[6, 14]	Penstock in not good condition, road has settled 6". Believed to be caused by leakage from catch basin pipes. Refers to 1935 filling of Parson's property (lot with the old Gilpatric homestead – shown on **Figure 1**) and says "Mr. Rogers did not want to do anything that would jeapordize his rights for flumes or shaft holes thru the bridge." Likely Mr. Rogers of Rogers Fibre Co. along west bank of river, directly south of the Griffin & Reed Mill, near the "lower dam", in 1926 Sanborn map (no longer shown on 1942 Sanborn map). 12/6/41 letter indicates Mr. Rogers no longer cares about these rights and would allow filling.

Table 1 – Summary of Available Historical Sinkhole Related Information, South Approach
Kennebunk Bridge Over the Mousam River
MaineDOT PIN 15098.00

Date(s)[1]	Event[2]	Description/Comments
Recent Sinkholes, 2004-2008		
9/24/04	Sinkhole 1 [7]	Uncovered broken 15" clay drain pipe section, water outlets through pipe in abutment. Backfilled the sinkhole excavation with bank run gravel, compacted with an excavator bucket. Voids under the water main were not completely filled to avoid damage to the main. Washout of base material appears to follow path of sluiceway. The sluiceway was not observed in the excavation.
9/27/04-9/30/04	Additional investigation of sinkhole by KPWD, MDOT	Could not account for outlet of the basin at Rt. 1 and Brown Street. Dye test indicates outflow through outcrop under bridge abutment on west side of Rt. 1. Transmitting locater line confirms clay drain pipe exposed in sinkhole investigation comes from Rt. 1/Brown Street basin. Estimated location shown on **Figure 1** based on description of the location from documentation for the 7/6/05 sinkhole.
10/6/04	NDT conducts GPR survey for sinkhole investigation[8]	Results in 10/11/04 report, document location of possible wooden sluiceway and clay drain pipe. GPR areas indicative of settlement or filled sinkholes shown on **Figure 1** (brown hatched areas).
10/18/04	RWG drills borings for sinkhole investigation	Results in 11/9/04 report, voids in B2 from 14 to 20' deep, wood and voids in B5 from 11 to 18' deep, potential wooden flume. Recommend remove/backfill flume and grout clay pipes.
2/1/05	Caswell structural assessment	Report describes anticipated staging challenges during flume removal, mostly associated with excavation support and additional loads on abutments. Concludes bridge would not be affected, but wingwall stability would require consideration.
3/05-4/05	Install new Brown St. drainage[9]	Installed to re-route drainage away from the abandoned clay pipe section in sinkhole. Documentation does not indicate whether clay pipe was removed or not. Drainage routed down Brown St. to a swale. KPWD placed a boot over the outlet from the catch basin at the corner of Brown Street and Route 1 to the abandoned clay pipe during this work. Approximate location of new drainage shown on **Figure 1** (green hatched area along Brown Street).

Table 1 – Summary of Available Historical Sinkhole Related Information, South Approach
Kennebunk Bridge Over the Mousam River
MaineDOT PIN 15098.00

Date(s)[1]	Event[2]	Description/Comments
7/6/05	Sinkhole 2 [10]	About 4' deep, 6' by 6' in plan, within previous pavement patch area. Found intersection of clay pipes, removed and sealed pipes in all directions with brick and mortar. Cavities observed in area of water main were not excavated or filled. The utility duct bank in Route 1-SB was undermined with active seepage, S to N, at the time of excavation. KPWD backfilled/compacted. The top of a concrete wall was exposed upstream from the sidewalk in the excavation. Photos taken of sinkhole repair looking north from Cumberland Farms parking lot show offset at the north edge of the pavement patch from 9/04 relative to original pavement (indicates possible general subsidence). Photos taken of pipe interior show short clay tile pipe sections with cracks and soil infilling.
2005 +/-	Sinkhole behind Cumberland Farms[11]	Sinkhole repaired by excavating 8' by 8' area to 11' depth, placing flowable fill in open excavation below 11', and filling upper portion with granular fill.
10/19/06	Hascall & Hall letter, solicited by KPWD (Mike Claus)[12]	Propose to bore holes in road and pump flowable fill, leave casing in place and patch road on 11/6/06-11/8/06. No reference to tie limits of work – sketch indicates hydrant with no other features.
11/6/06-11/8/06	Grouting in area of Sinkhole 2 [1, 13]	Northern Test Boring drilled 4 holes for grouting, 2 in NB lane and 2 in SB lane. Encountered wood at 12' in SB lane (upstream), 15' in NB lane (downstream), installed casing to extend below wood layer. Hascall & Hall placed concrete fill in SB holes first, noted concrete fill in NB holes during process, then completely filled holes in NB side. Recent correspondence with Mike Claus, KPWD, indicates expected grout flowable fill volume was 110 cy, actual volume placed was 40 to 50 cy.

Notes:

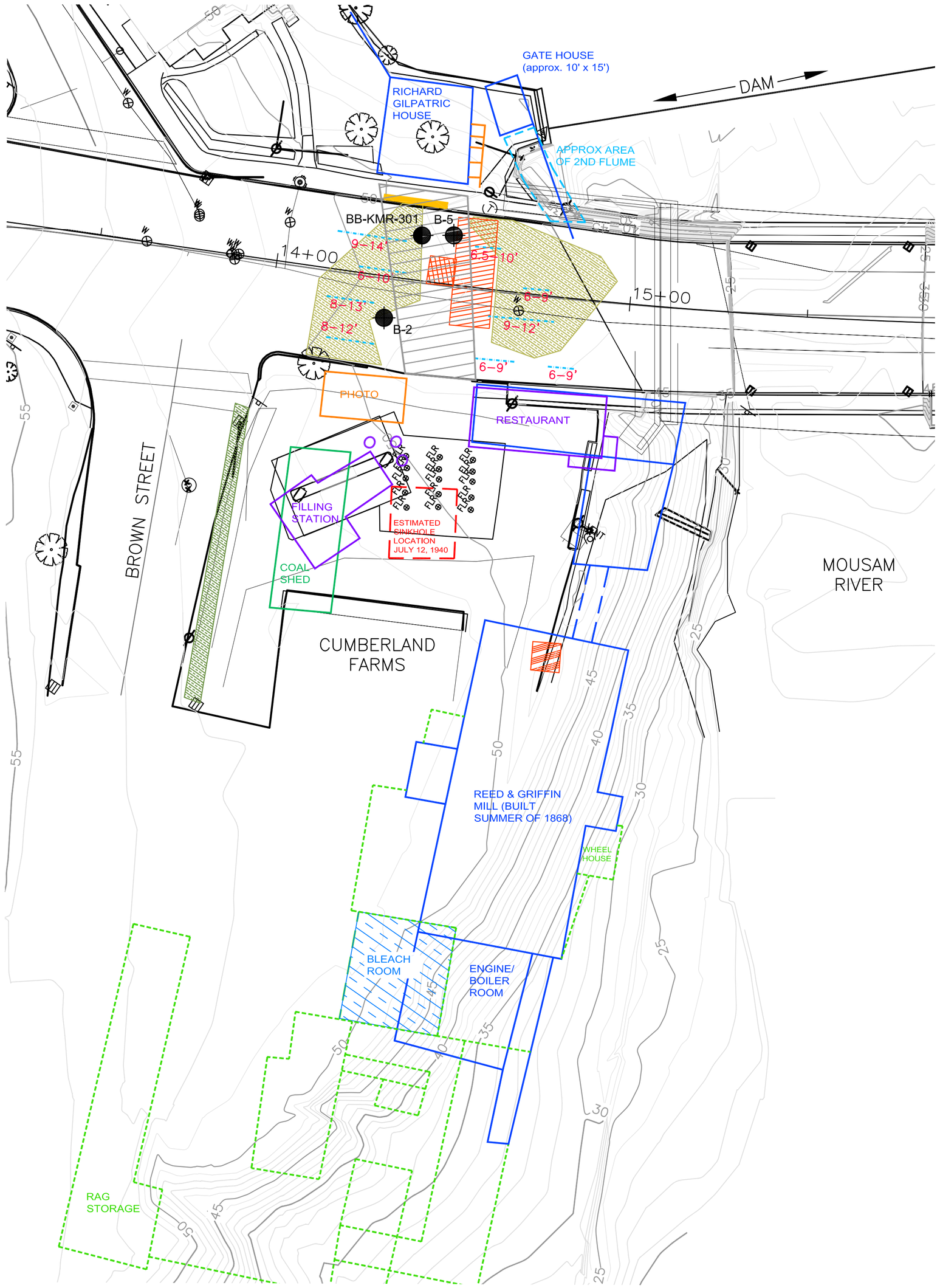
1. Dates provided for vents are based on information from attached references.
2. Superscript numbering for events indicates the reference(s) used to develop information.

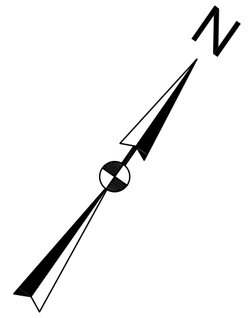
Table 1 – Summary of Available Historical Sinkhole Related Information, South Approach
Kennebunk Bridge Over the Mousam River
MaineDOT PIN 15098.00

Cited References:

1. Gilpatric, George A. The Village of Kennebunk, Maine. Kennebunk, Maine: The Star Print, Inc., 1935.
2. Undated sketch from the Maine DOT archives, provided by Mike Claus (Kennebunk Public Works Department; KPWD).
3. Hand written notes, page 33, provided by Mike Claus (KPWD).
4. State Highway Commission official letter to Mr. Max Wilder, Bridge Engineer, Augusta, Maine, dated September 25, 1936.
5. "Cave-In of Old Flume in Mill Yard." Kennebunk Star. July 12, 1940. Follow-up articles published August 30, 1940 and December 20, 1940.
6. Official correspondence between H.L. Greenleaf (State Highway Commission) and Max Wilder (Bridge Engineer) regarding the request to close the drain on the bridge that allows for water to flow into restaurant property. Copies of letters between the two parties dated November 18, 1941, November 19, 1941, November 27, 1941, December 6, 1941, and August 10, 1942.
7. Email and photo documentation of sinkhole and repair efforts between Karen Gross (Maine DOT), Marc Guimont (Maine DOT), and Mike Claus (KPWD) provided by Mike Claus (KPWD).
8. NDT Corporation. GPR Sinkhole Investigation, US RT 1, Kennebunk, Maine, prepared for Kennebunk Public Works, October 11, 2004. (Appendix D of this report).
9. Photo documentation of drainage installation provided by Mike Claus (KPWD).
10. Email and photo documentation of sinkhole between Mike Claus (KPWD), Marc Guimont (Maine DOT), and others provided by Mike Claus (KPWD).
11. Details of sinkhole event provided during interview and site walk with Mike Claus (KPWD) and Andy Blaisdell (GZA) on June 29, 2010.
12. Hascall & Hall letter to Mike Claus (KPWD), dated October 19, 2006. Copy provided by Mike Claus (KPWD).
13. Photo documentation of sinkhole repair provided by Mike Claus (KPWD). Project Costs Worksheet for repair, dated March 23, 2007 and authorized by Mike Claus (KPWD) provided by Mike Claus (KPWD). Copies of field note documentation for sinkhole repair, dated November 6 through November 8, 2006 provided by Mike Claus (KPWD).
14. Historic Fire Insurance Maps, Sanborn Maps collections for Kennebunk, Maine dated 1885, 1891, 1895, 1901, 1906, 1911, 1926, 1942, and 1962.

FIGURE





HISTORIC INFORMATION LEGEND:

- STRUCTURES IDENTIFIED FROM 1885 SANBORN FIRE INSURANCE MAP (REED & GRIFFIN MILL, RICHARD GILPATRIC HOUSE, & GATE HOUSE)
- STRUCTURES IDENTIFIED FROM 1891 SANBORN FIRE INSURANCE MAP (COAL SHED)
- STRUCTURES IDENTIFIED FROM 1895 SANBORN FIRE INSURANCE MAP (PHOTO SHOP, STAIRWAY AT GILPATRIC HOUSE)
- ADDITIONS TO MILL IDENTIFIED FROM 1901 SANBORN FIRE INSURANCE MAP
- MILL BLEACH ROOM IDENTIFIED FROM 1911 SANBORN FIRE INSURANCE MAP (PROBABLE HISTORICAL SLUICEWAY OUTLET)
- STRUCTURES IDENTIFIED FROM 1942 SANBORN FIRE INSURANCE MAP (FILLING STATION AND RESTAURANT)
- INTERPRETED LIMITS OF NEW GRAVITY STORM DRAIN INSTALLED IN 2005 (TO REROUTE DRAIN THAT PREVIOUSLY OUTLETTED IN THE SINKHOLE AREA)
- INTERPRETED LIMITS OF SEPTEMBER 24, 2004 SINKHOLE AND FILLING
- INTERPRETED LIMITS OF JULY 6, 2005 SINKHOLE AND FILLING
- INTERPRETED LIMITS OF 2005 SINKHOLE EAST OF CUMBERLAND FARMS
- APPROXIMATE LIMITS OF SETTLED STREET CURB (DOCUMENTED BY GZA JULY 2010)
- B-2 — BORING LOCATIONS WHERE WOOD AND/OR POTENTIAL VOIDS WERE ENCOUNTERED
- INTERPRETED LIMITS OF SETTLEMENT OR FILLED SINKHOLES (BASED ON NDT'S OCTOBER 2004 GPR SURVEY)
- 9–14' — INTERPRETED LIMITS AND DEPTH INTERVAL OF LOOSE MATERIAL (BASED ON HAGER–RICHTER'S 2010 MASW RESULTS)
- INTERPRETED LIMITS WHERE NORTH–SOUTH TRENDING, 14 FOOT WIDE SLUICEWAY WAS PROBABLY LOCATED

NOTES:

1) BASE MAP DEVELOPED FROM ELECTRONIC MICROSTATION FILES PROVIDED BY DONALD ETTINGER OF HNTB, TRANSMITTED VIA EMAIL ON MAY 24, 2010 AND JUNE 15, 2010 (FILES INCLUDED: 3DTOPO_10JUNE10.dgn, 001_PLAN.dgn, TOPO.dgn, ALIGNMENTS.dgn, APPROACH.dgn, CONTOURS.dgn, and 001_DETOURPLAN.dgn).

2) THE AS–DRILLED LOCATION OF BB–KMR–301 TEST BORING WAS DETERMINED BY MAINE DOT USING GPS EQUIPMENT.

3) THE LOCATION OF THE B–SERIES BORINGS WERE ESTIMATED USING A SITE PLAN IN THE R.W. GILLESPIE GEOTECHNICAL REPORT AND SHOULD BE CONSIDERED APPROXIMATE.

4) THE B–SERIES TEST BORINGS WERE DRILLED BY GREAT WORKS PUMP AND TEST BORING INC. OF BERWICK, MAINE ON OCTOBER 18, 2004.

5) THE BB–KMR–300 SERIES TEST BORINGS WERE PERFORMED BY MAINE TEST BORING OF BREWER, MAINE BETWEEN MAY 25, 2010 AND JUNE 8, 2010 AND OBSERVED BY GZA PERSONNEL.

6) INTERPRETATION OF HISTORICAL RECORDS AND ACCOUNTS BY OTHERS IS LIMITED BY THE QUALITY OF THE INFORMATION USED TO DEVELOP THE INTERPRETATIONS. VARIATIONS WILL EXIST BETWEEN GZA'S INTERPRETATIONS AND THE FIELD CONDITIONS.

7) GEOPHYSICAL DATA WAS COLLECTED ON OCTOBER 6, 2004 BY NDT CORPORATION OF WORCESTER, MASSACHUSETTS USING GPR AND ON JULY 29 AND 30, 2010 BY HAGER–RICHTER GEOSCIENCES, INC OF SALEM, NEW HAMPSHIRE USING GPR AND MASW.

8) THE GEOPHYSICAL DATA IS BASED ON INTERPRETATIONS BY NDT CORPORATION PRESENTED IN A REPORT DATED OCTOBER 11, 2004 (SEE APPENDIX D) AND BY HAGER–RICHTER GEOSCIENCES IN A REPORT DATED AUGUST 20, 2010 (SEE APPENDIX E).

0 10 20 40 60
SCALE IN FEET

NO.	ISSUE/DESCRIPTION	BY	DATE

KENNEBUNK BRIDGE REPLACEMENT

KENNEBUNK, MAINE

HISTORICAL AND SUBSURFACE DATA
ESTIMATED SLUICEWAY & SINKHOLE LOCATIONS

PREPARED BY:
GZA GeoEnvironmental, Inc.
Engineers and Scientists
4 FREE STREET
PORTLAND, MAINE 04101
(207) 879-9190

PREPARED FOR:
MAINE DEPARTMENT OF TRANSPORTATION

PROJ MGR: CLS	REVIEWED BY: ARB	CHECKED BY: JVE	FIGURE 1
DESIGNED BY: ARB	DRAWN BY: JRB	SCALE: 1"=20'	
DATE AUGUST 2010	PROJECT NO. 09.0025597.10	REVISION NO.	SHEET NO.

APPENDIX A

LIMITATIONS

LIMITATIONS

Explorations

1. The analyses and recommendations in this report are based in part upon the data obtained from subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretations of widely spaced explorations and samples; actual soil transitions are probably more erratic. For specific information, refer to the boring logs.

3. Water level readings have been made in the drill holes at times and under conditions stated on the boring logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors occurring since the time measurements were made.

Review

4. In the event that any changes in the nature, design, or location of the proposed structures are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of this report modified or verified in writing by GZA GeoEnvironmental, Inc. It is recommended that this firm be provided the opportunity for a general review of final design and specifications in order that earthwork and foundation recommendations may be properly interpreted and implemented in the design and specifications.

Construction

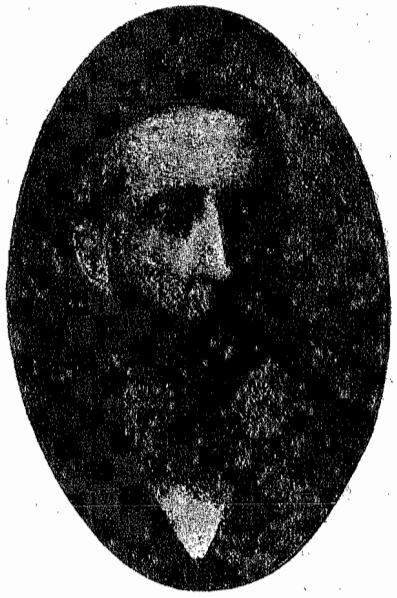
5. It is recommended that this firm be retained to provide soil engineering services during construction of the excavation and foundation phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to start of construction.

Use of Report

6. This soil and foundation engineering report has been prepared for this project by GZA GeoEnvironmental, Inc. This report is for design purposes only and is not sufficient to prepare an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to design considerations only.

7. This report has been prepared for this project by GZA GeoEnvironmental, Inc. for the exclusive use of the Maine Department of Transportation and their project team for specific application to the Kennebunk Bridge over the Mousam River in Kennebunk, Maine in accordance with generally accepted soil and foundation engineering practices. No Warranty, express or implied, is made.

APPENDIX B –HISTORICAL SINKHOLE DATA, ACCOUNTS AND PHOTOGRAPHS



George A. Gilpatric

The Village of Kennebunk, Maine

Interesting Facts from
old documents and
maps, and
Observations
by the author,

George A. Gilpatric

The STAR PRINT, Inc.
PRINTERS PUBLISHERS

1935

THE BRICK STORE MUSEUM
KENNEBUNK, MAINE

CHAPTER FIVE

MANUFACTURING AND MILLS 1670-1888

The first dam and saw mill at Kennebunk was built in 1670, at what was known at one time as Emerson's Falls, a little above the present Sayward Street. It was built by Henry Sayward. This mill and other buildings were destroyed by the Indians in 1688, and for 40 years it was again a wilderness. In 1730 a new dam and mill was built on the old site. The raceway from the wheel used to be called the gut and extended nearly to the present dam. Reference is made to a mill which had not been operated since the freshet of 1708, being rebuilt in 1750, but we are told that the great freshet of 1755 destroyed every dam and bridge on the river. In 1759 a dam was built on the site of the present uppper dam. It was probably owned by Col. Joseph Storer or he had a controling interest in it, as a few years later he had a saw mill there. There does not seem to be any record of when the first dam was built on the site of the present lower dam. There is a record of Iron Works at the western end of the lower dam in the early 1770's. The Chapter "Kennebunk in 1790" says that there were iron factories then. There was a mill at the eastern end which with additions became the Mayal Mill, then the machine shop of the Mousam Manf. Co. and it was destroyed by fire in 1840. Maj. Wm. Jefferds had a Fulling or Cloth Mill on the western side in 1790 and probably many years after. Richard Gilpatric also had a Grist Mill at the western end of the lower dam. Edmund Pierson removed his Tan Yard here in 1811 from Curtis Lane. He built the buildings afterwards used by George Leach as a machine shop and by John H. Ferguson & Co. Planing, Sash, Blind and Door Manf.

There was a dam, Grist Mill and Iron Works at the head of tide water in 1770. The dam was destroyed by the freshet of 1785. A part of the lower dam Iron Works was removed soon after 1800 to the intersection of York and High Streets and was the blacksmith shop of Dimon Gilpatric. One of the Jefferds buildings was removed to Pleasant Street.

Kennebunk Manufacturing Company

In 1825 a Company was formed and incorporated as the Kennebunk Manf. Co., who bought all of the property on both dams, also of Enoch Storer 60 acres of woodland and 25 acres of grass and pasture land, on the east side of the river (the old Factory Pasture), and of Richard Gilpatric his homestead (the old boarding house), and 30 acres or more of grass and pasture land on the west side including both sides of what is now Brown Street.

They also purchased a controlling interest of the shares of the Cat Mousam Saw Mill and probably the Old or Fluellen Falls property. They began to make preparations to build a large cotton factory. They built a new upper dam in 1825 and it was built 26 inches higher than the one it replaced. The flowage damages were $1,800.00, the largest amount being at the Parson Fletcher farm. Aaron Littlefield was master carpenter. This company did not prosper and all of the property was sold at auction Nov. 10 and Dec. 1, 1828. When the property was advertised for sale mention was made of two dams nearly new, which would indicate that a second dam had been built at the lower pond.

When the Leatherboard Co. built their dam in 1876 no record could be found of when the old dam was built. It was old and rotten but judging from the time other dams have lasted, it does not seem probable that it was a hundred years old. The dam of 1876, like the one it replaced, was built straight to the eastern bank with head gates to a flume by the side of the river to the Leatherboard Mill. In 1895 a stone bulkhead was built a little farther down the river and a wing dam built, the head gates being in the bulkhead. The wing dam was replaced in 1907 and there was a new lower dam built in 1919. The sale of the property in 1828 did not realize enough to pay their debts.

Mousam Manufacturing Company

In the spring of 1832 a company was formed and the Counting Room built (1832). A Cotton Mill was built, date not given. A charter was granted by the State of Maine, approved Feb. 22, 1834, for the purpose of Manufacturing Iron and Steel, Cotton and Woolen Goods; to purchase Real and Personal Property not to exceed $100,000.00. Jonathan Fiske was chosen Agent. In addition to operating the Cotton Mill they built what was known as the Old Factory Barn on Water Street and carried on an extensive farm business. They probably did their own teaming as their cotton would naturally come by coaster to Kennebunkport. They either operated or leased the Saw Mill on the eastern end of the upper dam until 1843 when they voted to take it down and build a new one on the site of the machine shop burned in 1840; also to locate a street through the Gilpatric field. In 1847 they voted that the Town may take Brown Street and continue it to the Sea Road if they will keep it in repair. I do not find any record of any building on the site of the saw mill of Joseph Storer. I know that Oliver Littlefield had a Planing, Sash, Blind and Door Mill there before 1850. He bought the first wood planer in Town in 1844 and must have had a mill of some kind to put it in. I do not find any record of the use that Mousam

Mfg. Co. made of the Pierson buildings. I am wondering if the machinery of Littlefield was not removed there about 1851 and either operated by him or sold to J. H. Ferguson & Co.

The Mousam Manf. Co. made many changes on the river bank. A wall of split stone was built the entire length of their plant and around the lower dam wheel pit, west side of the river. This company probably built the large and expensive flume at the western end of the upper dam. There was a bank wall above the dam, and a large head chamber, a flume nearly the size of the building now at the end of the dam. The bottom was as low as the river bottom. There were four large head gates with rack above. From this head flume there was another extending under the street in to the Mill Yard and nearly down to boiler room of the Griffin and Reed Mill. This was 14 ft. wide and 6 ft. high. A smaller one 6x6 ft. carried the water to the wheel. These flumes were of oak timber planked both sides and puddled between with blue clay. There were also logs with 2 in. holes bored through for drainage in the yard. The Richard Gilpatric house was converted into two tenements.

In March, 1850, an agreement was made with Capt. Wm. Lord, Jr., to increase the capital stock and enlarge the business, which probably meant new buildings or additions. April 5, 1850, the factory, machinery and stock in the factory were destroyed by fire.

Warp Mill

In 1851 the record says that machinery was put in the Sash and Blind Factory of Oliver Littlefield and a company formed called the Warp Mill, to spin cotton yarn, John Cobby, manager. This was in operation several years, probably leasing building and power from the Mousam Manf. Co. June 29, 1854, voted to sell all of the property, real and personal, to Mr. Wm. Lord for $25,000.00 and that the Treasurer pay the debts and divide the property. From this time until 1865 all that was doing at the upper dam was the Grist Mill operated either by Sam'l Kimball, A. F. Wormwood or Johnson Webber. The Warp Mill was closed and there was nothing in the old Counting Room.

At the lower dam Sam'l Clark was operating the Saw Mill most of the time. In the Pierson buildings George Leach had a machine shop and J. H. Ferguson & Co. a Planing, Sash, Blind and Door manufactory. Dec. 22, 1863, all of this property was sold to Capt. N. L. Thompson, Joseph Dane and Joseph Titcomb, for $31,000.00. I do not know how long it had three owners. I think not long.

story, about 100x50 ft.; a brick boiler house and ell extending from the lower back corner across the canal, and a water wheel installed; machine shop, dry and lumber house about same size as the mill, one-story, flat roof—later a pitch roof was put on and about 1907 a secnod and third story added. The mill was built by Capt. F. K. Small. The machinery was moved from the Griffin Mill and the new mill started Oct. 1, 1885, leaving the west side of the river for about ten years during which time a large number of trunks, cans, boxes, cars, cases and other goods were manufactured.

The Island plant was enlarged, the ice house built and a deep well, 200 ft. deep, to get cold water for soaking sheets. The Long building was erected in 1894, 400 ft. long, with tank nearly the whole length. In 1910 an ice pond was excavated on the island, approximately 400x150 feet, ice tools bought and the houses filled in the winter of 1910-11, and have been since. Before that it came from the upper pond.

During this time the company had bought or obtained control of the Grist Mill and Colvin Mill and with one-fifth of the water power of the upper dam. The flat roofed building was sold to John H. Ferguson who excavated a basement room about 1885. There was a machine shop in the lower end of the basement. A laundry was started in the basement and upper end in 1886. The lower end was the Eastern Star Printing Office, 1888 to 1929. The Reed & Griffin Mill with two-fifths of the water power was also acquired before 1896. This mill was used by the Kennebunk Manf. Co. making leatherboard lunch boxes and extension cases from about 1892 to 1906.

In the early spring of 1896 the Leatheroid Co. began getting ready to make paper. They took about one-half of the basement of the Reed & Griffin Mill, excavated below the floor for stock chest, installed a beating engine, built a one-story paper machine room in line with the back side of the mill about 100x25 ft., installed a paper machine with a store room farther down. In the corner of the boiler room a bleach room was built three stories high, and rag room on Brown Street with rag duster, cutters and benches for sorting rags. There was a bridge from this to the third story of the bleach room. This building was about 30x20 ft., afterward extended 20 and 30 and 20 ft., as the mill developed. A 75 h.p. engine was installed for more power—Jordan engine—to finish stock, and commenced making Island Paper from pure cotton rags. The wheel under the mill not proving of sufficient power, in the summer of 1897 a stone bulkhead was built into the river a little above the center of the mill, wheel pit excavated and a pair of twin wheels installed, right and left driving pulley in the center, and a flume built under the mill. A rope drive was installed, 800 ft. endless. This did not prove satisfactory and eight single ropes were used to drive the engine on grooved pulleys and a heavy tightener.

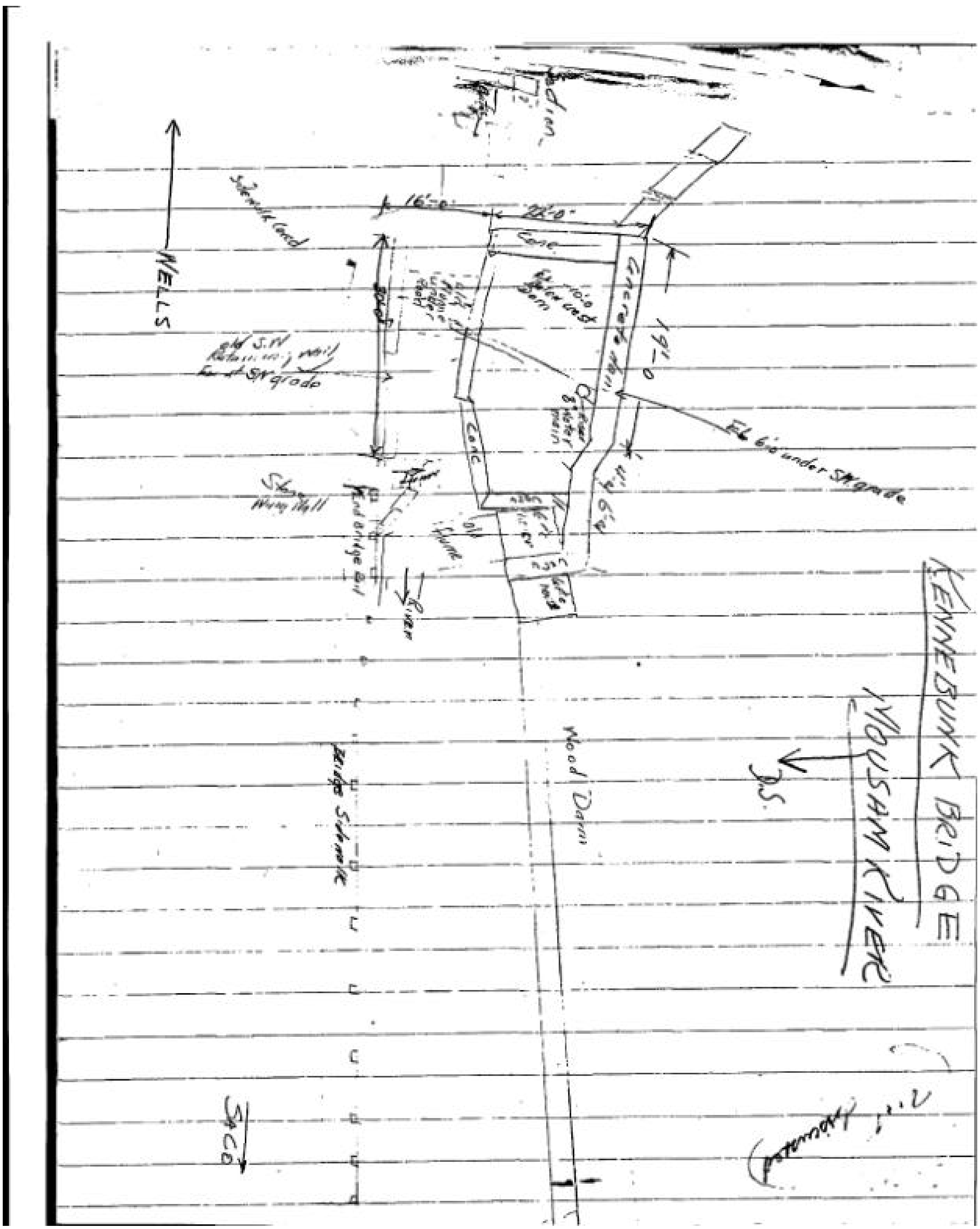
In the spring of 1898 the Dirigo Building was erected on about the site of the old Pierson Tannery Building. A Dirigo fibre machine was installed and tank built to soak sheets which were made by hydrochloride acid or zinc cloride process. The wheel at the western end of the lower dam being worthless, it was removed, the wheel pit enlarged and a Trump Turbine wheel installed in 1898. The shaft from this wheel was placed in line with the one already under the mill. The southwest corner of the mill was cut out and trussed, an extension built and No. 2 beater installed. Dirigo Paper made and commenced making Dirigo fibre. In 1889 a wheel pit was excavated at the upper end of the mill, a connection made with the big flume and another Trump Turbine installed. The crown gears of this wheel was placed upside down. The shaft was in line with the one already under the mill and was arranged to clutch together and form a continuous shaft to the lower wheel. One was driven from the upper dam and one from the lower using the water twice on the same shaft.

In 1900 a wheel pit was excavated above the bridge at the western end of the upper dam, another Trump Turbine installed and a tunnel for the shaft under Main Street to the mill was made. The wheel house was built with double walls to deaden the sound of the gears. No. 3 beater was installed this year in upper end of mill. In the spring of 1900 the Rag Stock house was built in the field in front of the office with trestle to walk to the coal trestle. Rags were wheeled to the top of the beams.

In December, 1900, a 200 h.p. engine was put in to replace the 75 h.p. previously used. A 14-ft. wheel drove to a sleeve on the main shaft with clutch to connect. Boilers were installed at different times making four in all with forced draft. Many changes were made in the buildings from 1900 to 1920. Dirigo department was extended and more tanks built, dry room for sheets, and thin sheets dried on frames, and canoes made.

After the Electric Road was extended to York in 1906 a track was built into the Paper Mill yard, a coal trestle built and coal and rags delivered in the yard. After the Lunch Box Co. vacated the rag department was moved from Water Street and rags were sorted, cut and carried to the bleach from the third story and the Brown Street rag room used for storage of rags.

The first crossing below the lower dam was by footbridge



Sketch from MaineDOT maintenance files
Note flume references

In the fall of 1867 A Mill was built below the first Mill by a Joint Stock Co. of Lacon It was used for spinning Cotton Yarn later owned by R. H. Colvin and after that called Colvin Mill burned in Shoe Shop Fire

In the Summer of 1868 a Mill was built on or near the site of the Cotton Mill burned Apr. 5-1858 - The site had been vacant from the time of the fire 87'x42' - 3 Story 2 Story Pitch Roof Brick Boiler room between This was leased to Griffin & Reed - The Union Lace Co - Manf. Shoe Laces & Shoe Strings

The Lace Co removed to Lake Village N. H. in 1878

Building used as a Shoe Shop 1881-2 by the Leathern & Skating Rink 1883-4 Means Felt Boots 1886 - Leatherboard Lunch Boxes & and in 1896 Paper making started. Since that time known as the Paper Mill July described under the head of Leatherside

Paper Machine removed to Poland about 1920?

Building Razed about 1922

Old Counting Room Razed 1918-20

Flume filled 1929

The Flume under the Road was 14 ft wide 6 ft high Oak Timber Floor both sides Puddled with Blue Clay

LUCIUS D BARROWS
CHIEF ENGINEER

Kennebunk

State Highway Commission

State of Maine

Augusta

Portland, Maine
Sept, 25, 1936

Mr. Max L. Wilder
Bridge Engineer
Augusta, Maine

Dear Sir;

Enclosed is a bill from the town of Kennebunk for work on Kennebunk Bridge which I have approved for payment. I approved the labor on the construction of a concrete wall to cut off the old flume that goes under the road and backfill. The town spent approximately $500. and will now extend the dam wall to the level of the sidewalk and grade the lot. The property was bought by Mr. Parsons and given to the town.

Very truly yours

H L Greenleaf

H. L. Greenleaf

Encl.
HLG/E

Paid 180.58

Halloween friends in Mexico and Temple, Maine, Wednesday.

Mrs. Thomas D. Green and children, Elliot, Thomas, Jr., and Julia, are expected to arrive at Drakes Island next week to occupy the Larrabee cottage for the summer.

Mrs. Annie Adams of Boston, formerly of Kennebunk and a sister of Frank Webb of Summer street, was a local visitor over the week-end. She was a guest at the Greenleaf.

Mr. and Mrs. O. W. Waterhouse of Beverly, Mass., who have been visiting his brother, Jesse E. Waterhouse of Grove street for ten days, returned to their home on Tuesday.

Rev. J. Wesley Prince officiated at the marriage, July 3, of Miss Doris Marguerite Day, daughter of Charles M. Day, of York, formerly of Kennebunk, and Charles H. Travers of Springvale.

Main street has had its annual striping to notify auto drivers the location of cross walks, parking places in business section and forbidden places at corners of streets. The work was done by Richard Adjutant, artist, and Henry Severance, assistant.

The Alewive Vacation Bible school opens next Monday for a two weeks' term with morning sessions from 9 to 11.30 on five days of each week. Mrs. Oscar W. Stuart will be in charge as in past years and her assistants will be Rufus Perkins, Miss Esther Stuart, Mrs. Percy Day and Mrs. Norman Wentworth. Fifty pupils have enrolled.

While rowing on Kennebunk pond about 6 o'clock last Sunday morning, Amos Boyden watched two animals swim across the pond and at a point opposite Leander Smith's camp saw them stop and eat lily pads. Not until they came out of the water and climbed the bank was he able to distinguish them as twin bull moose, about a year old. He said they apparently were unafraid and grazed leisurely as he followed a short way off shore in his boat.

Thirty-eight aliens have reported at the selectmen's office since Gov. Lewis O. Barrows issued his proclamation that residents of Maine, not American born or naturalized, must register and fill out blanks provided for this purpose. The greater number of registrants, 19, stated they were born in Canada, others as follows: England, 6; Nova Scotia, 5; New Brunswick, 4; Newfoundland, 2; Quebec, 1; Norway. 1. Some of the registrants had lived here 40 and 50 years.

The will of Alexander Burr, late of Kennebunk was allowed Tuesday at the opening of the July term of Probate Court held at Alfred. It was presented by the widow, Helene M.

So far as has been reported, Maine had one of the two deaths from fireworks in the Country. The control or prohibitory laws in many of the states proved their value. So did the weather, which hereabouts was decidedly unpropitious, as usual.—Portland Press Herald.

The Noble Grand requests all members to be present at the meeting of Olive Lodge next Monday evening, as nomination of officers will be held and other important business attended to. Also plans will be made to attend the picnic at the Emery Camp at Kennebunk Pond on July 19.

Frederick Hawkins is employed by the Water District as substitute for Charles E. Hatch, who is driving a Rutter Laundry truck during the summer season. The district is building a 2500-foot, 8-inch extension on Cat Mousam road from Kimball's farm to Charles Lemoine's. Four hydrants are to be installed.

CAVE-IN OF OLD FLUME IN MILL YARD

repairs to the buildings which in- day evening, a circular pit 16 ft. deep, 8x12 ft. wide at the top and broader at the bottom, was created in the old mill yard by a cave-in back of the Shell filling station at the western end of the Mousam River bridge. A cord of wood that was piled upon the surface disappeared like magic, the foundation at one end of the station gave way and left the corner suspended several inches above ground. A tool box held its place at the edge of the pit although it was expected momentarily to tip and disappear as there were large cracks that radiated from the edges of the big hole.

No one was injured. The first report of the cave-in was given by Leslie Pitts, who heard a sizzling sound as if a hot iron had been thrust into cold water. He made an investigation.

George A. Gilpatric, local historian, in his book, "The Village of Kennebunk," says the flume, a large and expensive one, was built many years ago by the old Mousam Mfg. Co. It was 14 ft. wide and 6 ft. high and extended from across the street to the mill yard. A smaller one, 6x6, carried the water to the wheel. These flumes were of oak timber planked both sides and puddled between with blue clay. There were also logs with 2 in. holes bored through for drainage in the yard. Several years ago during a Spring freshet sections of the flume under

Suddenly, swiftly, about 8 Wednesthe street caved in and were filled by

off Westfield (N
R., and held
American War
New York State
and earlier as
chapter, Brook
Smith died in
March 31.

Rebecca Emer
will be in charg
service, in which
of Saco, vice pr
former state
Boston of the I
trar, and Miss
Biddeford, will
Evans, state pre
R., and a delegat
A. Webber Post
with their color
part, and Miss
Goodwin's Mills,
prayer. Two m
York State Boa
Mothers, will a
tonight to conduc
are Mrs. Bart
Nelsie C. Robir
Mrs. Catherine I
Chapter No. 1, fo
Mrs. William Wil
Portland Chapter
members will att

Mrs. W. H. Sa
N. Y., and Mrs.
Augusta, daughte
and Miss Verna S
Oyster Bay, N. Y
ent. Headqharter
will be at The Gr

NATIVE

Mrs. Smith was
in Lyman, the d
and Eliza (Taylo
the Alfred road.
postmaster of Ly
serving under elev
istrations, of thre
He resigned in 18
Portland street, K

Mrs. Smith tau
man before her m
Webster Smith, a
Thanksgiving Day
member of the Go
tist church, whose
James A. Ferguso
law, officiated at
and her marriage.

Her later life w
Brooklyn, N. Y.
Hanson Place Bap
the pastorate of
She was intensely
her time and ene

TOURNAME BEGIN NEX

The Playground
second week of th

es received the de-
at the meeting of
t Monday evening.
esent from Saco as
:t deputy president,
lls. The new degree
the membership. Re-
:e served. The can-
Irs. Charles Cousens,
Wentworth, Miss
ric and Mrs. Harry

War Relief Society,
le, Kennebunk chair-
for donations to re-
ipment. You can ren-
service by helping this
extent of your ability.
merchants have gen-
space in their stores to
les for Britain: Harry
ent Cleaners, R. T. Cole
C. H. Cole & Sons, Mrs.
Geo. Tomlinson, Spiller
the I. G. A. Store and
ch.

High supporters are al-
t with an alibi when
te team is defeated, es-
n the licking is adminis-
nnebunk High. In 1939,
Kennebunk eleven won the
me, the Biddeford fans
ita Claus for their defeat.
e defeat of Biddeford was
that the fans solaced
with the excuse that
k this year has one of
as that crop up every so
maller schools." After los-
sketball game last Monday
he alibi was "the strength
ddeford club was weakened
ontest with the loss of Man-
piounais."

erated by a Boston organization as a camp for business girls.

Charles W. Horton, 61, formerly of Kennebunk, died Dec. 13, in Portland. A native of Zanesville, Ohio, he came to Maine at the age of 16 and was graduated from Portland High and a Portland business college. He was employed as an accountant the greater part of his life, at one time being employed in the State Auditing Dept. During his residence here in 1937, he was employed by the Chamberlin Auto Supply Co. as a bookkeeper. He was a member of the Masonic bodies. His widow and a sister survive. Funeral services were held Monday in Portland and interment was in Evergreen cemetery in that city.

After months of controversy between the road and bridge departments of the State Highway Commission, the latter branch has accepted the responsibility of permanently repairing a very bad condition in the road opposite the office of the Electric Light Commission on Main street. Last summer the side wheels of a van sank to the hubs as the result of a cave-in at this point which was caused by the breaking of a large drain pipe 20 feet below the surface. Several loads of gravel were dumped into the hole. A few weeks later there was another cave-in and another gravel filling. This happened three times. Eary this week a crew from the bridge department made excavation to the depth of the drain pipe and is to make a permanent repair by building a long and wide cement header over an old flume.

12/24/40

By the prayer
folk,
Join your prayers with theirs.
In this uniting bond
Grow strong in soul, free in peace of mind,
And happy in the warmth of spiritual joy.
And in all thy days
God's blessing will sustain thee.
Amen.

CHRISTMAS, 1940

In the United States stores and shops overflow with every kind of gayley colored toy, or serviceable article, suited to the desires or the needs of child and adult. Bright-eyed, eager-minded children visit the toy departments of the stores, or line up outside the display windows to discuss the merits of the toys, and to revel in imaginary ownership.

In the war ravaged lands there are no brightly lighted windows, and there are no companies of care free children to feast their eyes on toy displays, were such to be seen. Instead with a fearful glance at the heavens they, like harried rabbits, scurry down street or lane to dis appear into teeming underground warrens. Their mothers, in agony as great as that which filled the heart of Mary, watch over them and hope, hope, *hope!* What is there to hope for when fellow men pay no heed to the Spirit or the Purpose of Christmas?

The Spirit of Christmas is timeless, because it is the symbol of the promise that lies in each New Life. Each babe may become the exemplar of the Way of Peace. But, when war denies the rights of childhood, namely peace, happiness and proper opportunity for training, how can the babe develop the nobility of mind and soul that is within the province of an enlightened manhood and womanhood?

"Merry Christmas" is the spirit of goodwill and peace among men. *God keep us all in the spirit of Christmas!*

ORDER OF CHRISTMAS SERVICE

Prelude, Pastoral Symphony from "The Messiah" *Handel*
Chorale, "Jesu, Joy of Man's Desiring" *Bach*
Doxology
Invocation and Lord's Prayer
Response 550 - ii
Anthem, "Still as the Night in Bethlehem" *Spence*
Responsive Reading, "Christmas Service" P 16
Hymn 191
First Reading, "For These Things Are of God"
Anthem, "Sing, O Heavens" *Tours*
Scripture Lesson, Isaiah 9: 1-7; Luke 2:4-14
Response 554 - vi
Prayer
Anthem, "Be Still! Be Still" *Scott*
Announcements
Offertory
Anthem, "Softly the Night is Stealing" *B. F. Gilbert*
Response, Organ and Choir
Serman, "The Messiah"
Hymn 198
Benediction
Nunc Dimittis
Postlude, "Christmas Postlude" *Hosmer*

The members of the Church school will present a Christmas pageant in the church auditorium at four o'clock in the afternoon, Sunday, December 22nd. Mildred B. Thurrell, soprano soloist, Evie E. Littlefield, organist. Rev. Arthur Schoenfeldt, reader. The public is invited.

are classes for all age groups — everyone is welcome. This service convenes at the conclusion of morning worship.

At 7 o'clock in the evening, an interesting session of praise and prayer is to be conducted under the leadership of Oliver E. Curtis.

Christian Science Society

Church and Sunday school on Sunday morning at 10.45 o'clock at 25 Summer street.

"Is the universe, including Man, evolved by atomic force?" is the subject of the Lesson-Sermon that will be read in all Churches of Christ, Scientist, through out the world, on Sunday, December 22.

The Golden Text is: "Thus saith the Lord that created the heavens; God himself that formed the earth and made it; . . . I am the Lord; and there is none else" (Isaiah 45: 18).

The citations from the Bible include the following passages: "In the beginning God created the heaven and the earth. And God said, Let us make man in our image, after our likeness; and let them have dominion over the fish of the sea, and over the fowl of the air, and over the cattle, and over all the earth, and over every creeping thing that creepeth upon the earth. And God saw every thing that he had made, and, behold, it was very good" (Genesis 1: 1, 26, 31).

The Lesson-Sermon also includes the following passages from the Christian Science textbook, "Science and Health with Key to the Scriptures" by Mary Baker Eddy: "God creates and governs the universe, including Man. The universe is filled with spiritual ideas, which He evolves, and they are obedient to the Mind that makes them" (page 295: 5-8).

Wednesday evening Testimony meeting at 7.45 o'clock.

Reading-room open on Friday afternoons from 2 to 4.30 at 25 Summer street.

Baptist Church

Rev. O. W. Stuart, Pastor

"God so loved the world, that gave his only begotten Son, th whosoever believeth in him shou not perish, but have everlasti life."—John 3: 16.

"Christmas" will be the serm topic Sunday morning. There will appropriate music.

Sunday evening will be devoted a "Christmas-singspiration" Meditation. There should be so thing of the Joy of the Shephe following this service.

The Christmas Supper and will be held on Tuesday evening. usual happy informal gathering be enjoyed. Santa has promise be on hand for a few minutes.

The Congregational Chur

Rev. J. Wesley Prince, Past

Christmas Sunday.

The prelude to the morning s will consist of Christmas carols by the church school classes. I note that these carols preced regular service and will begin 10.15.

The musical program fo morning service will include th lowing:

Prelude, Gesu Bambino *Pietr*
Anthem, Arise, Shine

Kenneb

MITCHELL - GO

Miss F. Jeanette
teacher in the El
Schools, and Horace
editor of the Kitte
were married last Sa
ternoon at the hom
brides grandparents,
Mrs. C. Edward Dyer,
lin. Rev. Murchie A
father of the bride a
f the Bethtl Methodi
fficiated at a single
iony. The couple re
ittery Monday night
mping trip on the
ain Trail and will m
me at Kittery Point.

o do as you would be d
plain, sure, and undis
iorality and justice.—L
eld.

nkind will be God-gov
rtion as God's govern
apparent, the Golden
und the rights of man
of conscience held
—*Mary Baker*

Mrs. Hallet (May Nute) has
en local friends that it is prob-
that the house will be remodeled
ovide two tenements.

ymond H. Grant has been
ded the contract to build an 8-
house with three baths, and a
car garage for E. W. Jones on
her street and started excava-
s for the basement the early part
he week. The lot, with a 200 ft.
tage extends to the Mousam riv-
and is located between th home
es of Walter R. Cole and Roy
chins. Mr. Jones has a summer
e at Drakes Island.

ttention of citiizens is called to a
lic hearing on acceptance of a
ing Ordinance to be held in the
n hall on Thursday evening, Sept.
at 7.30 o'clock. The committee, in
awing up the ordinance, has given
ch study and time to framing the
ticles for the best interests of
e town. It is hoped that citizens,
t yet ready to accept the ordinance
r the streets on which they reside,
ill vote in favor of its enactment
r streets which have unanimous ap-
roval of the residents of those
treets.

Several weeks ago there was a
ave-in over the old flume under the
eastern approach to the Mousam riv-
er bridge. It has been filled three
times with gravel, an unsafe repair,
as drains enter the flume and the
gravel is washed away. One night
recently, Night Officer Fred Clark
found the gravel filling had disap-
peared and placed a barrel, topped
with a red light, over the hole to
warn motorists of danger at that
point. The unsatisfactory repairs
have been made by the state highway
department.

Roger Fredland of Portland, edi-
tor of "High Tide," which chronicles
the events of the summer colony from
Portland to Kittery, has chosen Joy
Dow, Jr., publisher of the paper, as
best man, at his wedding in the
Belmont, Mass. Methodist church, on
Saturday, Aug. 31, at four in the
afternoon. The bride-elect is Miss
Dorothy Halliday Staples, daughter
of Mr. and Mrs. Frank D. Staples
of Belmont. Mr. Fredland is an in-
structor of English at Pennsylvania
Staate University. Miss Staples is a
graduate of Bates College, class of
1936.

call the attention of legionaires to the regular meeting to be held at Legion headquarters in town hall next Wednesday evening. Recent meetings have been well attended and interesting and the commander hopes the high mark attained will be continued.

Manager George Thompson has arranged a baseball game for Saturday afternoon at 3 between the Kennebunk Advertisers and the St. Pete's team, a Boston twilight league club. The game scheduled for last Saturday between the Advertisers and the Lewiston-Auburn Bakers was cancelled at a late hour by the out of town club.

About 20 aliens have registered and had their finger prints taken at the local postotffice since last Tuesday, the opening day. Postmaster W. D. Hay is hoping to confine the registration from 3.30 to 5.30 each weekday so as not to interfere with the routine work of the postoffice. If more time is needed to accommodate registrants the opening hour will be earlier. Joseph R. Burke is the clerk in charge of the work.

A birthday party was celebrated in honor of Miss Agena Hines at the home of Mr. and Mrs. Clinton Hill on the Alfred road, Lyman Sunday night. Games were played with the oldsters having as much fun as the younger ones. Refreshments were served by the hostess, Mrs. Hill, consisting of sandwiches, cake, cookies ice cream and coffee . The birthday cake was made by Mrs. Perley Chase sister of the honor guest. Many nice presents were received. Among those present were Mr. and Mrs. Roland Hines, daughters Christie and Marion Hollis Center; Mr. and Mrs. Perley Chase and son Donnie, Elden White and William Booker, East Waterboro; Mr. and Mrs. Wallace Chase, Waterboro, Mrs. Hattie Hines, Plymouth; Miss Iola and Alvin Grey of Bangor; Mr. and Mrs. Maurice Dixon, Miss Dora Hubert, Alice Perry, Kennebunk; Miss Pearl Davis, Clayton King, Biddeford; Curtis Taylor, Joe Taylor, Mr. and Mrs. William Taylor, Irene and Lorette Cyr, Armand La Riche, Myron Grey, George Watkins, George Hines, Clifton Hines Stanley Hines, Lester Perry, Mr. and Mrs. Algie Hines, Mr. and Mrs. Clinton Hill and daughter Patricia and the guest of honor, Miss Algena Hines .

ence. This brings to a close the special features which have been enjoyed by Museum visitors every Wednesday afternoon throughout the summer.

CARD OF THANKS

I wish to thank my friends for the cards, flowers and gifts which were sent to me during my stay in the hospital.

Rosalie E. Thompson.

8/30/40

Kennebunk

November 18, 1941

Mr. H. L. Greenleaf,
52 Richardson St.,
Portland, Maine

Dear Sir:

We have the following letter from Elliot Rogers, President, Rogers Fibre Company, Inc., of Kennebunk:

> "We would ask you to close the drain on the bridge over the Mousam River that allows the water on the bridge to run on our land just at the end of Jones' Diner. This runs in enough to undermine the underpinning of the stonewall and is causing us considerable expense.
>
> "It would take just a little cement to close it and we are willing to do it with your permission."

I am not familiar with conditions, but if the request is reasonable, you can arrange to have it done.

Very truly yours,

Max L. Wilder,
Bridge Engineer

MLW:D

November 19, 1941

Mr. H. L. Greenleaf,
52 Richardson St.,
Portland, Maine

Dear Sir:

This week Commissioner Lord was speaking about the approach to the bridge at Kennebunk. He said there is a penstock which evidently is not in good condition and that the road has settled over it about 6 inches. I know he would like to have the condition remedied along with the other work which is being done through Kennebunk. I am not familiar with the conditions and wish you would let me know whether you believe this penstock could be filled and the roadway repaired.

Very truly yours,

Max L. Wilder,
Bridge Engineer

MLW:D

LUCIUS D. BARROWS
CHIEF ENGINEER

State Highway Commission
State of Maine
Augusta

Nov. 27, 1941
52 Richardson St
Portland, Maine

Mr Max L. Wilder
Bridge Engineer S.H.C.
Augusta, Maine.

Dear Sir:

Mr Wentzel and I looked at the masonry work on the Kennebunk bridge and we did not find that it required repairs. The road has never been in very good condition.

Mr Wentzel could see no objection to closing the drain as requested by the Rogers Fibre Co.

Yours truly
H. L. Greenleaf

LUCIUS D. BARROWS
CHIEF ENGINEER

State Highway Commission

State of Maine

Augusta

Portland, Maine
Dec. 6, 1941

Mr. Max L. Wilder
Bridge Engineer
Augusta, Maine

Dear Sir;

I have looked at the drainage around Kennebunk Bridge with Mr. John Balch. I believe the settlements referred to by Mr. Lord are caused by the leakage from catch basins pipes that are under the roadway. Last year when we placed the bulkhead in the old flume on the Kennebunk side, we found the catch basin outlets to be short lengths of tile with uncemented joints. Mr. Balch said that a very extensive survey of the drainage problem was made by the Highway Department last year.

I met Mr. Eliott Rogers and told him that it would be permissible to close the drain on the bridge, although I believe most of his trouble is from a catch basin outlet. In 1935 when we were making a fill on the land donated by Mr. Parsons, Mr. Rogers did not want to do anything that would jeppardize his rights for flumes or shaft holes thru the bridge. Monday Mr. Rogers informed me that he no longer cared about these rights and it would be agreeable to fill them if we desired.

Very truly yours

H. L. Greenleaf

HLG/E

Kennebunk Bridge

August 10, 1942

Mr. H. L. Greenleaf,
52 Richardson St.,
Portland, Maine

Dear Sir:

Commissioner Lord is very anxious for you to get together with Elmer Young and look over the conditions at the south end of the bridge at Kennebunk to see if anything can be done to prevent continued settlement.

Very truly yours,

Max L. Wilder,
Bridge Engineer

MLW:D

Gross, Karen

From: Guimont, Marc
Sent: Monday, September 27, 2004 7:38 AM
To: Gross, Karen
Subject: FW: Sinkhole Photos - US Route 1 - Kennebunk

Karen,
we had a failure Friday night. I think we still need to look at it. There was a broken 15 inch clay pipe; that would account for some of the void but not for most of it. I believe there is an old sluiceway under the road that was blocked off but never filled.
see you Wednesday.
Marc
-----Original Message-----
From: Michael Claus [mailto:mwc@kennebunk.maine.org]
Sent: Sunday, September 26, 2004 11:06 AM
To: 'Barry Tibbetts'
Cc: Marc Guimont; Lee.Emery@maine.gov; 'Fisk, Robert'; Don Gobeil
Subject: Sinkhole Photos - US Route 1 - Kennebunk

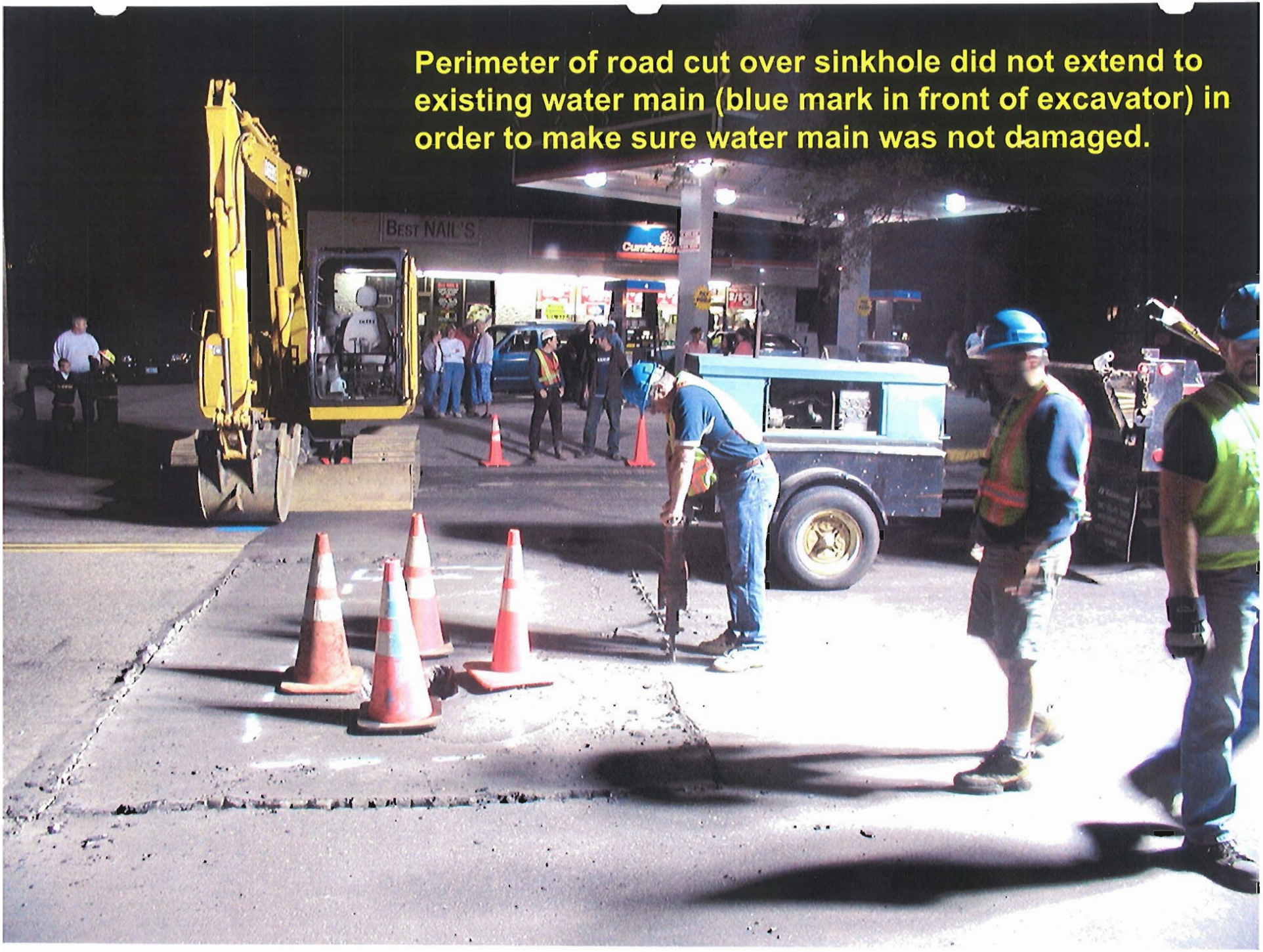
pdf file attached. We should all talk Monday regarding permanent repair plans. I think it was a great response from all involved Friday Night. I will draft a letter expressing the Town's thanks to all involved.

-- Mike

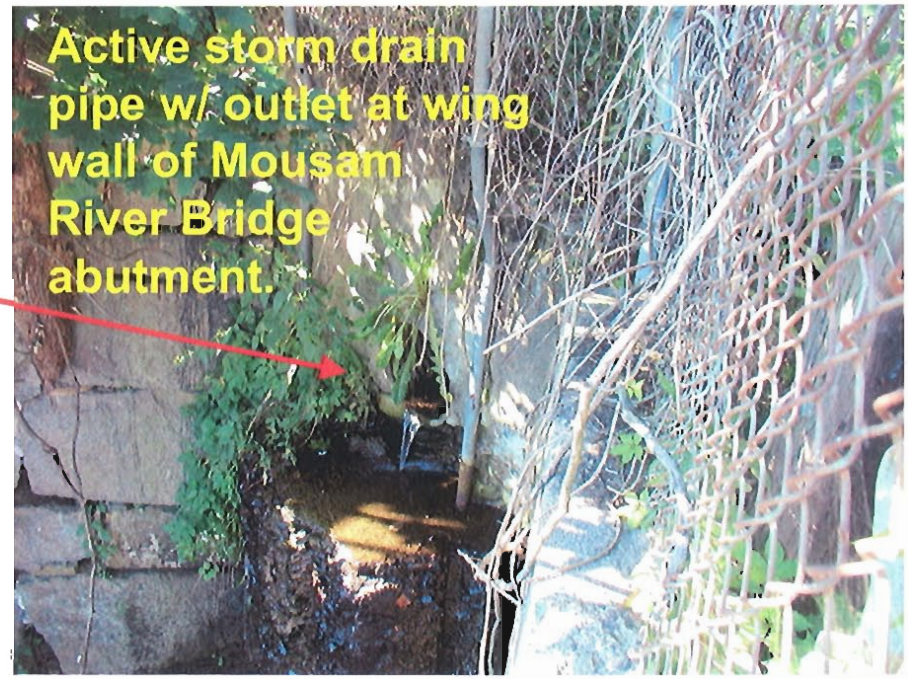
Michael W. Claus, P.E.
Kennebunk Public Works Director
1 Summer St.
Kennebunk, ME 04043

207.985.4811 (phone)
207.985.1144 (fax)

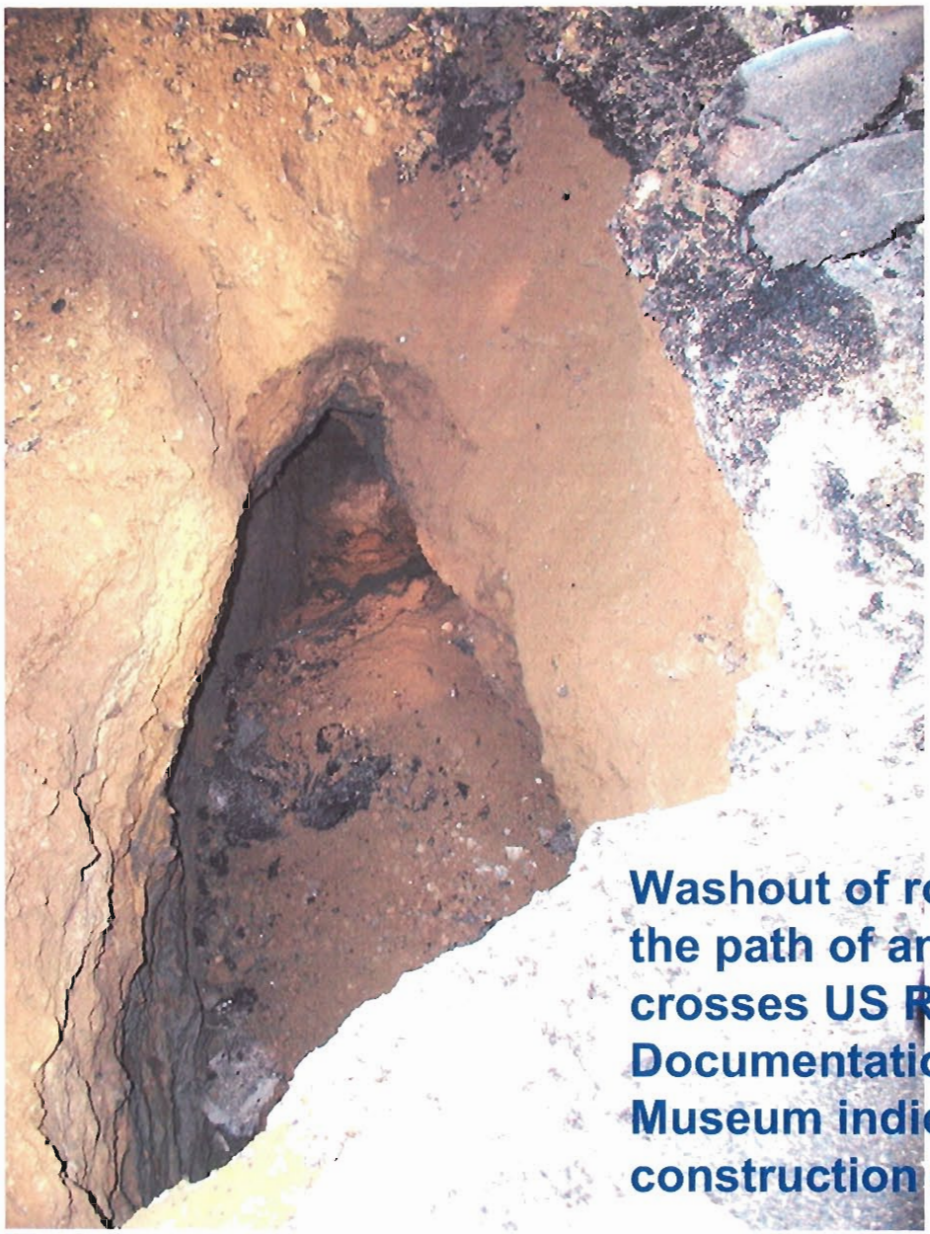
mwc@kennebunk.maine.org (e-mail)

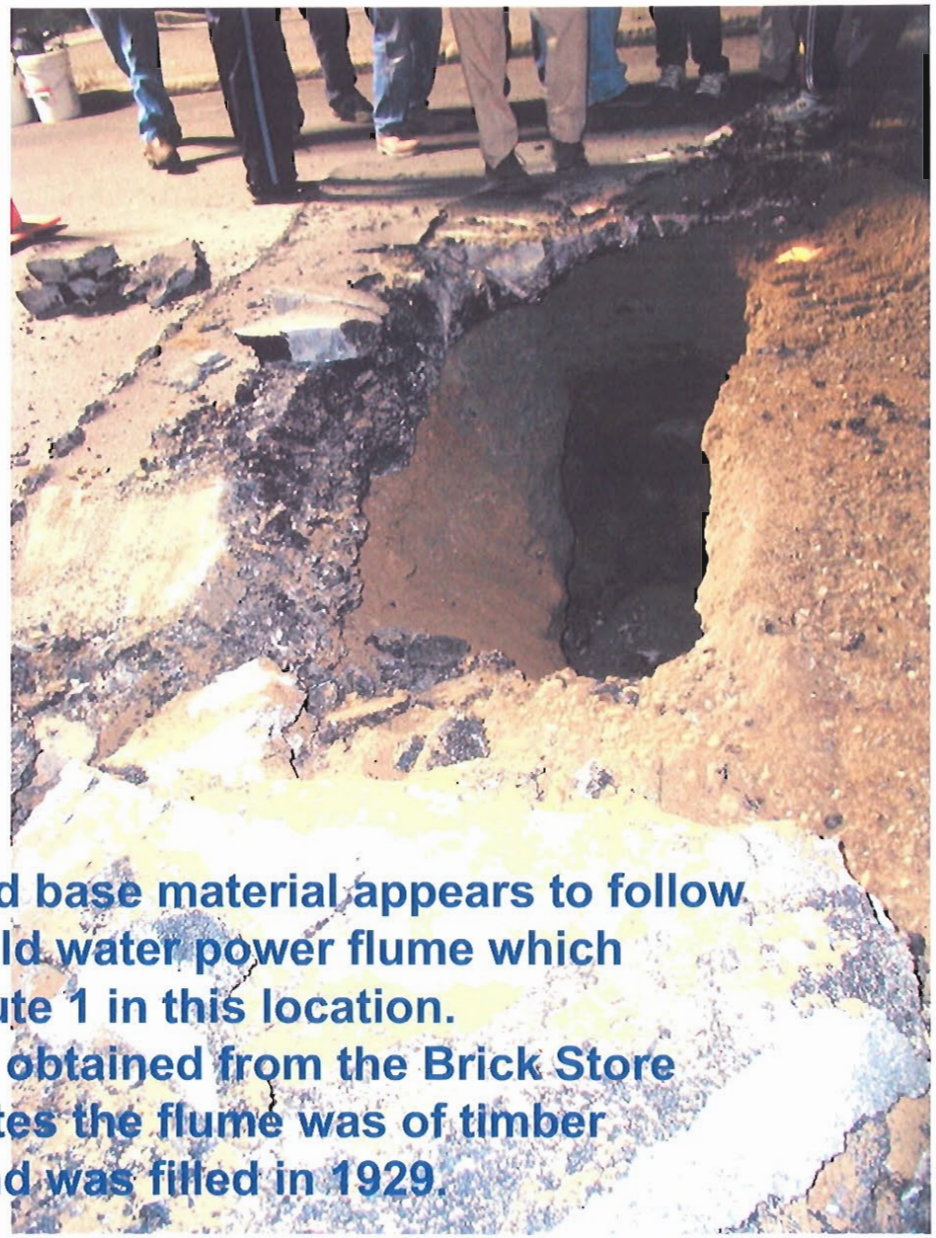

Perimeter of road cut over sinkhole did not extend to existing water main (blue mark in front of excavator) in order to make sure water main was not damaged.
BEST NAIL'S


Broken section of clay pipe at bottom of sinkhole. Kennebunk Fire Department put water in pipe and it was observed outletting from abandoned pipe in Mousam River Bridge abutment.


Active storm drain pipe w/ outlet at wing wall of Mousam River Bridge abutment.


The sinkhole was filled with bank run gravel compacted with the excavator bucket and a vibratory tamper. Voids under the water main were not completely filled in to avoid damage to the main.





Washout of road base material appears to follow the path of an old water power flume which crosses US Route 1 in this location. Documentation obtained from the Brick Store Museum indicates the flume was of timber construction and was filled in 1929.

Route 1 - Brown Street Drainage 001

Route 1 - Brown Street Drainage 002

Route 1 - Brown Street Drainage 005

Route 1 - Brown Street Drainage 006

Route 1 - Brown Street Drainage 007

Route 1 - Brown Street Drainage 008

Macdougall, George

From: Guimont, Marc
Sent: Monday, August 08, 2005 1:39 PM
To: Macdougall, George
Subject: FW: 7-6-05 Sinkhole Repairs


Snkhole Repair 7-6-05 008.jpg ...

Snkhole Repair 7-6-05 007.jpg ...

Snkhole Repair 7-6-05 002.jpg ...

Snkhole Repair 7-6-05 021.jpg ...

Snkhole Repair 7-6-05 020.jpg ...

George, here are the pictures.
Marc

-----Original Message-----
From: Michael Claus [mailto:mwc@kennebunk.maine.org]
Sent: Wednesday, July 06, 2005 3:26 PM
To: 'Guimont, Marc'; 'Sherlock, David'
Cc: 'Barry Tibbetts'
Subject: 7-6-05 Sinkhole Repairs

KPWD found another sinkhole on Route 1 today. Photos are attached of some of the work accomplished today. The sinkhole was about 4 ft. deep and 6' x 6' in width. I believe this is a sinkhole from the old drainage system that we rerouted in the spring. I believe the pavement failed, exposing the sinkhole, when the summer heat caused the pavement to lose strength without support from the road base material.

KPWD excavated down to the old clay pipes and the tee where the old Brown Street / Route 1 drain meets the pipes paralleling Route 1. Pipes in all directions were sealed with brick and mortar by KPWD today. I took pictures of the pipe interiors prior to sealing with brick and mortar. Let me know if you would like to see these photos.

KPWD noted that there are still cavities in the area of the water main under the middle of Route 1. These do not appear to be a danger and were not excavated.

KPWD noted that the concrete encasement of Verizon's ductbank in Route 1 was actively leaking water. Stephen Irving of Verizon was notified of this and he asked me to e-mail photos of the concrete encasement. Stephen told me that it is normal for underground ductbanks to fill with water.

KPWD backfilled the sinkhole area after sealing the old clay pipes. Backfill material was compacted by KPWD. We plan on paving the excavated area on Friday morning 7-8-05.

Scott Wentworth (KPWD Operations Manager) and I tracked time and equipment used in sinkhole repair work today. Is it possible to charge this work to the sinkhole repair PIN?

-- Mike

Michael W. Claus, P.E.
Kennebunk Public Works Director
1 Summer St.
Kennebunk, ME 04043

207.985.4811 (phone)
207.468.3020 (cell)
207.985.1144 (fax)

mwc@kennebunk.maine.org (e-mail)

Snkhole Repair 7-6-05 001

Snkhole Repair 7-6-05 002

Snkhole Repair 7-6-05 003

Snkhole Repair 7-6-05 004

Snkhole Repair 7-6-05 005

Snkhole Repair 7-6-05 006

Snkhole Repair 7-6-05 007

Snkhole Repair 7-6-05 008

Snkhole Repair 7-6-05 009

Snkhole Repair 7-6-05 010

Snkhole Repair 7-6-05 011

Snkhole Repair 7-6-05 012

Snkhole Repair 7-6-05 013

Snkhole Repair 7-6-05 014

Snkhole Repair 7-6-05 015

Snkhole Repair 7-6-05 016

Snkhole Repair 7-6-05 017

Snkhole Repair 7-6-05 018

Snkhole Repair 7-6-05 019

Snkhole Repair 7-6-05 020

Snkhole Repair 7-6-05 021

Snkhole Repair 7-6-05 022

Snkhole Repair 7-6-05 023

Snkhole Repair 7-6-05 024

Snkhole Repair 7-6-05 025

Snkhole Repair 7-6-05 026

Snkhole Repair 7-6-05 027

Snkhole Repair 7-6-05 028

Hascall & Hall
SINCE 1948
When Quality Counts

October 19, 2006

Mr. Michael W. Claus, P.E., Director
Kennebunk Public Works Department
1 Summer Street
Kennebunk, Maine 04043

Dear Mike:

I have made a bunch of phone calls with regard to our project and have come up with a game plan. Please look at the plan and let me know what you think.

Start November 6, 2006
- Bore holes in road and install 6" casings
- Weld pipe connections to top of pipe

November 7th or 8th (8th being fall back date)
- Set up concrete pump on side street and start pumping flowable fill (not sure if this will take one or two days)
- Remove small area of asphalt around casings and cut pipe below grade; re-patch road

Prices as follows:

- Coring per day	$1,782.00
- Casing - $72.00 per foot x 60 feet	$4,320.00
(Have ordered approximately 60' for project already)	
- Flowable Fill	$ 69.60 per cubic yard
(Auburn Concrete will hold price for 100 - 600± yards)	
- Pump Truck – first 4 hours	$ 864.00
– each additional hour	$ 144.00
- Hascall & Hall (per man-hour)	$ 60.00
- Welder (per man-hour)	$ 72.00

273 Presumpscot St • P.O. Box 1838 • Portland, ME 04104
TEL: (207) 775-1481 • 1-800-464-1481 • FAX (207) 773-5727

I have tentatively set this up to start November 6. You will be responsible for all traffic control, cones, permits, etc.

Please either issue a Purchase Order to bill from, or sign this letter as acceptance of our terms.

Sincerely,

Robert L. Bergeron
President

RLB/kbb

Accepted by: _____ Date: _____

Route One Sinkhole Repair – Kennebunk 11-6-2006

Route One Sinkhole Repair – Kennebunk 11-6-2006

Route One Sinkhole Repair – Kennebunk 11-6-2006

Route One Sinkhole Repair – Kennebunk 11-7-2006

Route One Sinkhole Repair – Kennebunk 11-7-2006

Route One Sinkhole Repair – Kennebunk 11-7-2006

WEDNESDAY NOVEMBER 8, 2006
50°F RAIN

0700 MIKE CLAUS
KEVIN - HASKALL & HALL
CONCRETE PUMP CO. TRUCK
ON SITE.
MUC SET UP WORK ZONE
MUC GETS WATER TRUCK TO SITE.
0730 FLAGGERS ON SITE (3)
0800 AUBURN CONCRETE TRUCKS
0830 GORDIE - DELUCA. ENGINEER
ROB BERGERON HASKALL & HALL
0900 DALL SEARLES KPWD
WITH LOADER

SINKHOLE PROJECT 11/8/06
KENNEBUNK
ROUTE 1

0730 CONCRETE PUMPING WORK STARTED IN SOUTH BOUND LANE. BOTH SOUTHBOUND HOLES FILLED AT 0830
CON. FILL NOTED IN HOLES ON NORTHBOUND SIDE.
0830 TRUCK SWITCHES TO NORTHBOUND LANE AND FILLS BOTH HOLES ON THAT SIDE OF ROAD
0930 CLEAN UP OF SITE BEGINS. ~~Homes~~ KPWD LOADER REMOVES CASING FROM STREET. HOLES HOLES FILLED TO TOP WITH CONCRETE.
HASKALL & HALL INSTALLS STEEL PLATES OVER HOLES.
1030 WORKZONE SIGNS DOWN.

TUESDAY NOVEMBER 7, 2006

SINKHOLE PROJECT
CLOUDY 50°

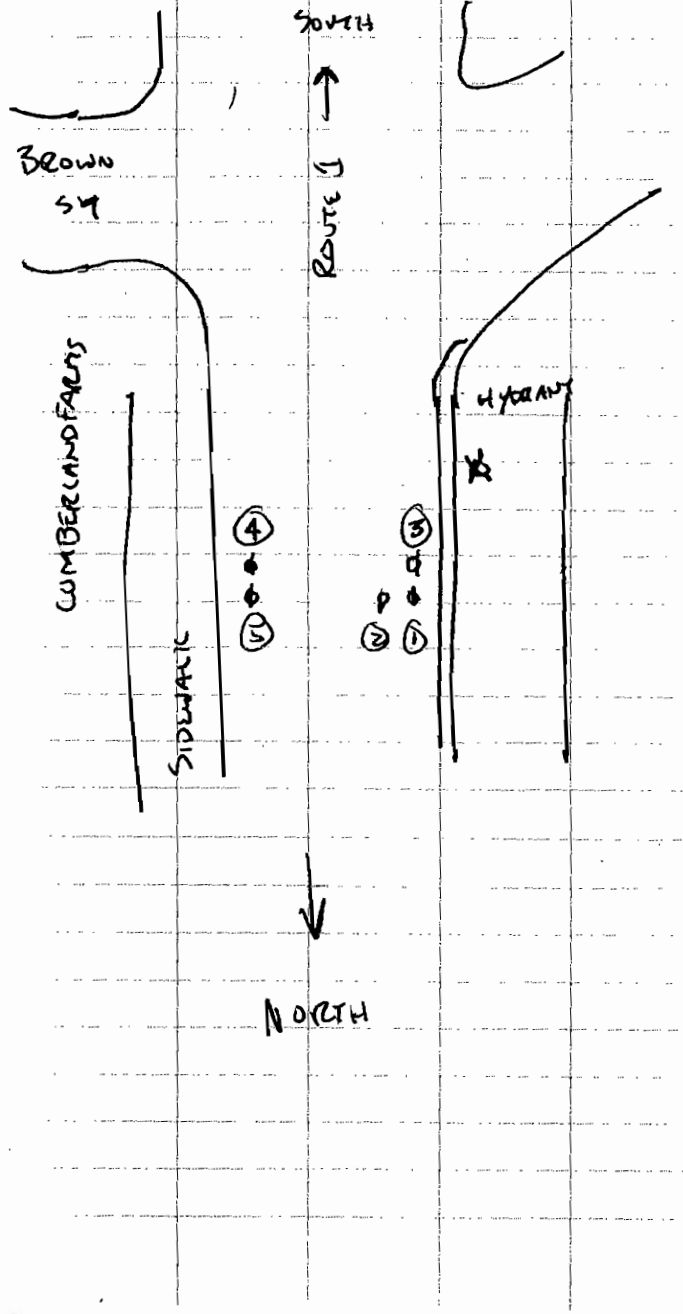
ON SITE
0700 MIKE CLAUS LOAD
0730 KEVIN - HASCALL & HALL SUPERVISOR
0800 HASCALL & HALL WELDER
0800 3 FLAGGERS LABOR READY

11/7/06 1/

0700 MIKE CLAUS SETS UP WORK ZONE SIGNS

0800 WELDER ON SITE
COMES USED TO SET UP WORK AREA IN ROAD
2 LANE TRAFFIC MAINTAINED
WELDER INSTALLING COUPLINGS ON WELL CASINGS TO ACCEPT FLOWABLE FILL FROM CONCRETE TRUCKS
WORK IN SOUTHBOUND LANE TO BE DONE FIRST. COUPLINGS WILL PROTRUDE 2" IN ROADWAY.

1230 WELDER FINISHED WITH WORK
MIKE & KEVIN TAKE DOWN WORK ZONE



SINKHOLE PROJECT 11/6/06 3/

1130 - 1430

SWITCHED DRILLING RIG TO NORTHBOUND LANE TO DRILL HOLES 4 & 5

START WORK ON HOLE (4)

WOOD HIT AT 15' DEPTH

CASING INSTALLED TO 16'

ZOB BERGERON OFF SITE 12⁰⁰

MAINTAINING 2 WAY TRAFFIC.

HOLE (5) SAME AS HOLE 4

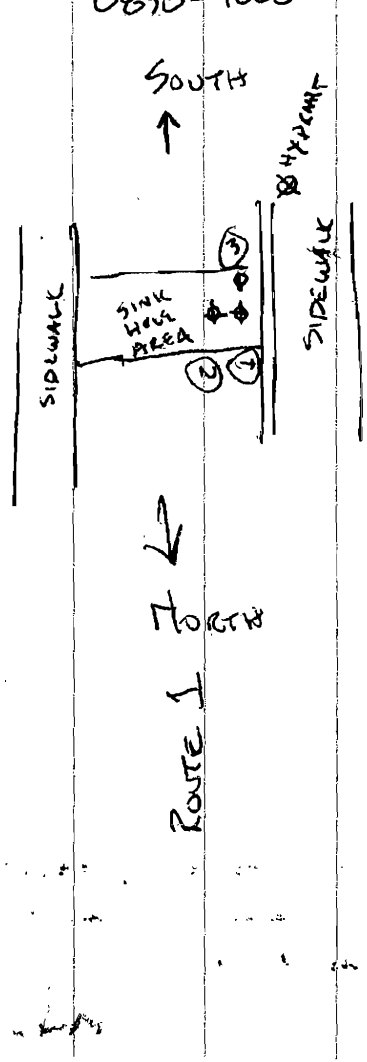
1315 GLEN HASKELL & [redacted] LEAVES SITE

1430 ALL WORK COMPLETE FOR DAY CASINGS COVERED WITH STEEL PLATE. CONFAST INTO ASPHALT.

MWC PICKS UP WORK ZONE SIGNS.

MWC

0830 - 1000



SINKHOLE PROJECT 11/6/06 2/

0830 - 1000 (CON'T)

AT SECOND HOLE (2)
VOID IS NOTED BELOW WOOD
BY AUGERING WOOD OUT OF
THE WAY OF SPLIT SPOON.
AFTER LARGER HOLE IS
AUGERED IN WOOD SPLIT SPOON
ENCOUNTERS NO RESISTANCE
FOR 4 FEET.

1000 - 1100

CASING WORK STARTED
6" ϕ STEEL CASING TO
BE INSTALLED IN (1) & (2)
DEPTH OF CASING (1) 12' VENT
(2) 13' POUR HOLE

(3) NOT SURE IF IN FLUME
(3) ABANDONED

1030 GLEN FROM HASKALL & HALLOWS ITC
HOLES 1 & 2 COVERED W/ STEEL PL
HOLE 3 FILLED W/ DIRT

MWC

MONDAY NOVEMBER 6, 2006

KENNEBUNK SINKHOLE
PIH #

0700 ~~NORTHERN~~ NORTHERN
ON SITE ~~MAINE~~ TEST BORING
2 MEN ~~HAS~~ MIKE -
TRUCK & TRAILER CASCO MAINE
DRILL RIG

HASCALL & HALL - KEVIN
SITE SUPERVISOR
W/ STAKE BODY TRUCK
MIKE CLAUS KPWD
PICKUP TRUCK

3 FLAGGERS FROM
LABOR READY. ARRIVE 0800
THE SHOW ME FLAGGER
CERT. CARDS

11/6/06 SINKHOLE PROJECT 1/
SUNNY 50°

0700 - 0800 SET UP WORK ZONE
SIGNS SET UP BROWN ST
& US ROUTE 1
CONES USED TO MAINTAIN
2 WAY TRAFFIC
SET UP DRILL RIG IN
SOUTHBOUND LANE
WATER TAKEN FROM MOUSAM RIVER
FOR DRILL RIG

0800 DRILL WORK STARTS
ONE BORING
~~ERR~~ CLAY 10 - 15 FT. ?
RESISTANCE NOTED

0810 - 1000 ROB BERGERON HASCALL & HALL
ON STE
2 HOLES DRILLED
DRILLING WORK DONE W
AUGER & SPLIT SPOON. SPLIT SPOON
FINDS RESISTANCE AT 12' DEPTH.
SPLIT SPOON SAMPLES OF WOOD
(PRESUMED TOP OF FLUME) FOUND

PKG

FIRE INSURANCE MAP ABSTRACT RESEARCH RESULTS

6/29/2010

09.0025597.10

KENNEBUNK, ME 04043

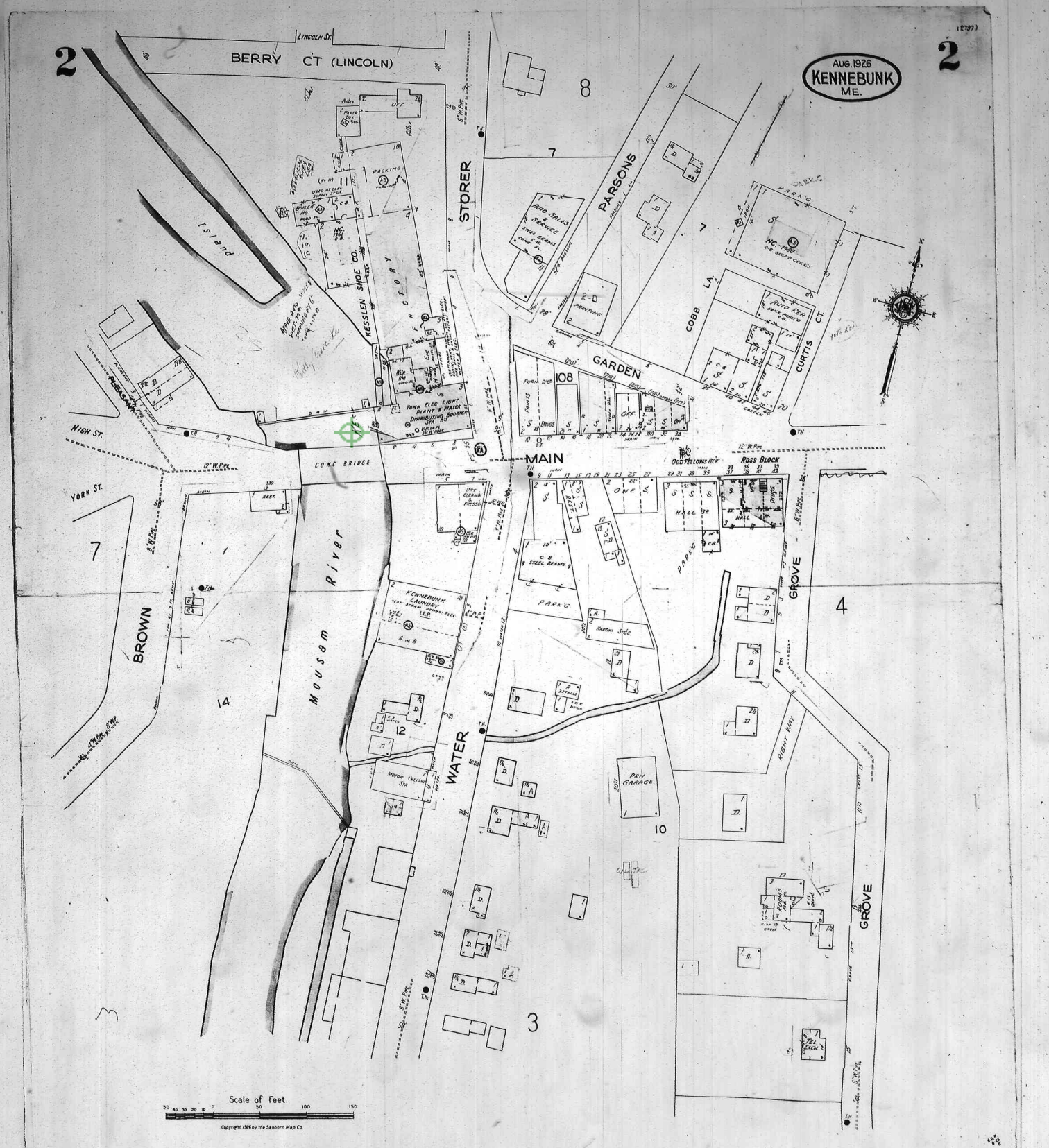
Listed below, please find the results of our search for historic fire insurance maps, performed in conjunction with your Environmental FirstSearch® report.

State	City	Date	Volume	Sheet Number(s)
Maine	Kennebunk	1962	none	2, abutter; 7
Maine	Kennebunk	1942	none	2, abutter; 7
Maine	Kennebunk	1926	none	2, abutter; 7
Maine	Kennebunk	1911	none	2, abutter; 3, 5
Maine	Kennebunk	1906	none	1
Maine	Kennebunk	1901	none	1
Maine	Kennebunk	1895	none	1
Maine	Kennebunk	1891	none	1
Maine	Kennebunk	1885	none	1

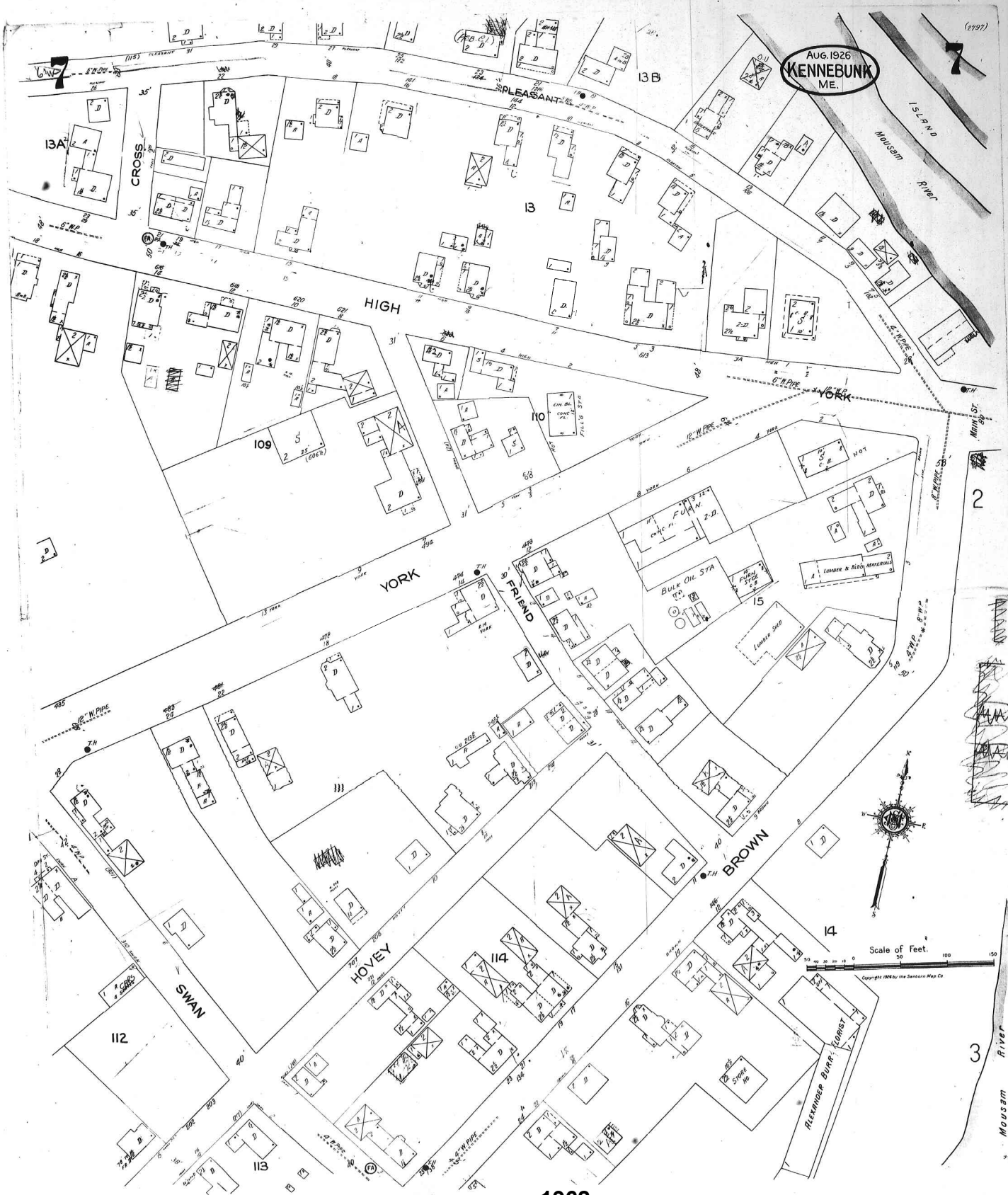
This abstract is the result of a visual inspection of various Sanborn® Map collections. Supporting documentation follows in the Appendix. Use of this material is meant for research purposes only.

FirstSearch Technology Corporation

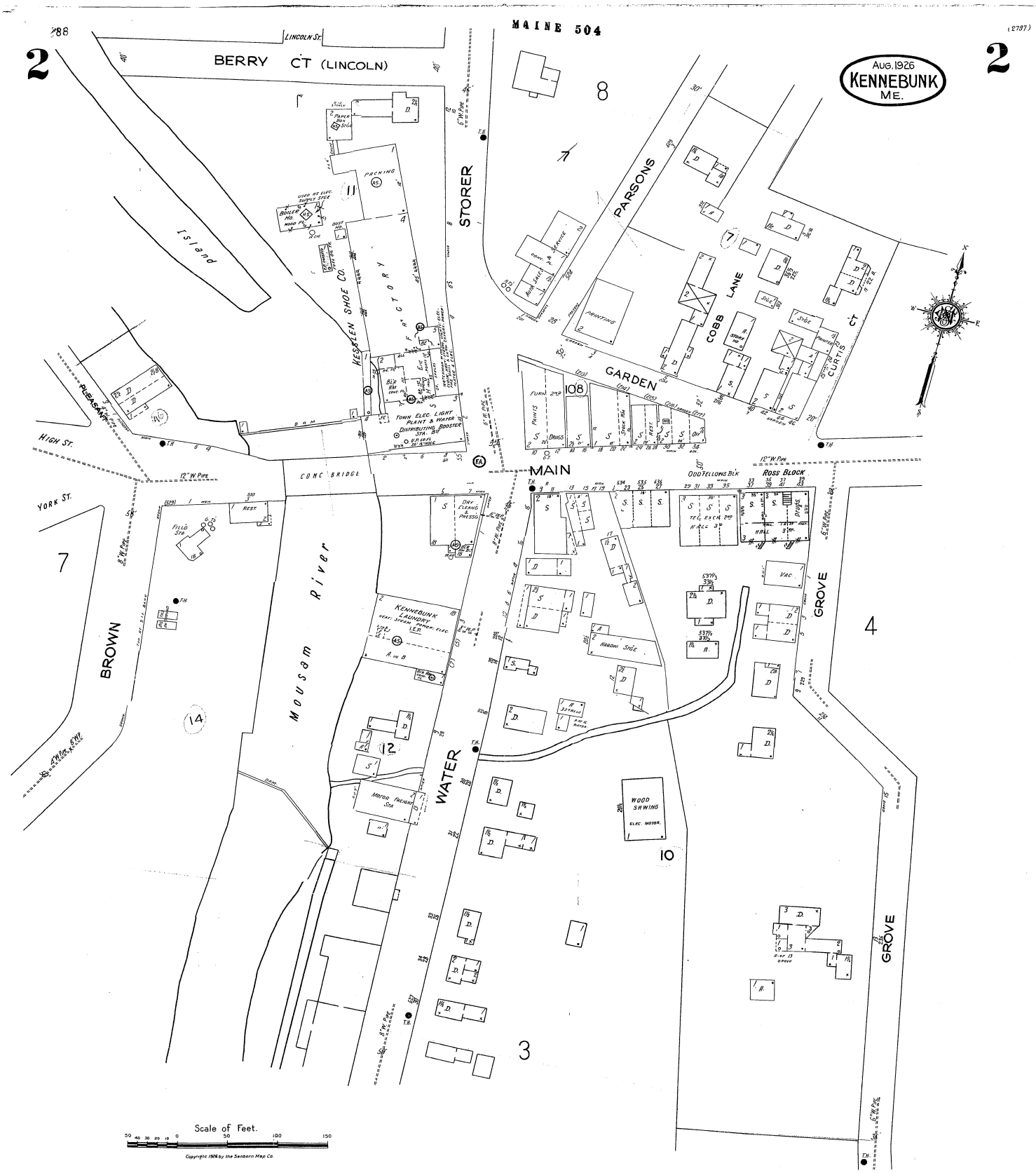
10 Cottage Street, Norwood, MA 02062
Tel: 781-551-0470 Fax: 781-551-0471

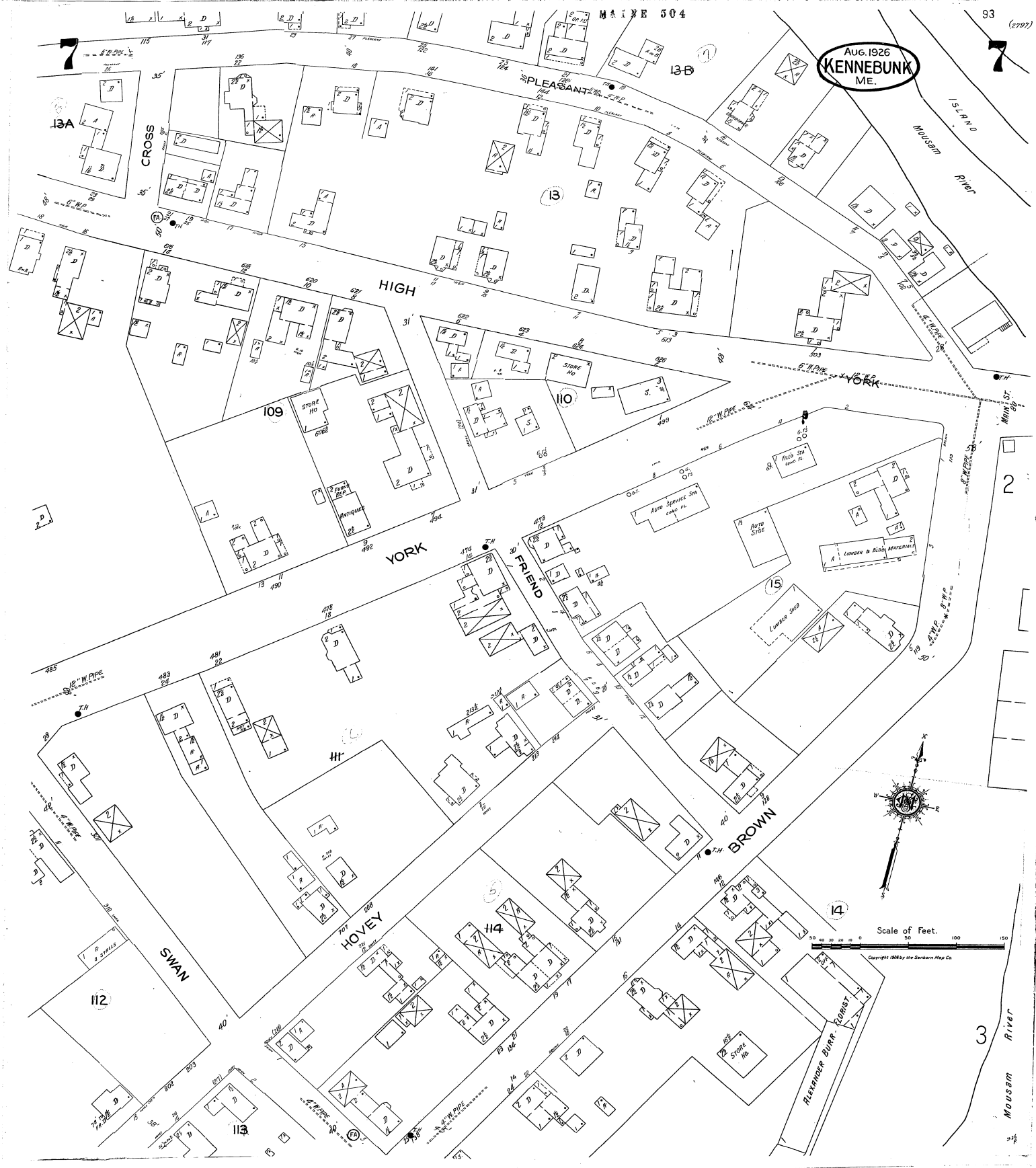

2
2
Aug. 1926
KENNEBUNK
ME.
BERRY CT (LINCOLN)
LINCOLN ST.
Island
STORER
KESSLEN SHOE CO.
FACTORY
PARSONS
COBB LA.
CURTIS CT.
GARDEN
108
HIGH ST.
PLEASANT
YORK ST.
CONC BRIDGE
MAIN
ODD FELLOWS BLK
ROSS BLOCK
BROWN
Mousam River
WATER
GROVE
RIGHT WAY
PRIV GARAGE
TEL EXCH
Scale of Feet.
50 40 30 20 10 0 50 100 150
Copyright 1926 by the Sanborn Map Co

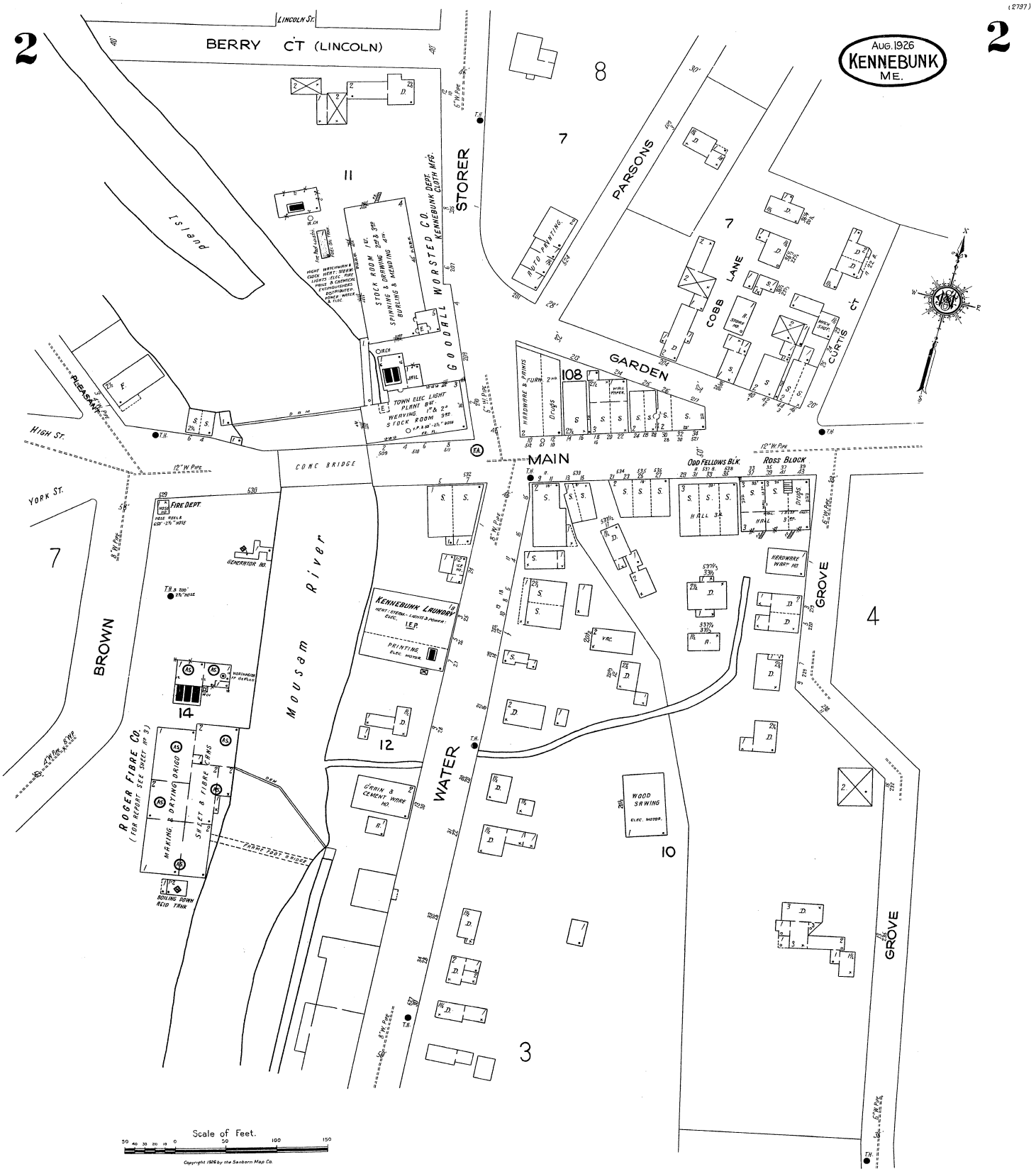
1962


AUG. 1926
KENNEBUNK
ME.
(2797)
7
PLEASANT
CROSS
HIGH
YORK
FRIEND
BROWN
HOVEY
SWAN
MAIN ST.
ISLAND
MOUSAM RIVER
13B
13A
13
109
110
111
112
113
114
15
14
2
3
BULK OIL STA
LUMBER SHD
LUMBER & BLDG MATERIALS
ALEXANDER BURR, FLORIST
STORE
Scale of Feet.
0 50 100 150
Copyright 1926 by the Sanborn Map Co

1962

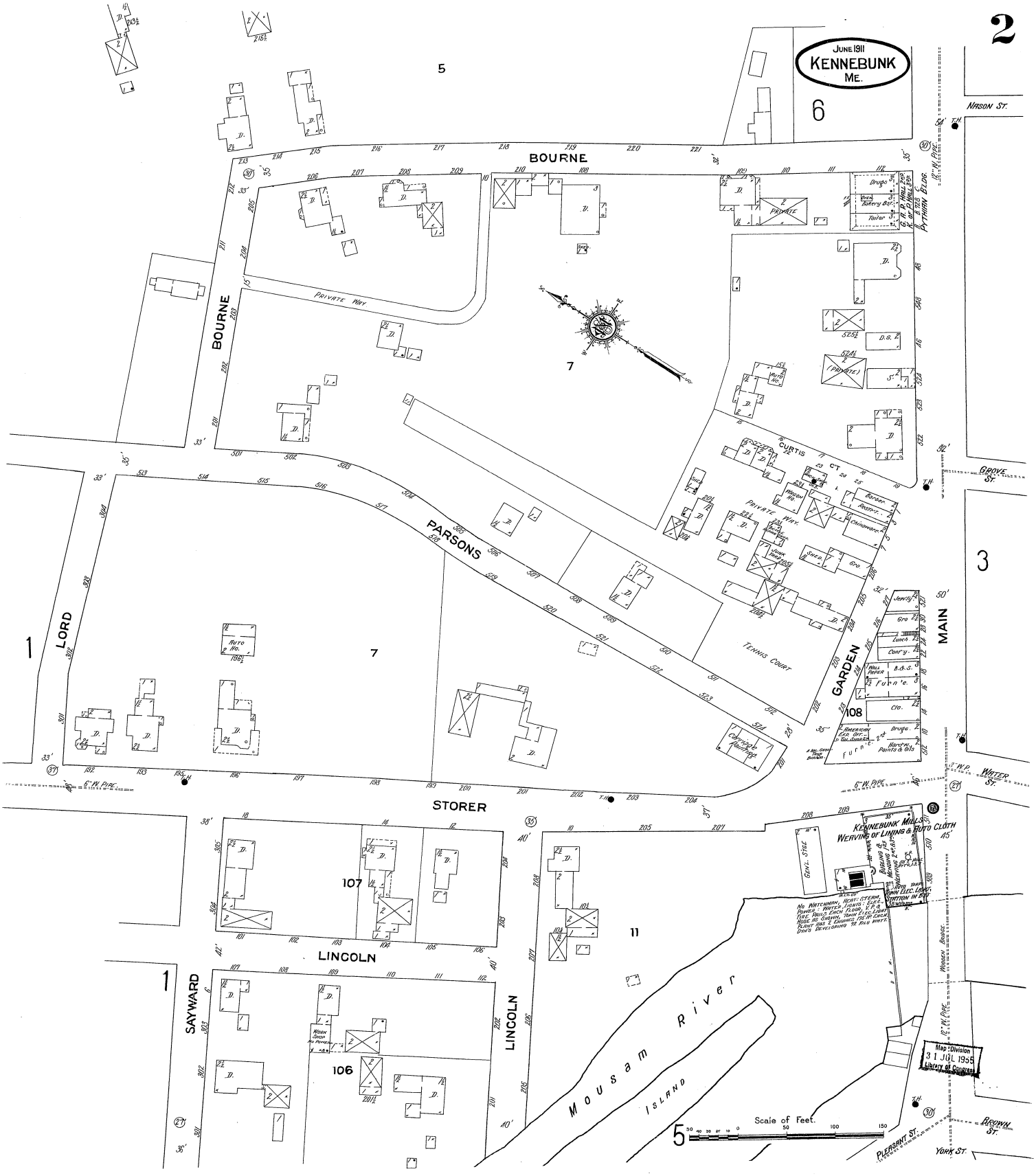

MAINE 504
2
2
AUG. 1926
KENNEBUNK
ME.
BERRY CT (LINCOLN)
LINCOLN ST.
ISLAND
STORER
PARSONS
LANE
COBB
CURTIS CT
GARDEN
MAIN
HIGH ST.
PLEASANT
YORK ST.
BROWN
MOUSAM RIVER
WATER
GROVE
KENNEBUNK LAUNDRY
TOWN ELEC. LIGHT PLANT & WATER DISTRIBUTING BOOSTER STA.
ODD FELLOWS BLK
ROSS BLOCK
WOOD SAWING
ELEC. MOTOR
MOTOR PUMP STA.
CONC. BRIDGE
Scale of Feet.
50 40 30 20 10 0 50 100 150
Copyright 1926 by the Sanborn Map Co.

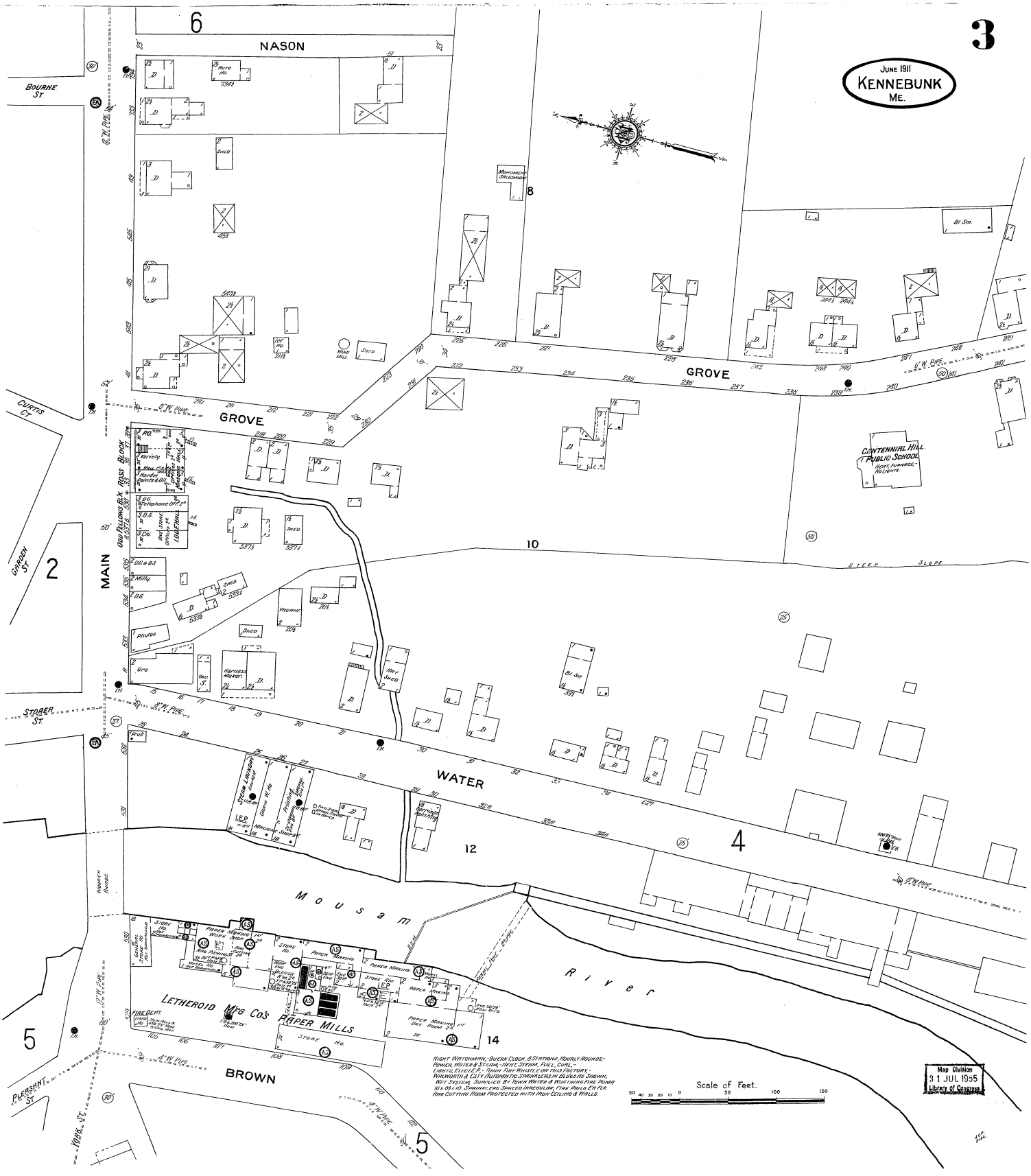

MAINE 504
93
(2797)
7
7
AUG. 1926
KENNEBUNK
ME.
SPLEASANT
CROSS
HIGH
YORK
FRIEND
BROWN
HOVEY
SWAN
MAIN ST.
MOUSAM RIVER
ISLAND
13A
13
13B
109
110
111
112
113
114
15
14
2
3
STORE 110
STORE HO
2 TUNN REP
ANTIQUE
AUTO SERVICE STA
AUTO STGE
LUMBER & BLDG MATERIALS
LUMBER SHED
ALEXANDER BURR - FLORIST
STORE HO
12" W. PIPE
6" W. PIPE
4" W. PIPE
8" W. PIPE
T.H.
FA
Scale of Feet.
50 40 30 20 10 0 50 100 150
Copyright 1926 by the Sanborn Map Co.


2
BERRY CT (LINCOLN)
LINCOLN ST.
Island
STORER
WORSTED CO.
KENNEBUNK DEPT. CLOTH MFG.
STOCK ROOM
SPINNING & WEAVING
BURLING & MENDING
GOODALL
TOWN ELEC LIGHT PLANT
WEAVING
STOCK ROOM
PLEASANT
HIGH ST.
CONC BRIDGE
YORK ST.
FIRE DEPT.
GENERATOR NO.
BROWN
Mousam River
KENNEBUNK LAUNDRY
PRINTING
ROGER FIBRE CO.
(FOR REPORT SEE SHEET No 3)
MAKING & DRYING DRUGS
SHEET & FIBRE CANS
BOILING DOWN ACID TANK
GRAIN & CEMENT MILL
WATER
WOOD SAWING
MAIN
ODD FELLOWS BLK.
ROSS BLOCK
HALL
HARDWARE WHSE NO.
GROVE
PARSONS
COBB LANE
CURTIS CT
GARDEN
108
HARDWARE & PAINTS
FURN.
Drugs
AWD PRINTING
7
8
11
12
14
10
4
3
Scale of Feet.
50 40 30 20 10 0 50 100 150
Copyright 1926 by the Sanborn Map Co.

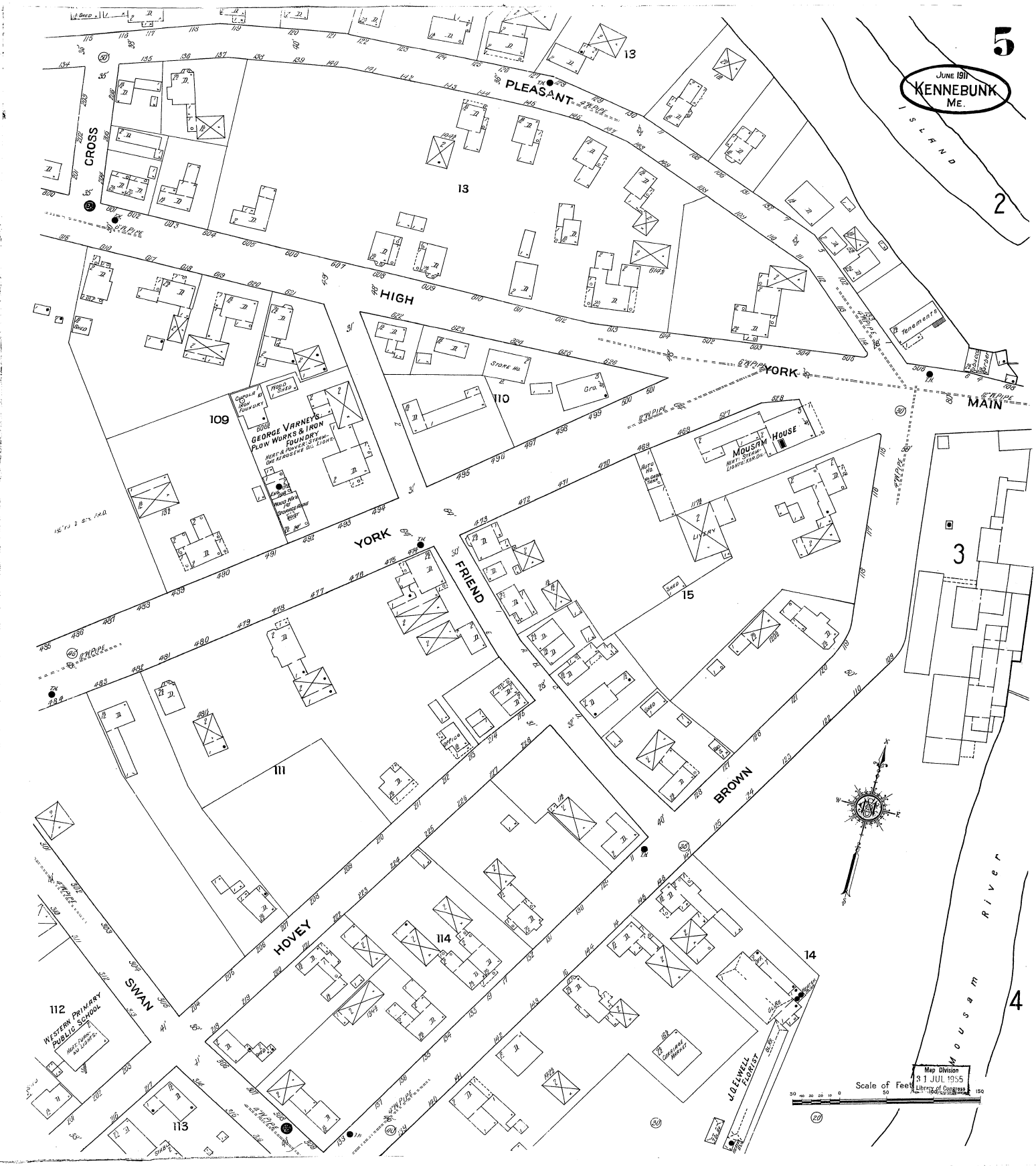
1926

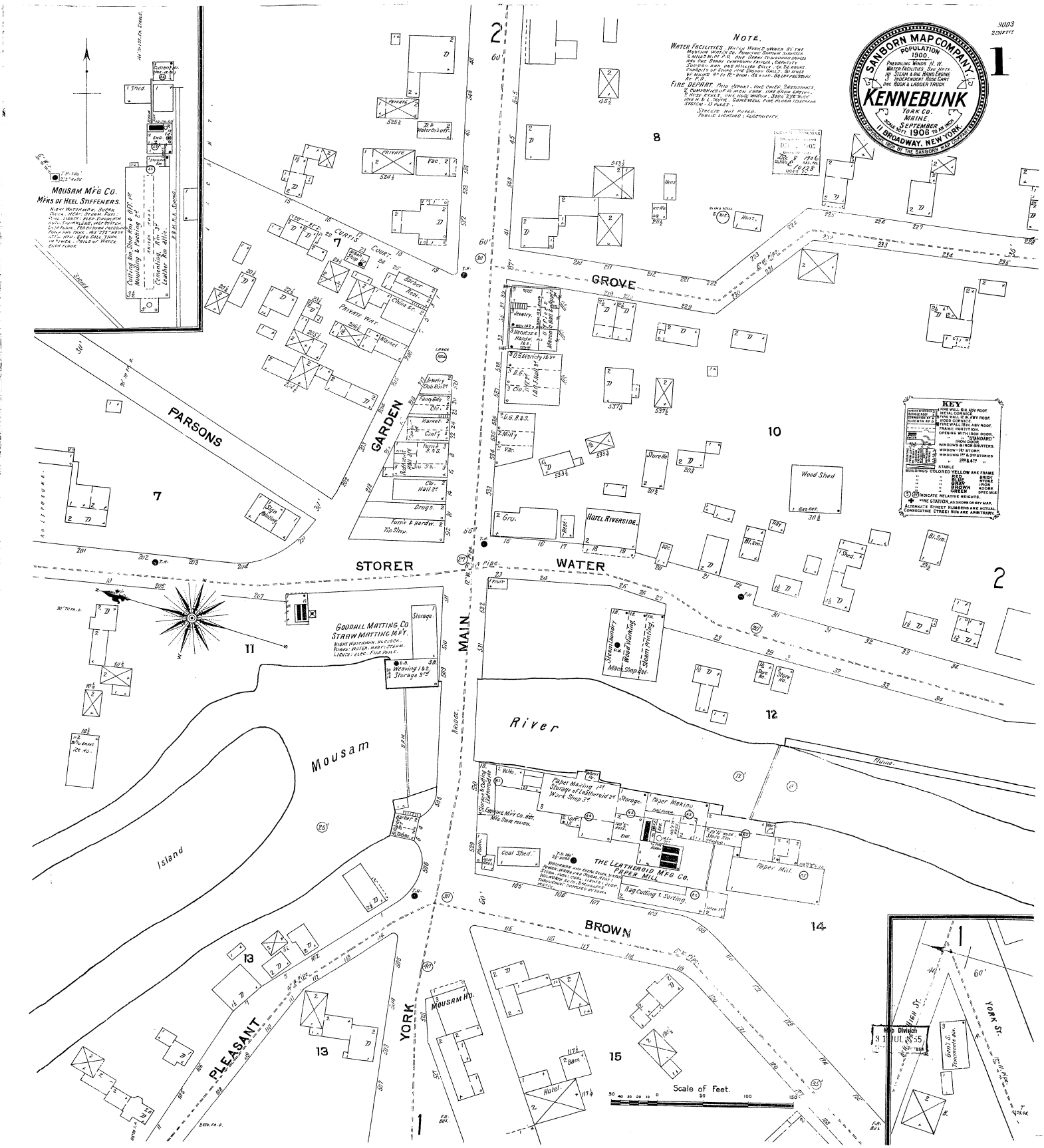

7
AUG. 1926
KENNEBUNK
ME.
(2797)
PLEASANT ST.
HIGH
YORK
FRIEND
BROWN
HOVEY
SWAN
CROSS
MAIN ST.
MOUSAM RIVER
ISLAND
13A
13
13B
109
110
111
112
113
114
15
14
2
3
STORE 110
STORE 110
STORE 110
STEVENS GARAGE
MOUSAM HOUSE
WESTERN PRIMARY PUBLIC SCHOOL
ALEXANDER BURR - FLORIST
12" W. PIPE
6" W. PIPE
4" W. PIPE
T.H.
FA
Scale of Feet.
50 40 30 20 10 0 50 100 150
Copyright 1926 by the Sanborn Map Co.


JUNE 1911
KENNEBUNK
ME.
2
5
6
7
3
1
11
BOURNE
NASON ST.
PRIVATE WAY
CURTIS CT
PARSONS
LORD
GARDEN
MAIN
GROVE ST.
WATER ST.
STORER
LINCOLN
SAYWARD
TENNIS COURT
107
108
106
KENNEBUNK MILLS
WEAVING OF LINING & AUTO CLOTH
Mousam River
ISLAND
PLEASANT ST.
BROWN ST.
YORK ST.
Scale of Feet.
Map Division
JUL 19 1955
Library of Congress

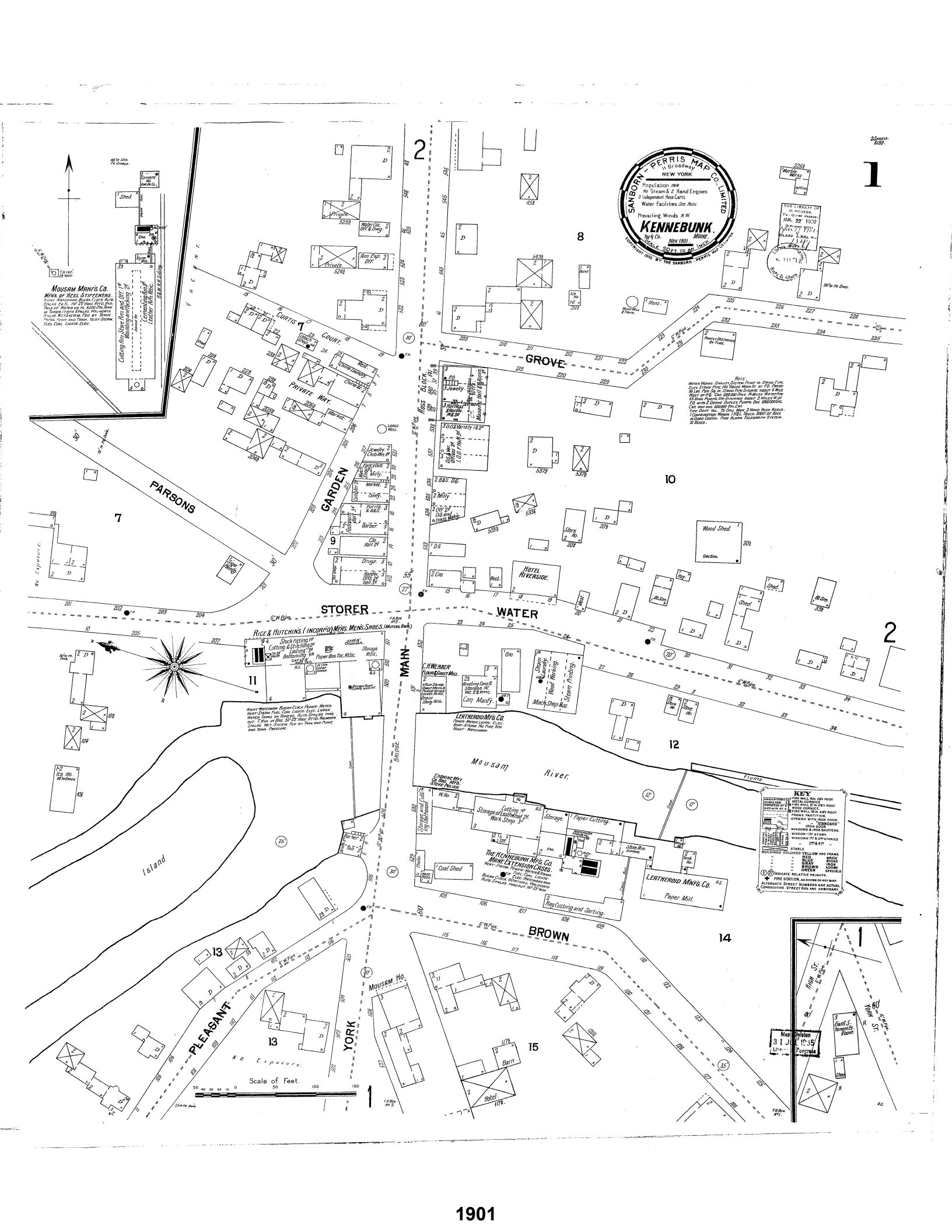

3
JUNE 1911
KENNEBUNK
ME.
NASON
GROVE
MAIN
WATER
BROWN
BOURNE ST.
CURTIS CT.
GARDEN ST.
STORER ST.
PLEASANT ST.
YORK ST.
ODD FELLOWS BLK
ROSS BLOCK
CENTENNIAL HALL
PUBLIC SCHOOL
LETHEROID Mfg Co's PAPER MILLS
STORE No.
PAPER MAKING
PAPER MAKING 1ST FLOOR
PAPER MAKING 2ND FLOOR
STEAM LAUNDRY
PRINTING
Mousam River
Scale of Feet.
Map Division
31 JUL 1955
Library of Congress

1911

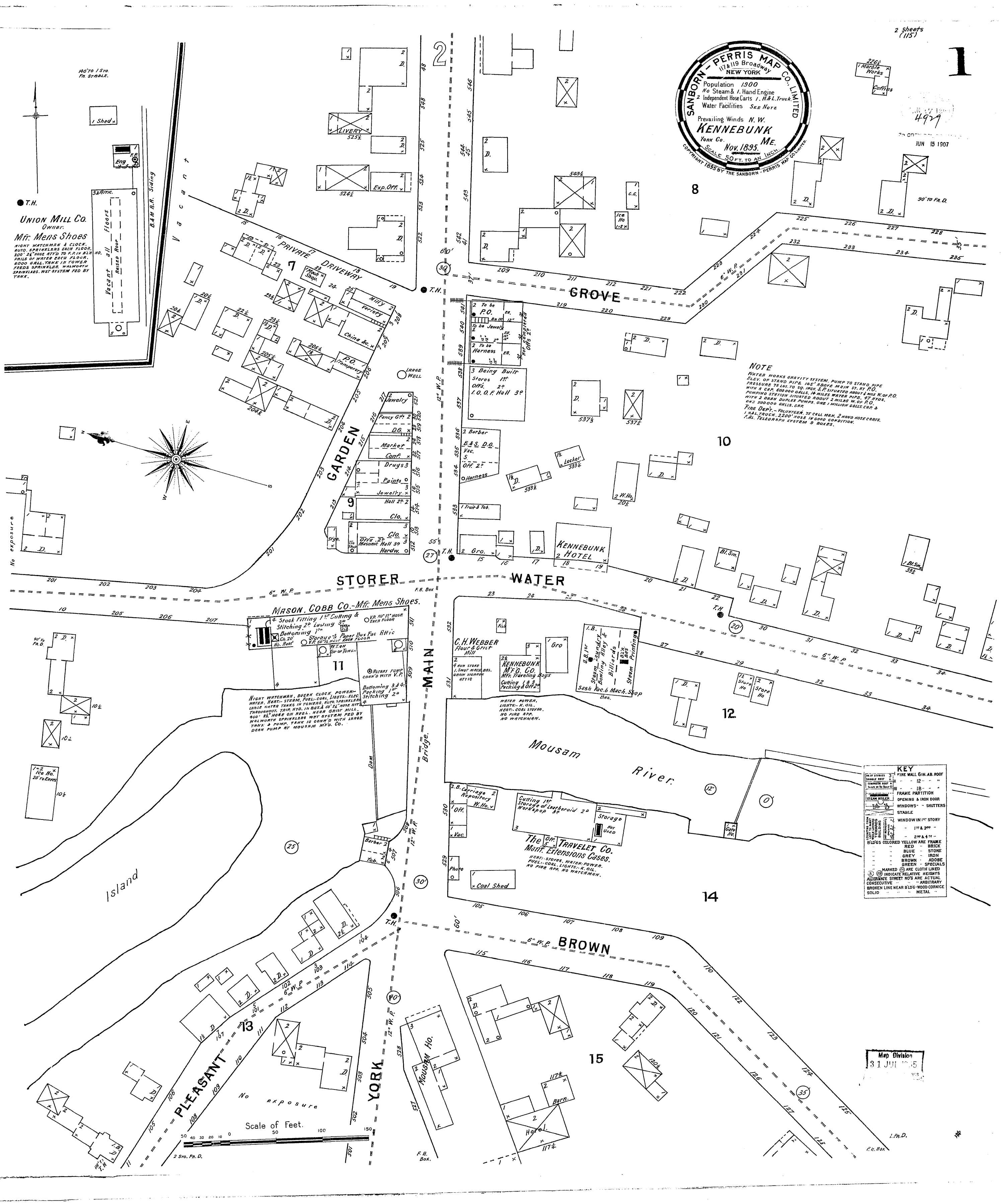

5
JUNE 1911
KENNEBUNK
ME.
PLEASANT
HIGH
YORK
MAIN
CROSS
FRIEND
BROWN
HOVEY
SWAN
GEORGE VARNEY'S
PLOW WORKS & IRON
FOUNDRY
MOUSAM HOUSE
WESTERN PRIMARY
PUBLIC SCHOOL
J.O. LEWELL
FLORIST
MOUSAM RIVER
ISLAND
Tenements
Scale of Feet
Map Division
31 JUL 1955
Library of Congress


SANBORN MAP COMPANY
POPULATION 1900
KENNEBUNK
YORK CO.
MAINE
SEPTEMBER 1906
11 BROADWAY, NEW YORK
1
NOTE.
KEY
MOUSAM MFG CO.
MFRS OF HEEL STIFFENERS.
GOODALL MATTING CO.
STRAW MATTING MFY.
THE LEATHEROID MFG CO.
PAPER MILL
HOTEL RIVERSIDE.
PARSONS
GARDEN
CURTIS COURT
GROVE
STORER
WATER
MAIN
BROWN
PLEASANT
YORK
River
Mousam
Island
Scale of Feet.

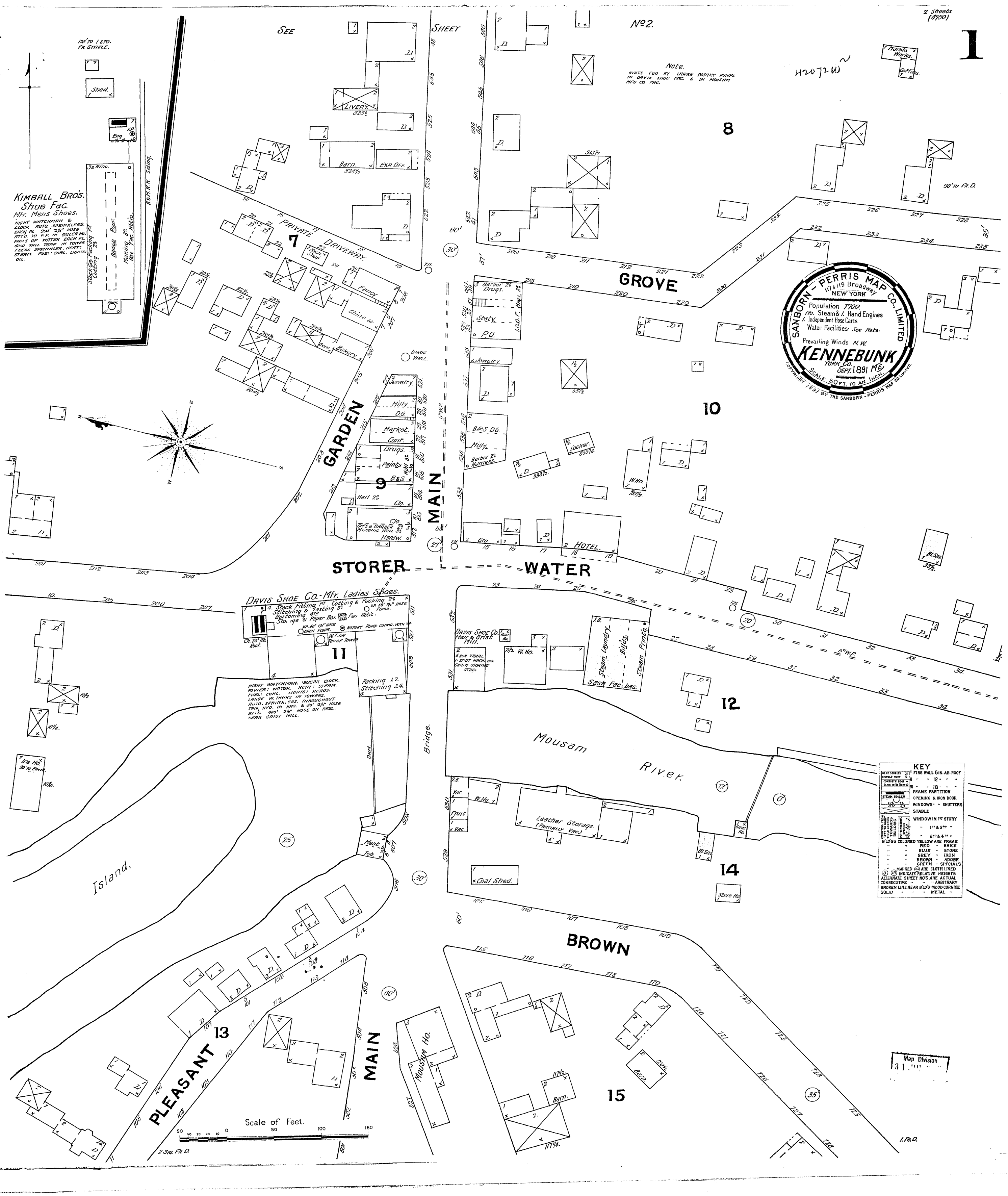
1906


SANBORN-PERRIS MAP CO. LIMITED
11 Broadway
NEW YORK
Population 2000
No Steam & 2 Hand Engines
2 Independent Hose Carts
Water Facilities See Note.
Prevailing Winds N.W.
KENNEBUNK.
York Co. MAINE.
Nov 1901.
SCALE 50 FEET TO AN INCH.
COPYRIGHT 1901 BY THE SANBORN-PERRIS MAP CO. LIMITED
MOUSAM MANF'G. CO.
MFRS. OF HEEL STIFFENERS.
GROVE
COURT
PRIVATE WAY
PARSONS
GARDEN
STORER
WATER
MAIN
BROWN
PLEASANT
YORK
HIGH ST.
HOTEL RIVERSIDE.
RICE & HUTCHINS (INCORP'D) MFRS. MENS. SHOES.
C.H. WEBBER FLOUR & CONST. MILL
LEATHEROID MF'G CO.
THE KENNEBUNK MF'G. CO. MAINE EXTENSION CASES.
LEATHEROID MF'G. CO.
Paper Mill.
Mousam River
Island
Flume
Barn
Hotel
Coal Shed
Mousam Ho.
No Exposure.
Scale of Feet.
KEY
Map Division 1935
Congress

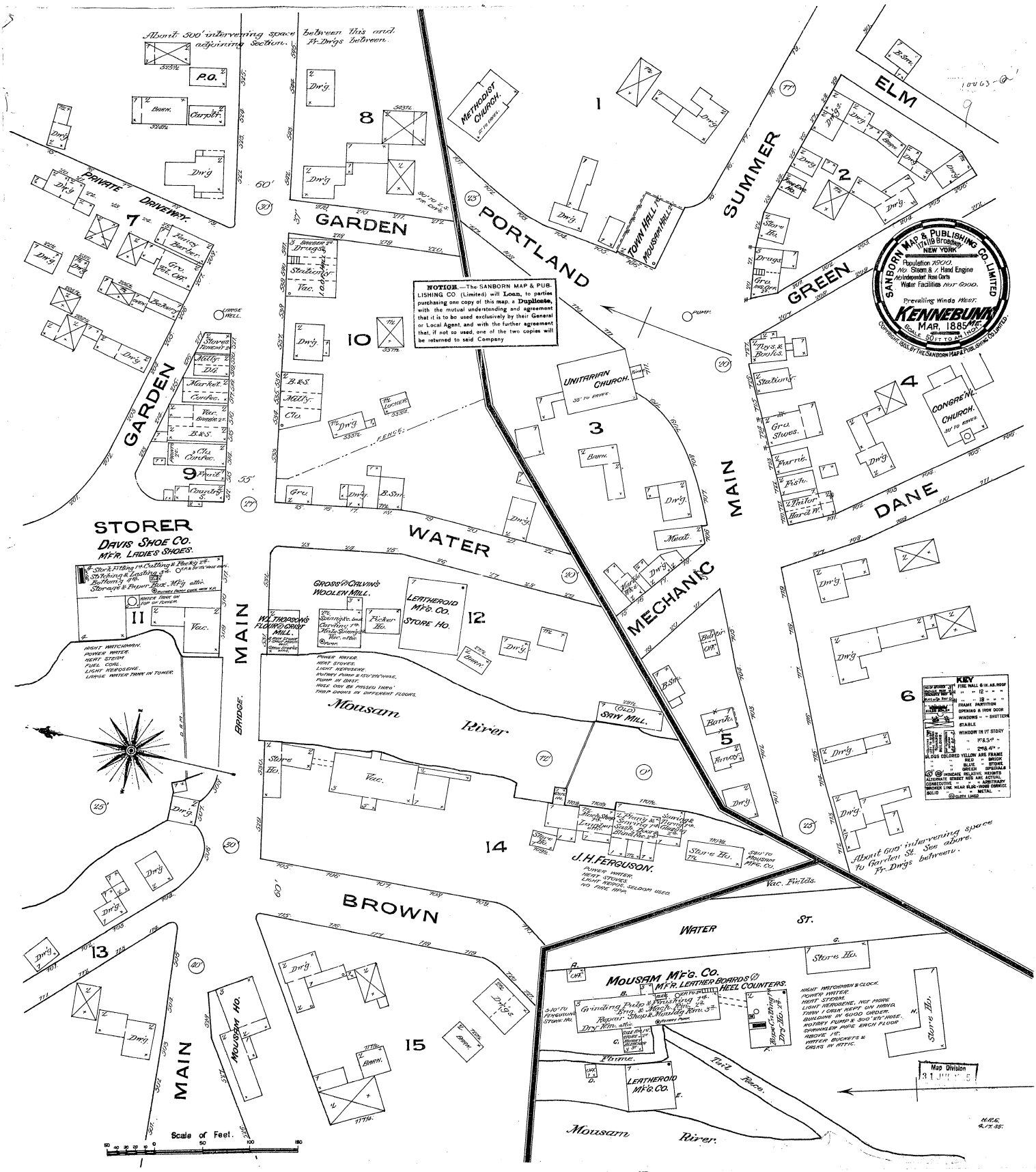
1901


SANBORN - PERRIS MAP CO. LIMITED
117 & 119 Broadway
NEW YORK
Population 1900
No Steam & 1. Hand Engine
2 Independent Hose Carts 1. H. & L. Truck
Water Facilities See Note
Prevailing Winds N. W.
KENNEBUNK
York Co. Me.
Nov. 1895.
Scale 50 Ft. to an Inch.
1
2 Sheets
UNION MILL CO.
Owner.
Mfr. Mens Shoes
MASON, COBB CO.-Mfr. Mens Shoes.
C. H. WEBBER
Flour & Grist Mill
KENNEBUNK MFG. CO.
Mfr. Traveling Bags
KENNEBUNK HOTEL
The TRAVELET Co.
Manf. Extensions Cases.
Livery
Exp. Off.
P.O.
I.O.O.F. Hall
Masonic Hall
Bowling Alley
Billiards
Sash Fac. & Mach. Shop
Carriage Repository
Coal Shed
Ice Ho.
B. & M. R.R. Siding
Vacant
PRIVATE DRIVEWAY
GROVE
GARDEN
STORER
WATER
MAIN
BROWN
PLEASANT
YORK
Mousam River
Island
Dam
Bridge
NOTE
No exposure
Scale of Feet.
KEY
Map Division

1895


1
2 Sheets (1750)
See Sheet No 2.
Note.
H2072W
Sanborn-Perris Map Co. Limited
117 & 119 Broadway New York
Population 7700.
No. Steam & 1. Hand Engines
1. Independent Hose Carts
Water Facilities: See Note.
Prevailing Winds N.W.
KENNEBUNK
York Co. Sept. 1891 Me.
Scale 50 Ft. to an Inch.
Copyright 1891 by the Sanborn-Perris Map Co. Limited
Kimball Bro's. Shoe Fac.
Mfr. Mens Shoes.
Davis Shoe Co. Mfr. Ladies Shoes.
Davis Shoe Co. Flour & Grist Mill.
Private Driveway
GROVE
GARDEN
MAIN
STORER
WATER
BROWN
PLEASANT
Mousam River.
Island.
Bridge.
Dam.
Livery
Barn.
Exp. Off.
China &c.
Bakery
Fancy
Jewelry.
Milly.
Market.
Drugs.
Paints
Hall 2d.
Clo.
Hardw.
Masonic Hall 3d.
Barber 2d. Drugs.
Staty.
P.O.
Jewelry
Barber 2d. Harness
Locker.
Hotel.
Gro.
W.Ho.
Steam Laundry
Steam Print'g.
Sash Fac. bas.
Leather Storage (Partially Vac.)
Coal Shed.
Store Ho.
Meat.
Tob.
Fruit
Vac.
Ice Ho.
Mousam Ho.
Marble Works.
Coffins.
Shed.
Eng.
Stitching 4th.
Packing 1st. Stitching 3d.
7
8
9
10
11
12
13
14
15
KEY
Scale of Feet.
50 40 30 20 10 0 50 100 150
Map Division

1891


About 300' intervening space between this and adjoining Section. Ft. Drgs between.
P.O.
Barn.
Carpt.
Drg.
PRIVATE DRIVEWAY
GARDEN
METHODIST CHURCH. 30" to eaves
PORTLAND
TOWN HALL
MOUSAM HALL
SUMMER
ELM
GREEN
NOTICE.—The SANBORN MAP & PUBLISHING CO. (Limited) will Loan, to parties purchasing one copy of this map, a Duplicate, with the mutual understanding and agreement that it is to be used exclusively by their General or Local Agent, and with the further agreement that, if not so used, one of the two copies will be returned to said Company
SANBORN MAP & PUBLISHING CO. LIMITED
11 to 19 Broadway
NEW YORK
Population 2900.
No Steam & 7 Hand Engine
No Independent Hose Carts
Water Facilities NOT Good.
Prevailing Winds West.
KENNEBUNK
MAR, 1885
SCALE 50 FT TO AN INCH.
COPYRIGHT, 1885, BY THE SANBORN MAP & PUB. SHING CO. LIMITED.
UNITARIAN CHURCH. 35" to eaves
CONGRE'NL. CHURCH. 30" to eaves
STORER
DAVIS SHOE CO.
MF'R. LADIES SHOES.
MAIN
WATER
MECHANIC
DANE
BRIDGE
Mousam River
GROSS & CALVIN'S WOOLEN MILL.
W.L. THEBOCKIS FLOUR & GRIST MILL.
LEATHEROID MF'G. CO. STORE HO.
SAW MILL.
J.H. FERGUSON.
BROWN
WATER ST.
MOUSAM MF'G. CO.
MF'R. LEATHER BOARDS & HEEL COUNTERS.
Flume.
Tail Race.
LEATHEROID MF'G. CO.
MOUSAM HO.
Vac. Fields.
Scale of Feet.
KEY
Map Division
1885

APPENDIX C – LOGS OF TEST BORINGS

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Kennebunk Bridge Replacement
Location: Kennebunk, ME

Boring No.: BB-KMR-301
PIN: 15098.00

Driller:	Maine Test Boring	**Elevation (ft.)**	49.2	**Auger ID/OD:**	NA
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Split
Logged By:	Eric Baron	**Rig Type:**	Mobile B 53 Truck Rig	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	06/02/10-06/02/10	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ
Boring Location:	Sta. 14+40, 12.5' L	**Casing ID/OD:**	3"/3.5"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							Auger		Asphalt.	
	1D	18/14	1.4 - 2.9	20-29-24	53	53		47.8	1.4 Brown, dry, very dense, gravelly fine to coarse SAND, trace Silt. -FILL-	
									Brown/dark brown, layered, dry, medium dense, fine to coarse SAND, little Gravel, trace Silt, layering of fine to coarse sand and fine sand. -FILL-	
	2D	24/24	3.0 - 5.0	13-13-9-9	22	22				
5	3D	24/21	5.0 - 7.0	4-5-4-5	9	9	8	44.2	5.0 Top 3": Brown, moist, loose, fine to medium SAND, layered with Sandy Clay. Bottom 18": Gray/brown, moist, stiff, lean CLAY, some fine to medium Sand, trace Gravel, appeared reworked. -FILL-	
							6			
	4D	24/16	7.0 - 9.0	4-3-8-9	11	11	10			CL/A-6/IV
							13		Gray/brown, moist, stiff, fine to medium Sandy CLAY. -FILL-	
	5D	24/8	9.0 - 11.0	5-4-3-4	7	7	15	39.9	Top 4": Gray/brown, moist, medium stiff, fine to coarse Sandy CLAY.	
10							9		9.3 Bottom 4": Gray, moist, loose, silty fine SAND, poorly graded, non plastic, organic fibers within.	
	6D	24/9	11.0 - 13.0	4-2-2-3	4	4	10	37.5	Top 7": Blue/gray, medium stiff, fine to coarse silty SAND, brick fragments within.	SM/A-4/II
							12	37.3	11.7 Horizontal grained wood in tip.	
	7D	19/9	13.0 - 14.6	2-1-46-50/0.1'	47	47	15	36.2	11.9 Apparent void from 11.9' to 13.0'.	
								36.0	13.0 Top: Horizontal grained wood.	
15									13.2 Bottom: Light gray/white, moist, medium SAND, little Silt, probable voids. -FILL-	SM/A-1-b/0
	8D	24/8	15.0 - 17.0	8-4-3-3	7	7	18		Gray, wet, medium dense, fine to coarse SAND, some Gravel, little Silt. -FILL-	
							20			SM/A-1-b/0
	9D	24/10	17.0 - 19.0	1-1-25-7	26	26	21	31.5	Top 8": Gray, wet, very loose, medium SAND, little Silt, trace Gravel. Probable voids from 17 to 17.7'. 1911 penny in recovery.	
							35	31.3	17.7	
	10D	7/1	19.0 - 19.6	30-50/0.1'			RC	29.6	Bottom 2": Wood, horizontal grained.	
20									17.9 Piece of Gravel/ledge.	
								28.2	19.6 Rolled to 21' below ground surface. Consistent resistance indicates probable bedrock from 19.6 to 21.0'.	
									21.0 **Bottom of Exploration at 21.00 feet below ground surface.**	
25										

Remarks:

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

R.W. Gillespie & Associates, Inc.
Geotechnical Engineering•Geohydrology•Materials Testing Services

Project: Sink Hole Evaluation
Location: Kennebunk, Maine
Client: Town of Kennebunk
Project No. 317-04

Boring Log: B-2
Surface Elevation:
Observed Water Depth: 10
Date Completed: 10/18/04

DEPTH, FT.	SYMBOL	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
0				ASPHALTIC PAVEMENT (8 inches).					
			S-1	GRAVELLY SAND (SW); Very dense, damp, gravelly sand, trace silt, brown.	19	18 38 21	59		
			S-2	GRAVELLY SAND (SW); Very dense, damp, gravelly sand, little to trace silt, lenses of brown and dark gray-brown soil.	16	17 23 30 29	59		
5			S-3	SAND WITH SILT AND GRAVEL (SM); Medium dense, damp, sand, little silt and gravel, brown.		24			
			S-4	-FILL-	14	9 6 5	4		
			S-5	SILTY SAND (SM); Medium dense to loose, moist, medium to fine sand, some silt, trace gravel, gray-brown.	21	6 3 3	5		
10			S-6	SILTY SAND WITH CLAY (SM); Very loose, wet, silty sand, little clay and gravel, with pieces of brick, trace organics, gray.	7	2 2 2 1 1 1	2		
15			S-7	SILTY SAND WITH CLAY (SM); Loose, wet, silty sand, little clay, trace gravel, gray with pieces of angular rock and light-colored wood fibers. -FILL IN PROBABLE VOID-	4	1 2 3 2	5		
20				Auger resistance indicates coarse-grained soil at 20'. -PROBABLE GLACIAL TILL-					
25				Very hard auger resistance at 24'. -PROBABLE WEATHERED ROCK-					
				Bottom of Exploration at 25'; Not refusal. Borehole backfilled with granular soil, tamped, and layer of cold patch asphalt place to ground surface.					
30									
35									

R.W. Gillespie & Associates, Inc.
Geotechnical Engineering • Geohydrology • Materials Testing Services

Project: Sink Hole Evaluation
Location: Kennebunk, Maine
Client: Town of Kennebunk
Project No. 317-04

Boring Log: B-5
Surface Elevation:
Observed Water Depth: 14
Date Completed: 10/18/04

DEPTH, FT.	SYMBOL	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
0			S-1	ASPHALTIC PAVEMENT (2 inches). GRAVELLY SAND (SW); Medium dense, damp, gravelly sand, trace silt, brown.	19	11 18 13 11	21		
5			S-2		5	1 1	3		
			S-3	SILTY SAND (SP); Very loose, wet, medium to fine sand, little silt, dark brown, occasional rock fragments and seams of black soil, brown, grading at 7.5' to very loose, wet, silty fine sand, little clay, dark brown and gray, with particles of ceramic pipe. -FILL-	12	2 2 2 1 1 1	2		
10			S-4		8	48 11 5 13/3"	16+		
				SILTY CLAY (CL); Stiff, wet, silty clay, gray. Wood layer from approximately 11.6' (Spoon refusal at 11.7').		50/0"			
				SAND (SP); Very loose, wet, medium to fine sand, brown and dark brown. -FILL IN PROBABLE VOID-					
15			S-5		16	2 10 15 13	25		
				Wood layer from approximately 17.7' to 17.8'.					
20				SILTY SAND WITH GRAVEL (SM); Medium dense to dense, wet, silty sand, little gravel and clay. -GLACIAL TILL-					
				Bottom of Exploration at 19'; Not refusal. Borehole backfilled with granular soil, tamped, and layer of cold patch asphalt placed to ground surface.					
25									
30									
35									

APPENDIX D – 2004 GEOPHYSICAL INVESTIGATION REPORT

APPENDIX D – 2004 GEOPHYSICAL INVESTIGATION REPORT

F C9292

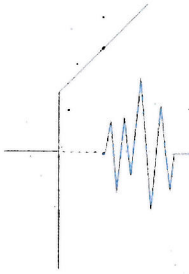
GPR SINKHOLE INVESTIGATION

US RT 1
KENNEBUNK, MAINE

Prepared for

KENNEBUNK PUBLIC WORKS

OCTOBER, 2004



NDT CORPORATION

NDT CORPORATION

October 11, 2004

Mr. Michael Clause
Kennebunk Public Works
1 Summer Street
Kennebunk, Maine 04043

Dear Mr. Clause:

In accordance with authorization to proceed, NDT Corporation conducted ground penetrating radar (GPR) measurements in both the North and Southbound lanes of US Route 1 between Brown Street and the Mousam River Bridge. The Purpose of the GPR investigation was to identify the presence and extents of soil settlement indicative of developing sinkholes that may exist in this area. Fieldwork was conducted on October 6, 2004. This report presents the results and findings of our investigation.

METHOD OF INVESTIGATION

Survey Control

The general location of the GPR survey is shown on Figure 1. Figure 2 is a sketch plan of the site showing the location of GPR lines and results of the survey. GPR lines were referenced to a fire hydrant along the western curb/sidewalk of Route 1 across from the intersection of Brown Street. Forty-eight cross lines were collected(24 at 60 nanoseconds and 24 at 120 nanoseconds); the first of these was located 15 feet south of the hydrant and subsequent lines were collected at a 5 foot spacing for 100 feet North of the hydrant. Cross lines began at the west edge of the western sidewalk and ended near the eastern edge of the eastern sidewalk. Five longitudinal lines (western curb, middle of southbound lane, centerline, middle of northbound lane and western curb) of data were also collected along Route 1 from North to South (100 feet North of the hydrant to 15 feet South of the hydrant) beginning 100 feet north of the hydrant and ending 15 feet south of the hydrant.

67 MILLBROOK STREET, WORCESTER, MA 01606 Tel (508) 754-0417 Fax (508) 754-0418

Ground Penetrating Radar (GPR)

GPR data were acquired using a digital system coupled with a 400 MHz antenna. The GPR method uses a pulsed electromagnetic signal that is transmitted to and reflected by a target back to the point of transmission. The electromagnetic wave transmission and reflection is dependent on the dielectric constant and conductivity (electrical) properties of the material(s) being investigated. These electrical properties are highly dependent on moisture content, saturated or concentrated moist conditions provide both strong reflections and high attenuation. A detailed discussion of the GPR Survey Method is included in Appendix 1.

DISCUSSION OF RESULTS

Indicators of sinkhole and/or soil settlement using GPR are: 1) sloping or draped marker layers, 2) broken or disturbed marker layers, 3) areas of high conductivity/high moisture content relative to sandy host materials, and/or 4) areas of low conductivity/low moisture content relative to silty/clay host materials. Filled utility trenches and old excavations may have similar characteristics; therefore the data was correlated to known utility locations painted on the road previous to the investigation. A highly conductive layer at approximately 15 nanoseconds (2.5 to 3 feet in depth) was used as a marker layer for this investigation. At this site the GPR investigation had an approximate depth of penetration of 10 to 15 feet, and detected the buried water line, and indications of subsidence.

Figure 2 shows two types of anomalies associated with soil subsidence and possible sinkhole development marked on each individual GPR line;

1) Marked as purple ovals on Figure 2, GPR data at these locations indicate disturbances in the soil layering, such as dipping or broken layers. These disturbances may also be abandoned utility trenches, reworked soil for road construction or previously filled sinkholes.

2) Marked as orange squares on Figure 2, GPR data at these locations indicate higher moisture content in soils at depths at or greater than 7.5 feet. Higher moisture conditions may be the result of loose soil conditions caused by soil settlement or may be saturated timbers (sluiceway).

Two areas, marked as red on Figure 3, have been delineated as areas GPR data indicates there may be soil subsidence and possible sinkhole development. Area 1 extends from approximately 10 feet north of the fire hydrant to approximately 35 feet north of the fire hydrant, and extends the width of the road. This area, in the general location of the clay drain pipe and encompasses the previous sinkhole, is characterized by dipping and broken layering. Area 2 extends from 50 feet north of the fire hydrant to approximately 80 feet north of the fire hydrant and extends the width of the road. This area is characterized by dipping and broken layering over areas of high moisture content. It is believed due to the location and characteristics of the anomalies in this area that the old wooden sluiceway may be located in this area as delineated by the dashed black lines on Figure 3.

The results of the GPR investigation should be verified and therefore NDT recommends that several locations be sampled with a split spoon probe.

1) 12 Feet North of hydrant and 15 feet East of west edge of sidewalk
2) 22 Feet North of hydrant and 36 feet East of west edge of sidewalk
3) 72 Feet North of hydrant and 36 feet East of west edge of sidewalk
4) 80 Feet North of hydrant and 25 feet East of west edge of sidewalk

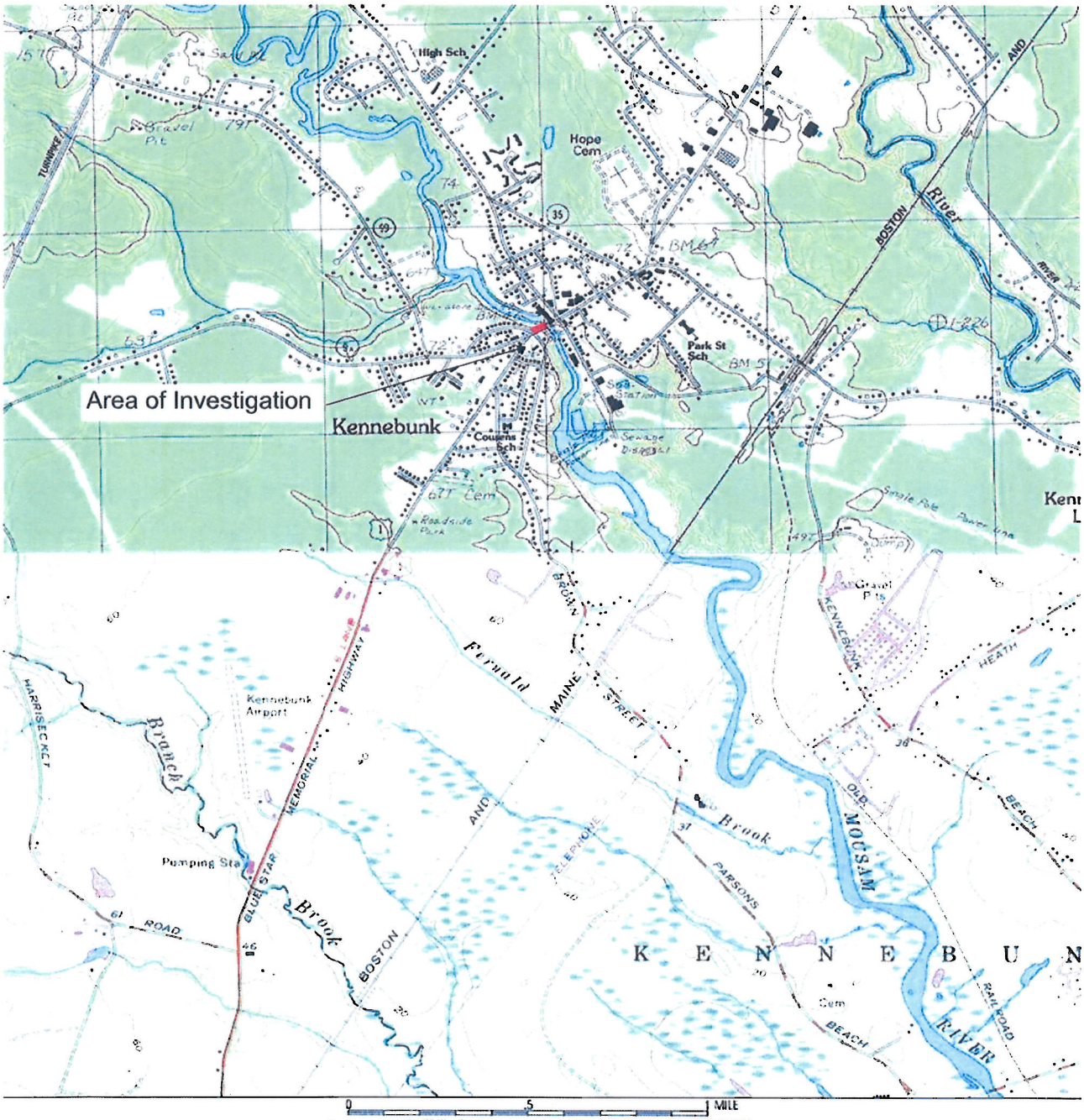
A separate location should also be sampled outside of the reported settlement areas to use as a baseline for the other test locations. It is recommended that these probes extend for at least 10 feet of depth.

If you have any questions, please contact the undersigned at 508-754-0417.

Sincerely,
NDT CORPORATION

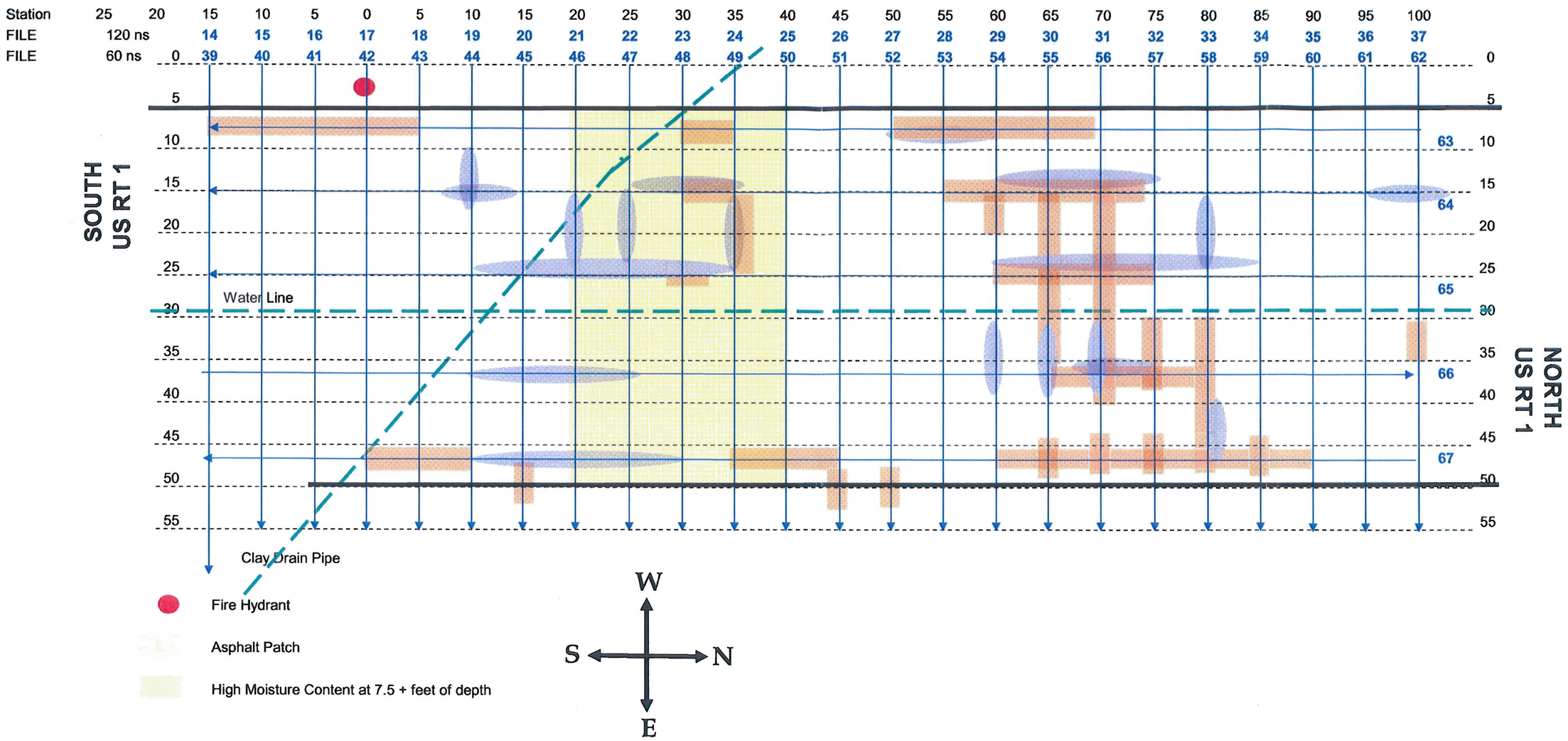
Paul S. Fisk

FIGURES



Map created with TOPO!® ©2003 National Geographic (www.nationalgeographic.com/topo)

GPR SINKHOLE INVESTIGATION US RT 1 KENNEBUNK, MAINE FOR KENNEBUNK PUBLIC WORKS By NDT CORPORATION	AREA OF INVESTIGATION	
	Oct. 2004	Figure 1



Fire Hydrant

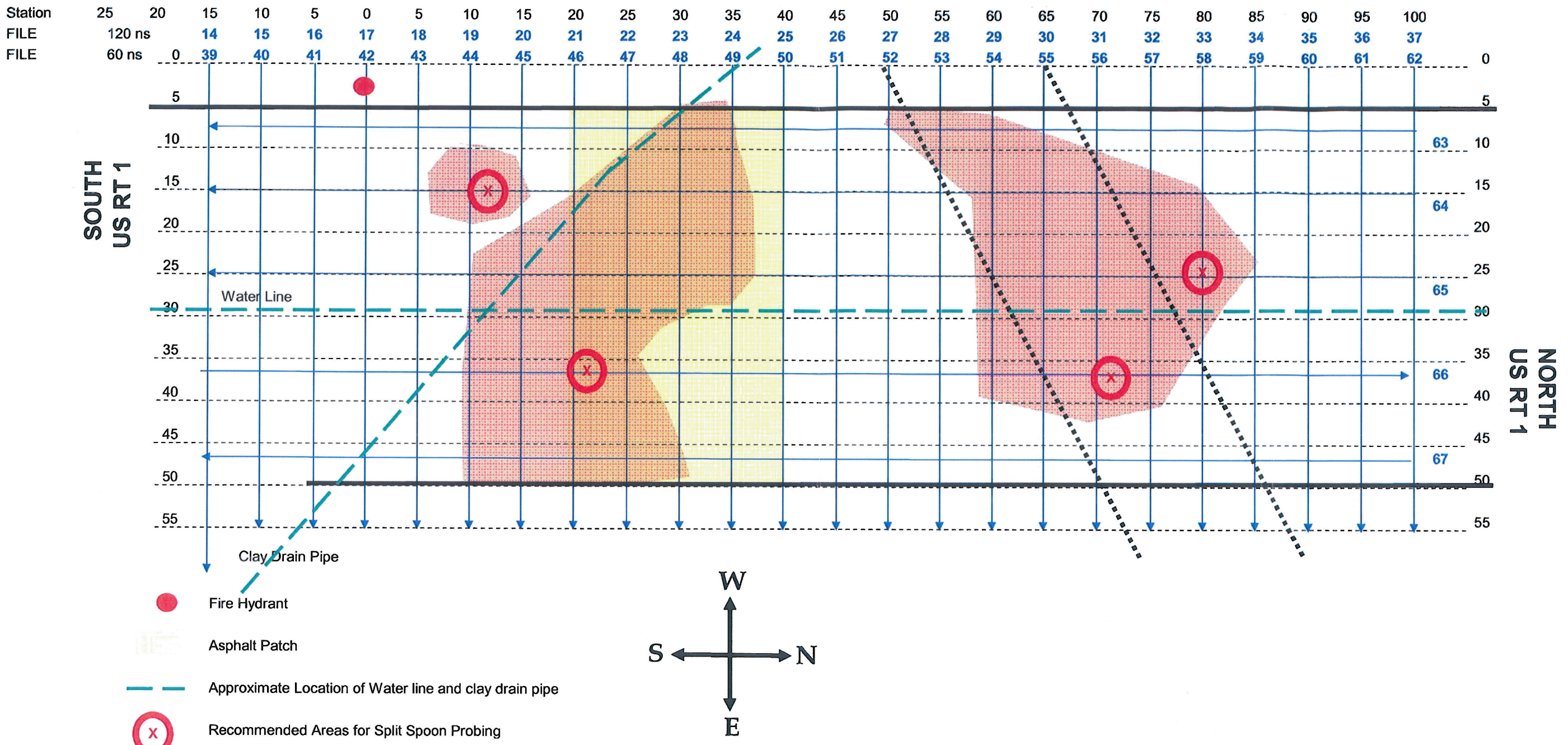
Asphalt Patch

High Moisture Content at 7.5 + feet of depth

Dipping and Broken Layering

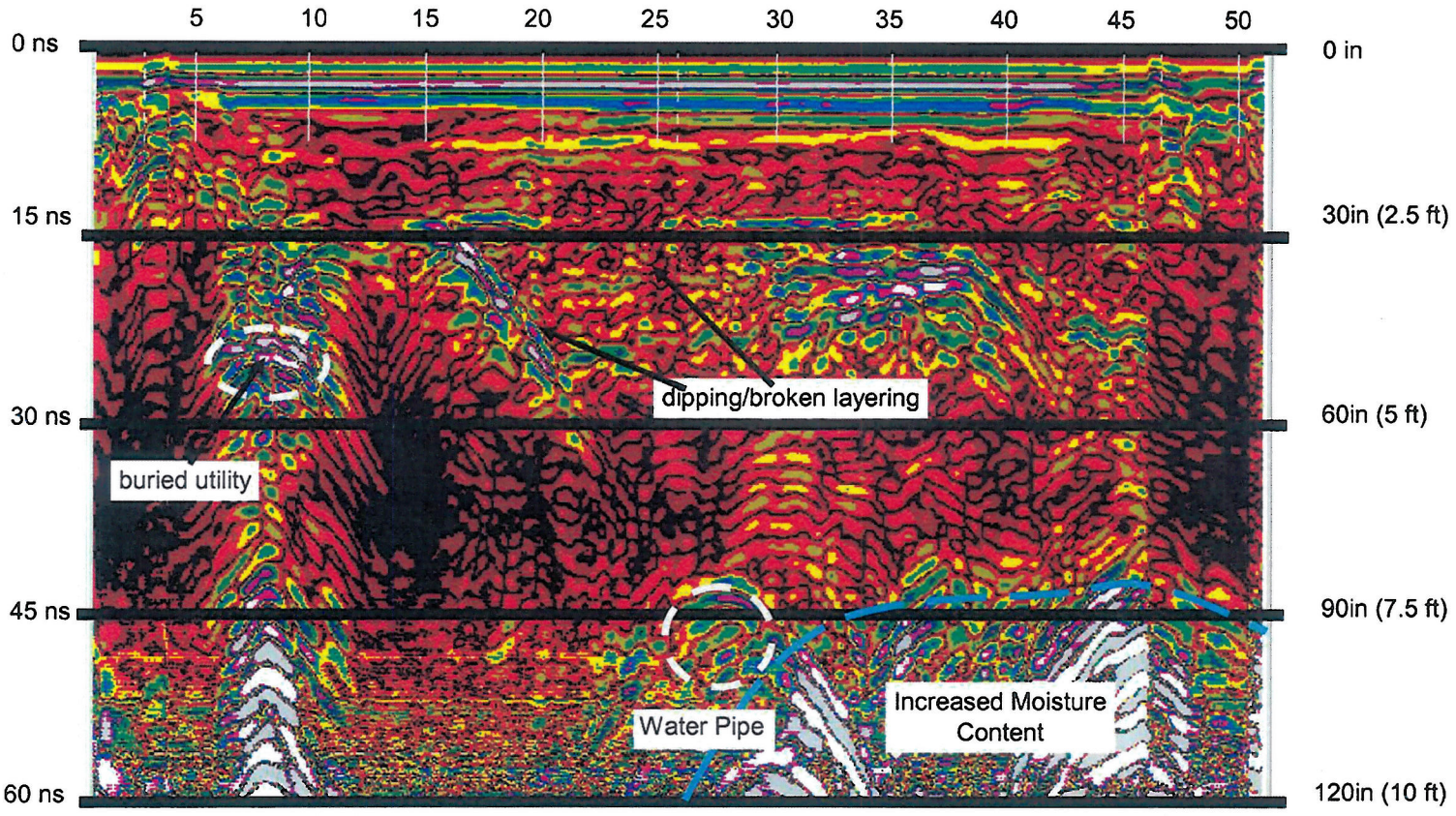
Approximate Location of Water line and clay drain pipe

GPR SINKHOLE INVESTIGATION US RT 1 KENNEBUNK, MAINE FOR KENNEBUNK PUBLIC WORKS By NDT CORPORATION	GPR COVERAGE AND RESULTS	
	Oct. 2004	Figure 2

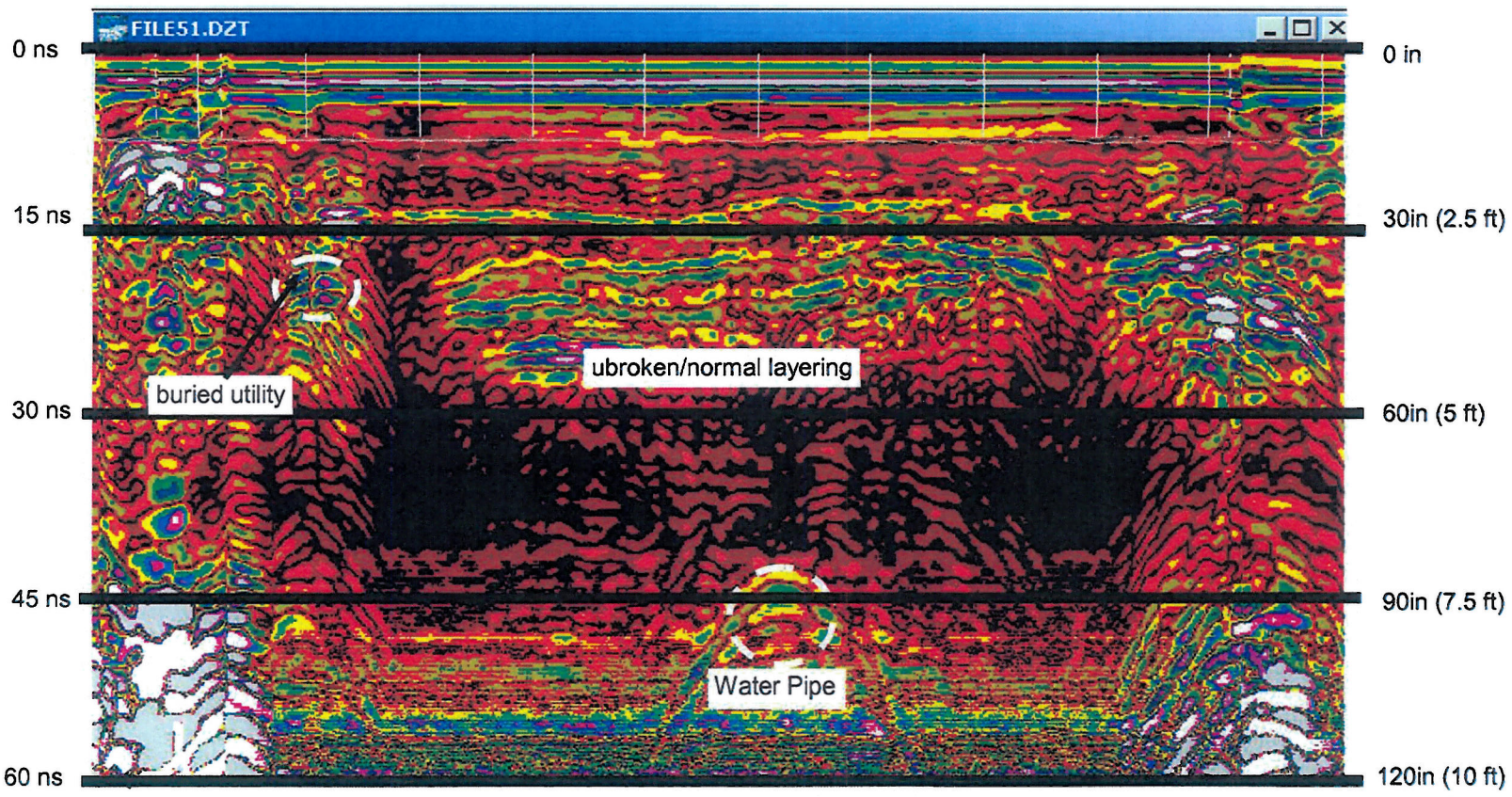


GPR SINKHOLE INVESTIGATION US RT 1 KENNEBUNK, MAINE FOR KENNEBUNK PUBLIC WORKS By NDT CORPORATION	INTERPRETATION OF GPR RESULTS	
	Oct. 2004	Figure 3

File 58 West to East Cross Line
80 Feet North of Hydrant



File 51 West to East Cross Line
45 Feet North of Hydrant



GPR SINKHOLE INVESTIGATION US RT 1 KENNEBUNK, MAINE FOR KENNEBUNK PUBLIC WORKS By NDT CORPORATION	ANNOTATED GPR RECORDS	
	Oct. 2004	Figure 4

APPENDIX

GROUND PENETRATING RADAR

APPENDIX: GROUND PENETRATING RADAR

Ground Penetrating Radar (GPR) is an electrical geophysical method for evaluating subsurface conditions by transmitting high frequency electromagnetic waves into the ground and detects the energy reflected back to the surface. Electromagnetic signals are transmitted from the antenna (transmitter and receiver) at ground surface and reflected back to the antenna from interfaces with differing electrical (dielectric constant and conductivity) properties. The greater the contrast in the electrical properties between two materials, the more energy that is reflected to the surface and the more defined results are.

GPR reflections typically occur at subsurface discontinuities such as:

- Buried metal objects (utilities, tanks, reinforcing)
- Open and Water filled voids
- Water table
- Soil stratification
- Seepage paths
- Bedrock Fractures

The depth of penetration of GPR is site specific, limited by the attenuation of the electromagnetic energy. Signal attenuation is controlled by four different mechanisms:

- Scattering: energy losses due to scattering occur when signals are dispersed in random direction, away from the receiving antenna, by large irregular shaped objects, such as boulders, tree stumps and closely spaced rebar.
- High conductivity layers: the greater the conductivity values of materials at a site, the more signal attenuation or less penetration. (mineral content, high moisture content, water table, metal plates, etc.)
- Water/Moisture Content: water molecules polarize in the presence of the applied electromagnetic field. Electromagnetic energy is lost to the radar system when it is converted to kinetic and thermal energy.
- Clays, (Ion content): ions along clay surfaces polarize in the presence of the applied electromagnetic field. Electromagnetic energy is lost to the radar when it is converted to kinetic and thermal energy.

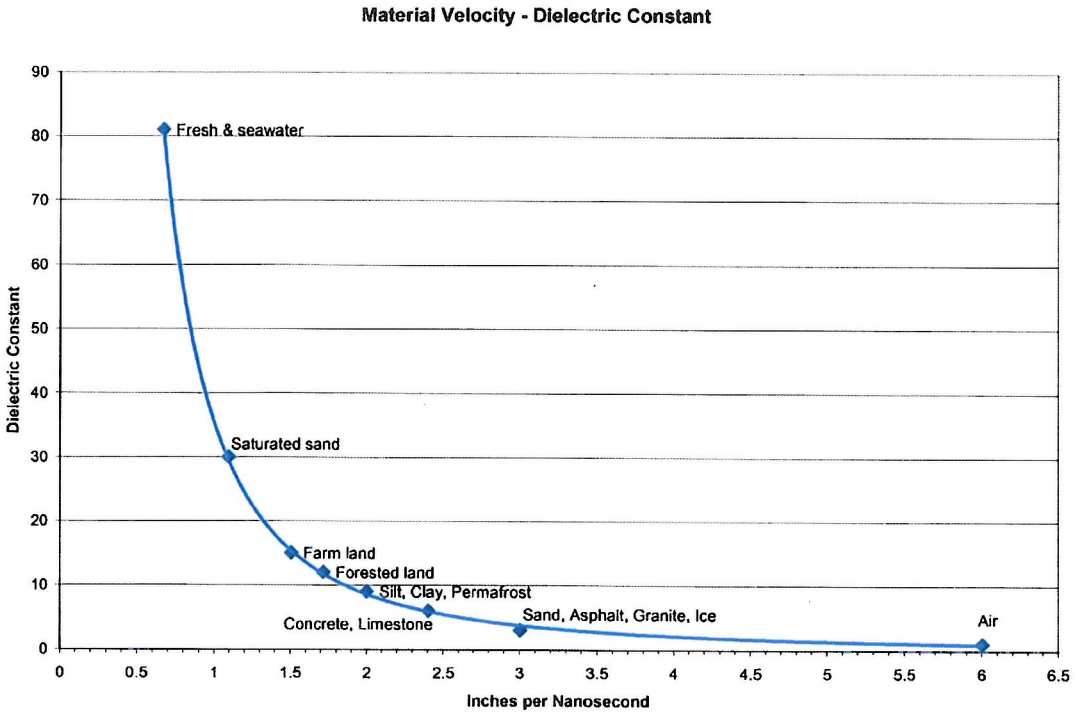
An onsite calibration should be conducted so that the velocity for the materials and the depth of penetration can be determined. Sites can be electrically variable so it may be necessary to conduct multiple onsite calibrations.

Signal penetration is also dependent on the frequency of the antenna. High frequency antennas have shallow penetration and high resolution. A 1500 MHz high frequency antenna has an approximate depth of penetration of 1.5 feet and is able to identify wire mesh. Low frequency antennas have lower resolution and deeper depth of investigation. A 400 MHz antenna is capable of penetrating 10 to 15 feet in dry soils.

Ground Penetrating Radar (GPR) can be used to locate underground pipes, buried drums, foundations, voids in rock and concrete, soil settlement, determine stratigraphy, depth to

water table, buried artifacts, filled excavations, and locate voids/settlement behind walls and under floor slabs. GPR is also a good tool for evaluating concrete structures such as bridges, walls, beams, ceilings, etc where the GPR can locate rebar and conduits, quantify rebar spacing, cover variability over reinforcing, and concrete thickness.

Laterally GPR can cover large areas relatively quickly. Using a grid pattern of survey lines it is very effective for mapping the lateral extents of subsurface features as well as calculating the depth to the features of interest. Depth of investigation can be estimated using material dielectric constants and the diagram shown below. Accurate depth calculations require an onsite calibration, to determine the electrical properties (speed of the signal) of the materials at the site. Depth calibrations typically consist of collecting GPR data over a metal target with a known depth. Known utilities, and buried metal plates are good targets for calibrations. GPR surveys can be very effective when coupled with other geophysical surveys and/or ground truth methods to verify, correlate and extrapolate GPR results. GPR surveys are a fast and cost effective method to collect data over large or obstructed sites, and isolate anomalies and areas where borings or other methods can be focused for the best interest of a project.



GPR systems consist of: Control unit (pulse transmitter, digital recorder, data storage, monitor); Antenna(s); Coaxial Cable and Printer

GPR Control Unit is a computer which control data acquisition parameters, such as sampling rate, range, gain control, filtering, etc. The control unit also visually displays the data, digitally archives the data, and allows for play back of the data.

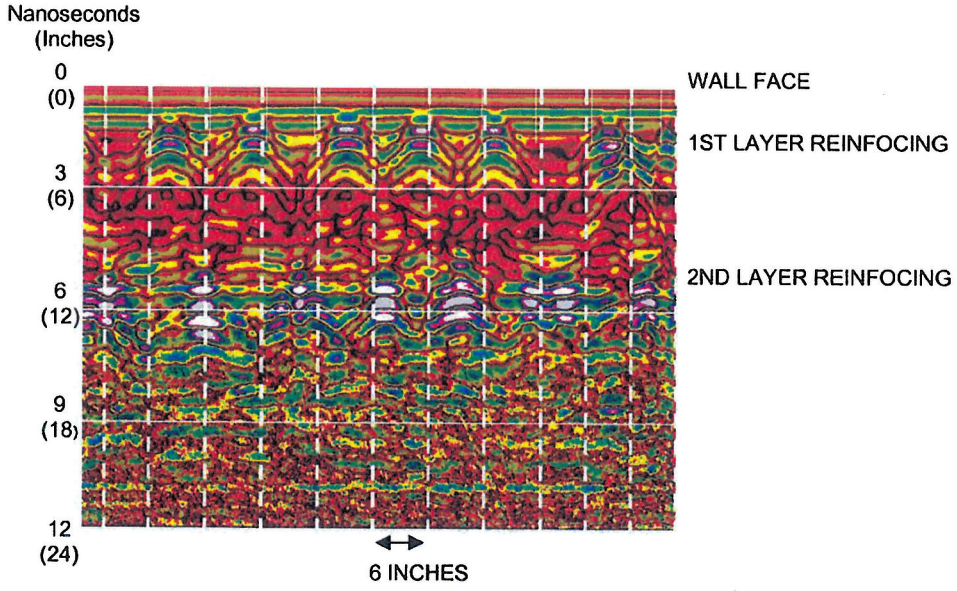
The coaxial cable connects the control unit to the Antenna. The Antenna(s) are sealed and shielded fiberglass housing for the transmitter and receiver. Selection of the antenna is dictated by the requirements of the survey. For high resolution, near-surface data, a high frequency antenna is used; for deeper penetration investigation, a lower frequency antenna is used. Typically the 80 to 300 MHz antennas are used for geologic surveys; 300 to 900 are used for utility, near surface voiding settlement, foundation, etc surveys while the high frequency antenna 900 to 1500 is used for concrete assessment.

ACQUISTION AND INTERPETATION:

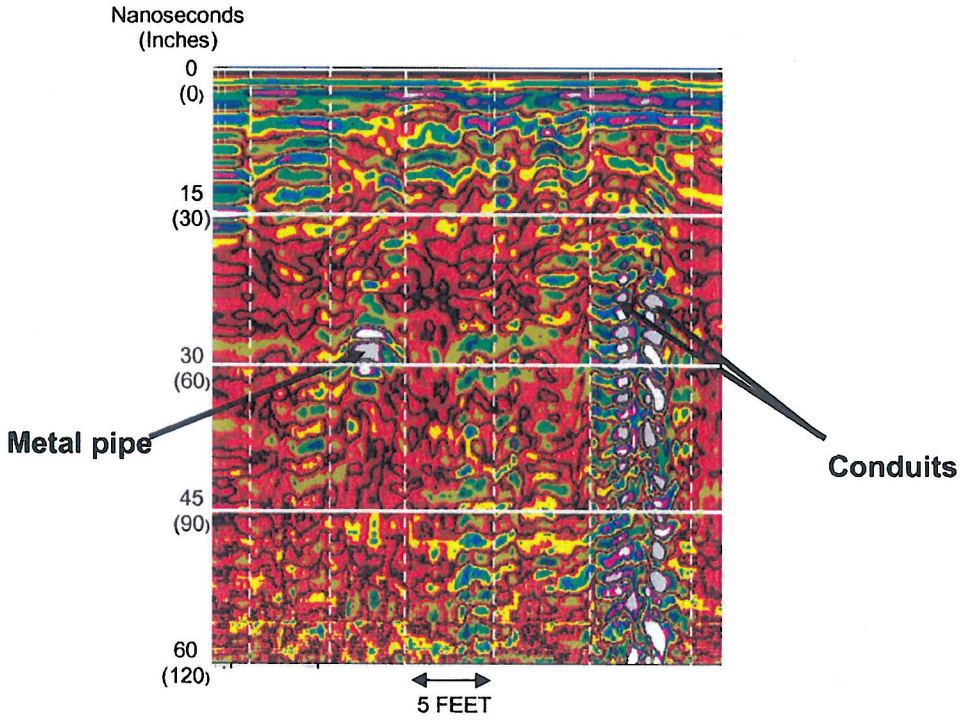
Radar signals propagate from the antenna in a 15 to 45 degree cone, thus the slower the speed of the antenna the greater the horizontal resolution. Radar data are typically acquired at a slow walking speed. Data are printed and digitally saved. Station markers and any field notes are written right on the printed copy and the digitally saved data can be used to reprint or to use with post processing software.

Interpretation of GPR data is subjective, even among experienced interpreters. GPR results should be verified with borings or test pits. The strength of a reflected signal and/or the continuity of the reflector across the record may be indicative of a stratigraphic contact. Point targets, such as reinforcing, buried utilities, boulders, create a distinctive parabolic feature on GPR records. Annotated GPR records of reinforcing and buried metal utilities are shown below. Positive identification of point targets is subjective, as the GPR signature of a pipe is similar to that of a large boulder.
Computer processing is available though it is somewhat costly and in most cases not necessary, except for presentation purposes.

GPR RECORD
12" THICK WALL WITH REINFORCING



UNDER GROUND UTILITY LOCATION/MAPPING



APPENDIX E – 2010 GEOPHYSICAL INVESTIGATION REPORT

HAGER-RICHTER
GEOSCIENCE, INC.

SURFACE GEOPHYSICAL SURVEY
US ROUTE 1 KENNEBUNK BRIDGE
KENNEBUNK, MAINE

Prepared for:

GZA GeoEnvironmental, Inc.
4 Free Street
Portland, Maine 04101

Prepared by:

Hager-Richter Geoscience, Inc.
8 Industrial Way D10
Salem, New Hampshire

File 10J44
August, 2010

0. EXECUTIVE SUMMARY

Hager-Richter Geoscience, Inc. (Hager-Richter) conducted a surface geophysical survey consisting of Multichannel Analysis of Surface Waves (MASW) and ground penetrating radar (GPR) methods at the western approach of the Route 1 bridge over the Mousam River in Kennebunk, Maine for GZA GeoEnvironmental, Inc. (GZA) in July 2010. The objective of the survey was to detect, and if detected, to locate possible sinkholes and to detect, if possible, historic timber flumes related to the formation of the sinkholes under the paved surface of US Route 1 between Brown Street and the bridge. The survey was conducted in support of an ongoing engineering investigation of the bridge and approaches by GZA for the Maine Department of Transportation.

The US Route 1 bridge is located a short distance downstream from a small power dam. According to information provided by GZA, three flumes were reportedly constructed extending from the dam downstream, and if present are located under the existing roadway. The flumes were constructed with oak timber planks and are approximately 10 to 20 feet below the ground surface. The flumes were reportedly filled in 1929. Sinkholes formed in the roadway south of the bridge in 2004 and 2005. The sinkholes reportedly might be related to the former flumes.

Borings located within the area of interest, indicate that the subsurface below the asphalt consists of sands with some silt, gravel, and clay layers above phyllitic bedrock. The top of weathered bedrock was reported at depths of between approximately 14 and 25.5 feet. Possible voids or loose fill within probable former flumes were reported within the approximately 11 to 20 foot depth interval in borings B-2, B-5, and BB-KMR-301, and thin wood layers were detected near the top and bottom of this interval in B-5 and BB-KMR-301.

The MASW survey consisted of four seismic lines designated as MASW Lines 1 - 4 and the ground penetrating radar survey consisted of GPR traverses spaced 1 foot apart in the area of interest located on the roadway of US Route 1 between its intersection with Brown Street and the bridge.

Based on the results of the MASW and GPR survey results at the western approach of the Route 1 bridge over the Mousam River in Kennebunk, Maine for GZA GeoEnvironmental, Inc. (GZA), we conclude:

- The former flume structures were not detected by the geophysical survey.

- An almost continuous, approximately 5-foot thick low shear wave velocity (410 to 700 fps) zone was detected for all four seismic lines, and the top of the low-velocity zone ranges from approximately 5 to 10 feet below the ground surface.

- Small low shear wave velocity zones were detected in the near surface for all lines, and are concentrated between approximately 0+40 and 0+80 stationing. The near-surface low velocity zone has a broad correlation to an area containing a filled depression as interpreted in the GPR data.

- Voids were not detected by the GPR survey.

- The GPR records contain reflections consistent with a filled depression that crosses the road in the vicinity of a patched and sunken area of the sidewalk on the north side of the roadway. Based on boring information that record wood layers and filled-in voids and historical information about repeated repairs to sinkholes in the vicinity, we interpret the filled in depression to represent the frequently repaired zone above one of the former sluiceways.

- Two other possible filled depressions were detected by the GPR survey on the eastern end of the area of interest.

- Linear features or utility line segments were detected by the GPR survey.

- Possible flat topped structures were detected by the GPR survey.

TABLE OF CONTENTS

FIGURES

APPENDICES

1. INTRODUCTION

Hager-Richter Geoscience, Inc. (Hager-Richter) conducted a surface geophysical survey consisting of Multichannel Analysis of Surface Waves (MASW) and ground penetrating radar (GPR) methods at the western approach of the Route 1 bridge over the Mousam River in Kennebunk, Maine for GZA GeoEnvironmental, Inc. (GZA) in July 2010. The objective of the survey was to detect, and if detected, to locate possible sinkholes and to detect, if possible, historic timber flumes possibly related to the formation of the sinkholes under the paved surface of US Route 1 between Brown Street and the bridge. The survey was conducted in support of an ongoing engineering investigation of the bridge and approaches by GZA for the Maine Department of Transportation.

The bridge is located on US Route 1 over the Mousam River between Brown Street and Water Street in Kennebunk. The general location of the Site is shown in Figure 1, and Figure 2 is a Site Plan showing the location of the four MASW lines and the GPR survey area. A small power dam is located 20-30 feet upstream of the bridge. According to information provided by GZA, three flumes were reportedly constructed extending from the dam downstream and, if present, are expected to be located under the existing roadway. The flumes were constructed with oak timber planks and are approximately 10 to 20 feet below the ground surface. The flumes were reportedly filled in 1929. Sinkholes formed in the roadway south of the bridge in 2004 and 2005. The sinkholes are possibly related to the former flumes.

As part of an ongoing engineering investigation of the Site, GZA requested a surface geophysical survey to locate possible additional sinkholes and, if possible, to detect the flumes related to the formation of the sinkhole features in an area of interest along the paved surface of US Route 1 that extends from the intersection of US Route 1 and Brown Street to the bridge. The area of interest was approximately 160 feet long and 45 feet wide.

Borings located within the area of interest, including B-2 through B-5, BB-KMR-106, BB-KMR-106A, BB-KMR-201, and BB-KMR-301 through BB-KMR-303, indicate that the subsurface below the asphalt consists of sands with some silt, gravel, and clay layers above phyllitic bedrock. The top of weathered bedrock was reported at depths of between approximately 14 and 25.5 feet where encountered, and appears to be shallowest immediately west of the edge of the abutment, and deepens towards Brown Street. Possible voids or loose fill within probable former flumes were reported within the approximately 11 to 20 foot depth interval in borings B-2, B-5, and BB-KMR-301, and thin wood layers were detected near the top and bottom of this interval in B-5 and BB-KMR-301. Wood fibers were also detected at approximate depths of 16 feet, 7 feet, and 9 feet in B-2, B-4, and BB-KMR-303, respectively. Generally, a zone of low N-values (10 or less) was recorded in most of the borings. The top of

the low N–value zone was typically encountered between 4 and 8 feet below the ground surface and the thickness of the zone ranged from approximately 2 to 8 feet.

Steven Grant, P.G., and Eric Rickert of Hager-Richter conducted the geophysical survey on July 29 and 30, 2010. The field work was coordinated with Mr. Andrew Blaisdell, P.E., G.E., of GZA. Mr. Michael Devoid, also of GZA, was present in the field, indicated the area of interest, and assisted with the survey, including traffic control and coordination with a private flagger and Town of Kennebunk Police officers assigned to traffic detail. Generally, geophysical surveying was conducted in the northbound lane on July 29 and in the southbound lane on July 30. Data analysis and interpretation were completed at the Hager-Richter offices. Original data and field notes will be retained in the Hager-Richter files for a minimum of three years.

2. MASW SURVEY

2.1 Equipment and Procedures

The multichannel analysis of surface waves (MASW) method is a seismic method that determines a shear-wave velocity (Vs) profile (i.e., Vs versus depth and horizontal distance) by analyzing a particular type of seismic wave on a multichannel record. The MASW method uses Rayleigh waves which are elastic waves that travel in the subsurface near the earth's surface. The amplitude of such waves decreases with depth and the phase velocity of the waves is a function of frequency. The method uses multichannel recording and processing concepts widely used in reflection surveying by the oil and gas industry.

MASW requires multichannel records with at least 12 traces to produce reliable results. We use 48 channels (two 24-channel Geometrics Geode digital seismographs), coupled to 48 geophones to acquire 24-trace records. The series of 24-trace records are obtained by rolling or stepping the spread of 24 receivers for each source location keeping the same shot-receiver geometry throughout the spread. We used 4.5-Hz low natural frequency vertical geophones for the survey.

The MASW survey was conducted using an active source, consisting of a 12-lb sledge striking an aluminum plate placed on the ground. Levels of ambient noise were monitored in real time during data acquisition. Ambient noise was not utilized by the survey but was avoided by waiting for times when nearby traffic (the main source of ambient noise) was not adversely affecting the quality of the data.

The surface waves used in MASW, considered noise in refraction and reflection surveys, are *enhanced* during data acquisition and processing for the MASW method. The seismic data are analyzed using *SurfSeis 2.0,* a commercially licensed software package developed by the Kansas Geological Survey. Results can be presented as 2-D graphical plots using contouring software such as *Surfer* or in tabular form showing shear wave velocity as a function of depth at a given station. The data for many stations acquired along a survey line can be presented as a contour plot of the shear wave velocity as a function of depth and distance along the line.

As discussed above, data are acquired for 24 channels at a time and the resulting 1-D shear wave distribution as a function of depth is assigned the horizontal position at the center of the 24-channel spread. The 1-D distributions are then combined to provide shear wave velocity distribution across the survey line and are presented as 2-D color plots. The variations in color correspond to apparent variations in subsurface shear wave velocity for the overburden and bedrock.

2.2 Limitations of the Method

As with all physical measurements, there is experimental error in the velocities that are determined using the MASW method. The uncertainty in velocity of shear waves for the MASW method is estimated to be approximately 15%. The depth of investigation is a function of the noise spectrum, and long wave lengths (low frequencies) are required to determine velocity at large depths.

2.3 Site Specific

The locations of the survey lines are shown on Figure 2. The MASW survey used 48 geophones and a geophone spacing of 3 feet for all lines, such that geophones were continuously installed between stations 0+00 and 1+41 on each line. This arrangement yields velocities as a function of depth for the interval between stations 0+33 on the west end to 1+08 or 1+11 on the east end of the lines. The data are processed for all 48 geophones, but only the central portion of the line has enough data coverage to generate the vertical velocity profile. The seismic source was a 12-pound sledge hammer striking a steel plate and/or the ground surface.

2.4 Results

The MASW survey consisted of four seismic lines designated as MASW Lines 1 - 4. The locations of the lines are shown in Figure 2. Figure 3 shows the MASW results for each line. Generally, the subsurface below the asphalt consists of sands with some silt, gravel, and clay layers above phyllitic bedrock. The top of weathered bedrock was reported at depths of between approximately 14 and 25.5 feet, where encountered. Possible voids or loose fill within probable former flumes, sometimes associated with wood layers, were reported within the approximately 11 to 20 foot depth interval in borings B-2, B-5, and BB-KMR-301. In addition, a zone of low N-values (10 or less) was recorded in most of the borings. The top of the low N-value zone was typically encountered between 4 and 8 feet below the ground surface and the thickness of the zone ranged from approximately 2 to 8 feet.

The quality of the MASW data is good to excellent. The data quality is determined based on the ease with which a dispersion curve can be fit to the data.

As discussed above, the MASW method determines the shear wave velocity distribution with depth and distance for the central portion of each seismic spread of 48 channels, at least for the SurfSeis 2.0 software. The velocity profiles for the four survey lines determined with the MASW method are shown in graphical form in Figure 3. Several borings are located near three of the four seismic survey lines, and are represented on the profiles, showing the depth of probable bedrock and N-values as reported in the boring logs. The seismic profiles shown in Figure 3 indicate the presence of lower velocity soils overlying higher velocity bedrock, generally

corresponding to the blue-green colors and orange-red colors, respectively. An approximate top of bedrock is shown on each of the profiles, based in part on information from boring logs and on the shear wave velocities.

An almost continuous, approximately 5-foot thick low-velocity shear wave zone was detected for all four seismic lines, and the top of the low-velocity zone ranges from approximately 5 to 10 feet below the ground surface. The shear wave velocity in the low-velocity zones ranges from approximately 410 to 700 fps. The low-velocity zone as detected by the MASW survey has a broad correlation to the intervals of low-N-values recorded in the boring logs, although in general, the MASW low velocity zone is a few feet deeper.

In addition, less continuous low velocity zones were detected in the near surface for all lines, and are concentrated between approximately 0+40 and 0+80 stationing. The near-surface low velocity zone has a broad correlation to an area containing a filled depression as interpreted in the GPR data (see section 3.4, below). The limits of the interpreted filled depression are shown in Figure 3 for comparison.

The former flumes were not detected by the MASW survey. One possible explanation is that the shear wave velocity of the former flume structures did not contrast strongly enough with surrounding materials to be detectable. We note that the almost continuous, approximately 5-foot thick, low-velocity shear wave zone (discussed above) may be located in the same approximate depth range as the former flume structures, so that the presumed low velocity characteristics of the former flume structures cannot be distinguished from the low-velocity shear wave zone .

3. GPR SURVEY

3.1 Equipment and Procedures

The GPR survey was conducted using a Sensors & Software Smart Cart Noggin Plus digital subsurface imaging radar system. The system includes a survey wheel that triggers the recording of the data at fixed intervals, thereby increasing the accuracy of the locations of features detected along the survey lines. The system was used with a 250 MHz antenna. We used 60 ns[1] and 90 ns time windows for the project.

GPR uses a high-frequency electromagnetic pulse (referred to herein as "radar signal") transmitted from a radar antenna to probe the subsurface. The transmitted radar signals are reflected from subsurface interfaces of materials with contrasting electrical properties. Travel times of the radar signal can be converted to approximate depth below the surface by correlation with targets of known depths or by analyzing the shapes of hyperbolic reflections. We monitor the acquisition of GPR data in the field and record the GPR data digitally for subsequent processing. Interpretation of the records is based on the nature and intensity of the reflected signals and on the resulting patterns.

3.2 Limitations of the Method

HAGER-RICHTER GEOSCIENCE, INC. MAKES NO GUARANTEE THAT ALL VOIDS, AREAS OF SUBSIDENCE, AND OTHER FEATURES OF INTEREST WERE DETECTED IN THIS SURVEY. HAGER-RICHTER GEOSCIENCE, INC. IS NOT RESPONSIBLE FOR DETECTING VOIDS, AREAS OF SUBSIDENCE, OR OTHER FEATURES OF INTEREST THAT CANNOT BE DETECTED DUE TO THE LIMITATIONS OF THE GPR METHOD OR BECAUSE OF SITE CONDITIONS.

There are other limitations of the GPR technique: (1) surface conditions, (2) electrical conductivity and thickness of the subsurface layers, (3) electrical properties of the target(s), and (4) spacing of the traverses. Of these restrictions, only the last is controllable by us in most cases.

The condition of the survey surface can affect the quality of the GPR data and the depth of penetration of the GPR signal. For exterior sites, a surface covered with obstacles such as

[1] ns, abbreviation for nanosecond, 1/1,000,000,000 second. Light and the GPR signal require about 1 ns to travel 1 ft in air. The GPR signal requires about 3.5 ns to travel 1 ft in unsaturated sandy soil.

automobiles, dumpsters, thick leaf debris, materials piles, etc. limit the survey access. Similarly, for interior sites, a surface covered with obstacles such as desks, benches, laboratory equipment, etc. also limit access. Some floor coverings may limit the coupling of the GPR antenna with the subsurface.

The electrical conductivity of the subsurface determines the attenuation of the GPR signals, and thereby limits the maximum depth of exploration. The GPR signal does not penetrate clay-rich soils or soils contaminated with road salt. In some cases, the GPR signal may not penetrate below concrete pavement, and some asphalts are electrically conducting.

A strong contrast in the electrical conductivities of the ground and the target (for examples, UST, pipe, void, dry well, drum, contaminant plume) is required to obtain a reflection of the GPR signal. If the contrast is too small, then the reflection may be too weak to recognize, and the target can be missed.

Spacing of the traverses is limited by access at many sites, but where flexibility of traverse spacing is possible, the spacing is adjusted on the basis of the size of the target.

3.3 Site Specific

GPR data were acquired along traverses oriented sub-parallel to US Route 1 and spaced 1 foot apart using a 250 MHz antenna and a 60ns time window. In addition, GPR data were acquired along traverses oriented sub parallel to US Route 1 and spaced 5 feet apart using a 90ns time window, although no additional features were detected between 60 and 90ns.

3.4 Results

The ground penetrating radar survey was conducted using a 250 MHz antenna. Figure 4 shows the locations of the GPR traverses and our interpretation of the GPR data. Figure 5 is an example GPR profile showing several features of interest. Appendix 2 consists of plates showing all GPR profiles. With the exception of a zone of limited GPR penetration located in the center of the western end of the area of interest, apparent GPR signal penetration was fair to good, with reflections recorded for 30-60 ns. Based on velocity matching calibrations made for the site and on handbook time-to-depth conversions for the GPR signal in average to sandy soils, the GPR signal penetration is estimated to have been approximately 5 to 10 feet over most of the area of interest. However, GPR signal penetration was limited to 15 ns (approximately 2.5 feet) in the center of the western end of the area of interest.

The GPR records do not indicate the presence of voids. Interpretation of GPR data is based on the fact that transmitted radar signals are reflected at subsurface interfaces of materials with contrasting electrical properties. Regions with low to moderate amplitude reflections are likely to be areas of relatively homogeneous materials, since the GPR signal passes through

homogeneous media with little reflection. Areas of high amplitude reflections are inferred to indicate regions where materials with contrasting electrical properties are present. In GPR sections, a void will typically produce localized zones of relatively high amplitude, low frequency GPR reflections - a phenomenon commonly referred to as "ringing." Based on this criterion, no evidence of voids was detected in the area of interest from the GPR sections.

The GPR records contain reflections consistent with a filled depression that crosses the road in the vicinity of a patched and sunken area of the sidewalk on the north side of the roadway. The edges of the filled depression that crosses the roadway are shown on Figure 4 and represent interfaces that dip from a depth of 1 foot toward the interior of the filled depression. The upper edges of dipping reflections are most prominent at a depth of approximately 1 foot, but reflections from approximately 3 feet were detected at the edges of the road where GPR signal penetration was deeper. Figure 5 is an example GPR record showing the dipping interfaces. In the center of the roadway, GPR signal penetration is very limited, and dipping reflections are not observed, although a change in the character of the horizontal banding indicates the presence of a shallow pavement patch (not observable at the surface, presumedly because of a newer asphalt resurfacing).

The GPR signal penetration was not sufficient to detect the expected sluiceway between 10 and 15 foot depth in the vicinity of the filled depression that crosses the roadway. However, based on boring information that records wood layers and filled-in voids (B-2, B-5, and BB-KMR-301) and historical information about repeated repairs to sinkholes in the vicinity, we interpret the filled in depression to represent the frequently repaired zone above one of the former sluiceways.

Two other possible filled depressions were detected by the GPR data on the eastern end of the area of interest and the edges of the possible filled depressions are shown on Figure 4 as interfaces that dip from a depth of approximately 3 feet toward the interior of the filled depression. Of the two, the possible filled depression located along the southern edge of the roadway appears more prominent.

The GPR records also contain reflections typical of linear features or utility line segments that are shown on Figure 4 as bold dashed black lines with depth annotations. Several of the short segments are located within and are oriented parallel to the filled depression that crosses the roadway. It is possible that such linear features within the filled depression represent structures related to former repairs (retaining walls, forms, construction debris), or may be diffractions from slope edges.

The GPR records contain reflections that are consistent with flat topped structures, and such features are shown with approximate depth annotations on Figure 4. One prominent flat topped structure with an interpreted depth of 8 feet is located along the southern edge of the road in the eastern portion of the area of interest and overlaps with one of the filled depressions. The

identity of such a feature is unknown, although based on its location adjacent to the abutment it is consistent with the horizontal location of one of the former filled sluiceways. The lateral extent of the 8-foot deep flat topped structure was not fully determined because GPR signal penetration deteriorated toward the center of the roadway. The 8 foot-deep flat topped reflections from dipping interfaces located above it are shown on the example GPR record in Figure 5.

5. CONCLUSIONS

Based on the results of a surface geophysical survey consisting of Multichannel Analysis of Surface Waves (MASW) and ground penetrating radar (GPR) methods at the western approach of the Route 1 bridge over the Mousam River in Kennebunk, Maine for GZA GeoEnvironmental, Inc. (GZA), we conclude:

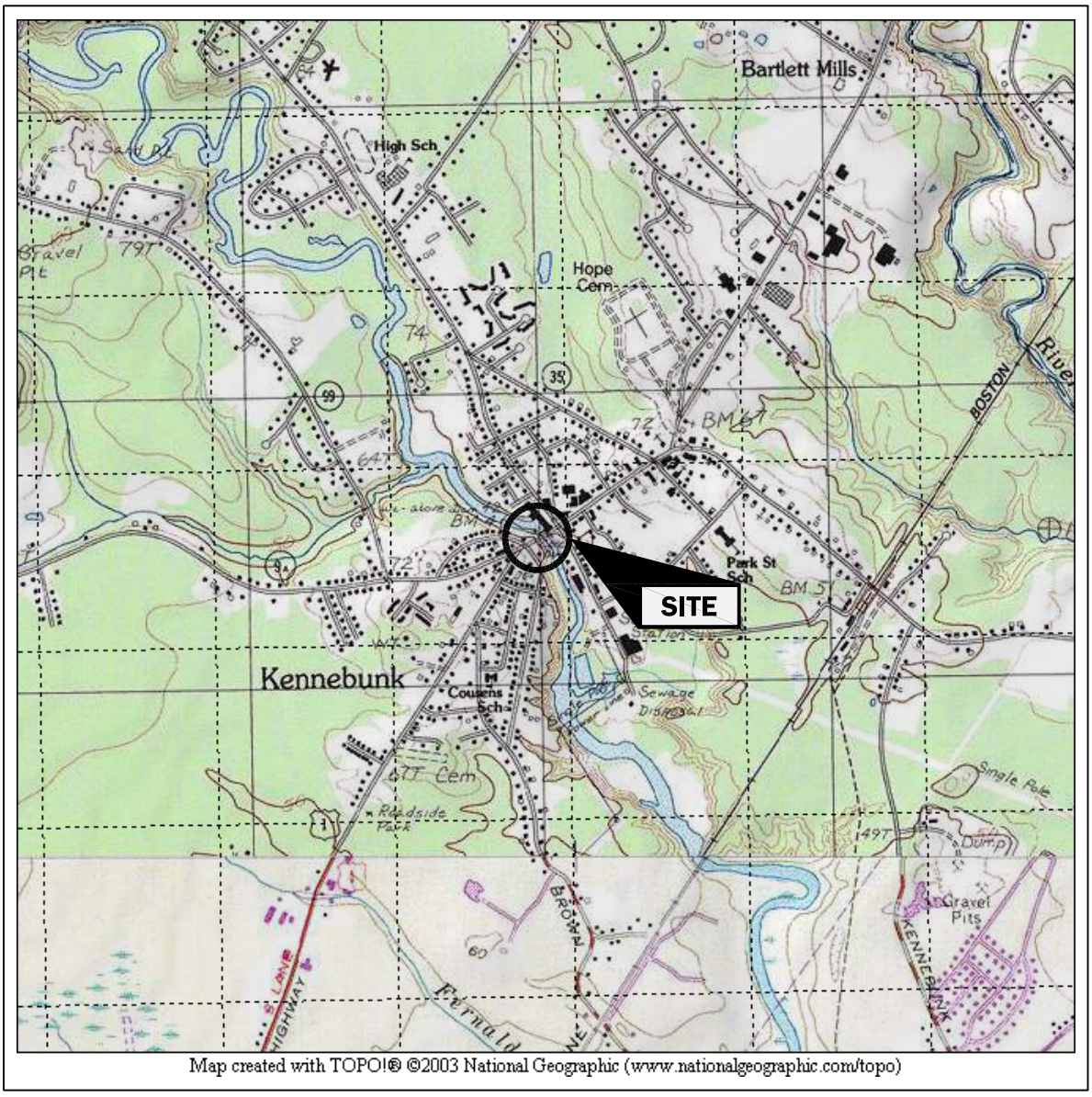
- The former flume structures were not detected by the geophysical survey.
- An almost continuous, approximately 5-foot thick low shear wave velocity (410 to 700 fps) zone was detected for all four seismic lines, and the top of the low-velocity zone ranges from approximately 5 to 10 feet below the ground surface.
- Small low shear wave velocity zones were detected in the near surface for all lines, and are concentrated between approximately 0+40 and 0+80 stationing. The near-surface low velocity zone has a broad correlation to an area containing a filled depression as interpreted in the GPR data.
- Voids were not detected by the GPR survey.
- The GPR records contain reflections consistent with a filled depression that crosses the road in the vicinity of a patched and sunken area of the sidewalk on the north side of the roadway. Based on boring information that records wood layers and filled-in voids and historical information about repeated repairs to sinkholes in the vicinity, we interpret the filled in depression to represent the frequently repaired zone above one of the former sluiceways.
- Two other possible filled depressions with were detected by the GPR survey on the eastern end of the area of interest.
- Linear features or utility line segments were detected by the GPR survey.
- Possible flat topped structures were detected by the GPR survey.

5. LIMITATIONS

This report was prepared for the exclusive use of GZA GeoEnvironmental, Inc. (Client). No other party shall be entitled to rely on this Report or any information, documents, records, data, interpretations, advice or opinions given to Client by Hager-Richter Geoscience, Inc. (H-R) in the performance of its work. The Report relates solely to the specific project for which H-R has been retained and shall not be used or relied upon by Client or any third party for any variation or extension of this project, any other project or any other purpose without the express written permission of H-R. Any unpermitted use by Client or any third party shall be at Client's or such third party's own risk and without any liability to H-R.

H-R has used reasonable care, skill, competence and judgment in the preparation of this Report consistent with professional standards for those providing similar services at the same time, in the same locale, and under like circumstances. Unless otherwise stated, the work performed by H-R should be understood to be exploratory and interpretational in character and any results, findings or recommendations contained in this Report or resulting from the work proposed may include decisions which are judgmental in nature and not necessarily based solely on pure science or engineering. It should be noted that our conclusions might be modified if subsurface conditions were better delineated with additional subsurface exploration including, but not limited to, test pits, soil borings with collection of soil and water samples, and laboratory testing.

Except as expressly provided in this limitations section, H-R makes no other representation or warranty of any kind whatsoever, oral or written, expressed or implied; and all implied warranties of merchantability and fitness for a particular purpose, are hereby disclaimed.



N

H-R

ME

LOCATION

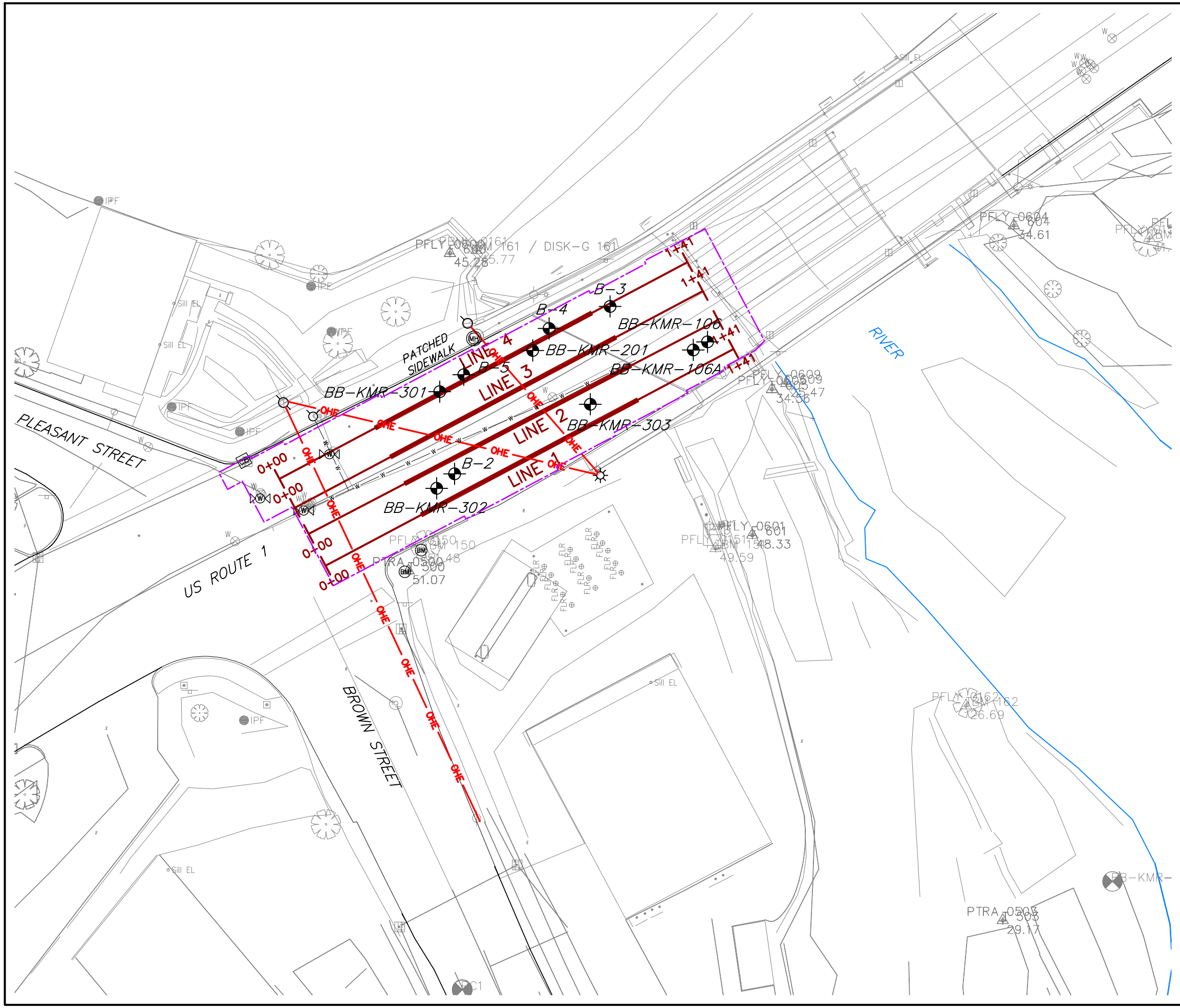
SCALE (feet)

0 2000 4000

Figure 1
General Site Location
US Route 1 Kennebunk Bridge
Kennebunk, Maine

File 10J44 | August, 2010

HAGER–RICHTER GEOSCIENCE, INC.
Salem, New Hampshire



N

H-R

LEGEND

- pVs SURVEY LINE (THICK IN ZONE OF EFFECTIVE COVERAGE)
- APPROXIMATE LIMITS OF GPR SURVEY AREA
- OHE — OVERHEAD ELECTRIC LINE
- LIGHT POLE
- UTILITY POLE
- MH — MANHOLE
- CB — CATCH BASIN
- HYDRANT
- WATER GATE
- BORING
- BM — SURVEYOR BENCH MARK
- W — WATER LINE – MARKED BY OTHERS

SCALE (feet)

0 30 60

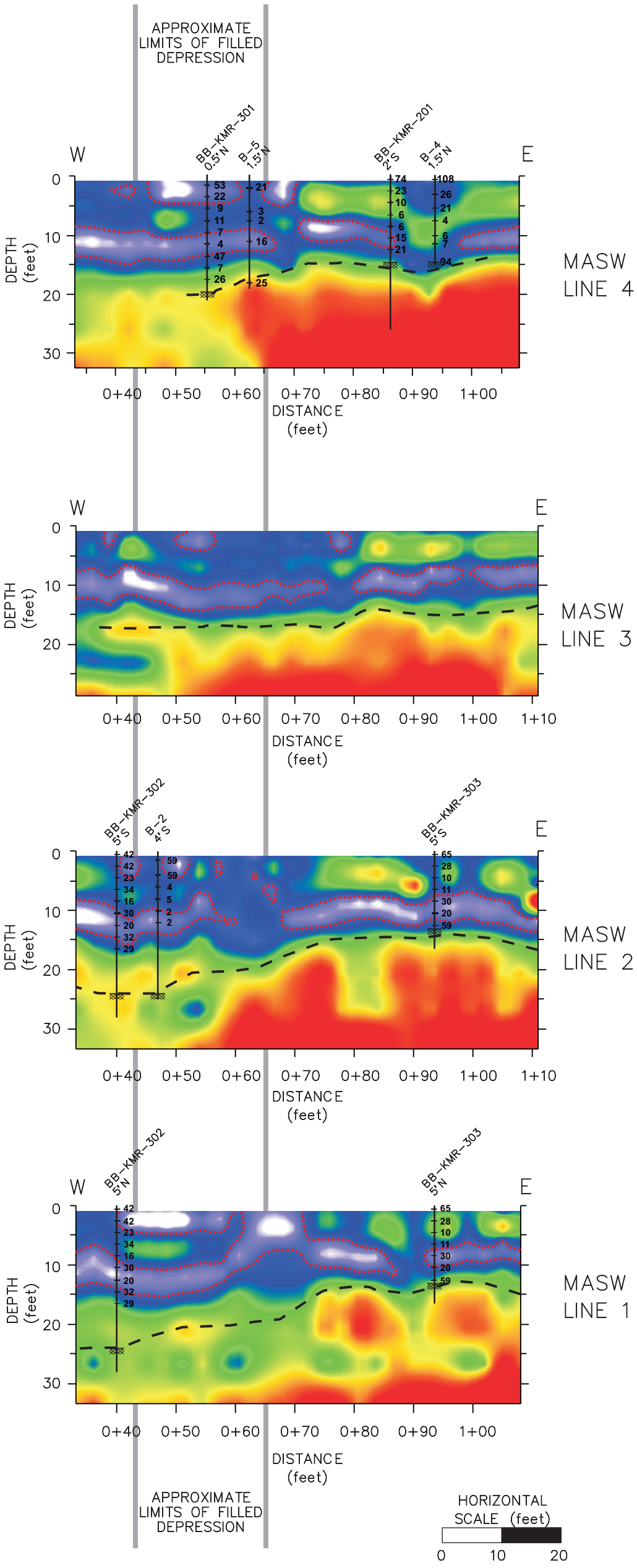
NOTE:

Modified from site plan provided by GZA GeoEnvironmental, Inc.

Figure 2
Site Plan
US Route 1 Kennebunk Bridge
Kennebunk, Maine

File 10J44 | August, 2010

HAGER–RICHTER GEOSCIENCE, INC.
Salem, New Hampshire



NOTES:

1. Approximate limits of filled depression determined from GPR data.
2. Boring logs provided by GZA.

Figure 3
MASW Results
US Route 1 Kennebunk Bridge
Kennebunk, Maine

FILE 10J44 | August, 2010

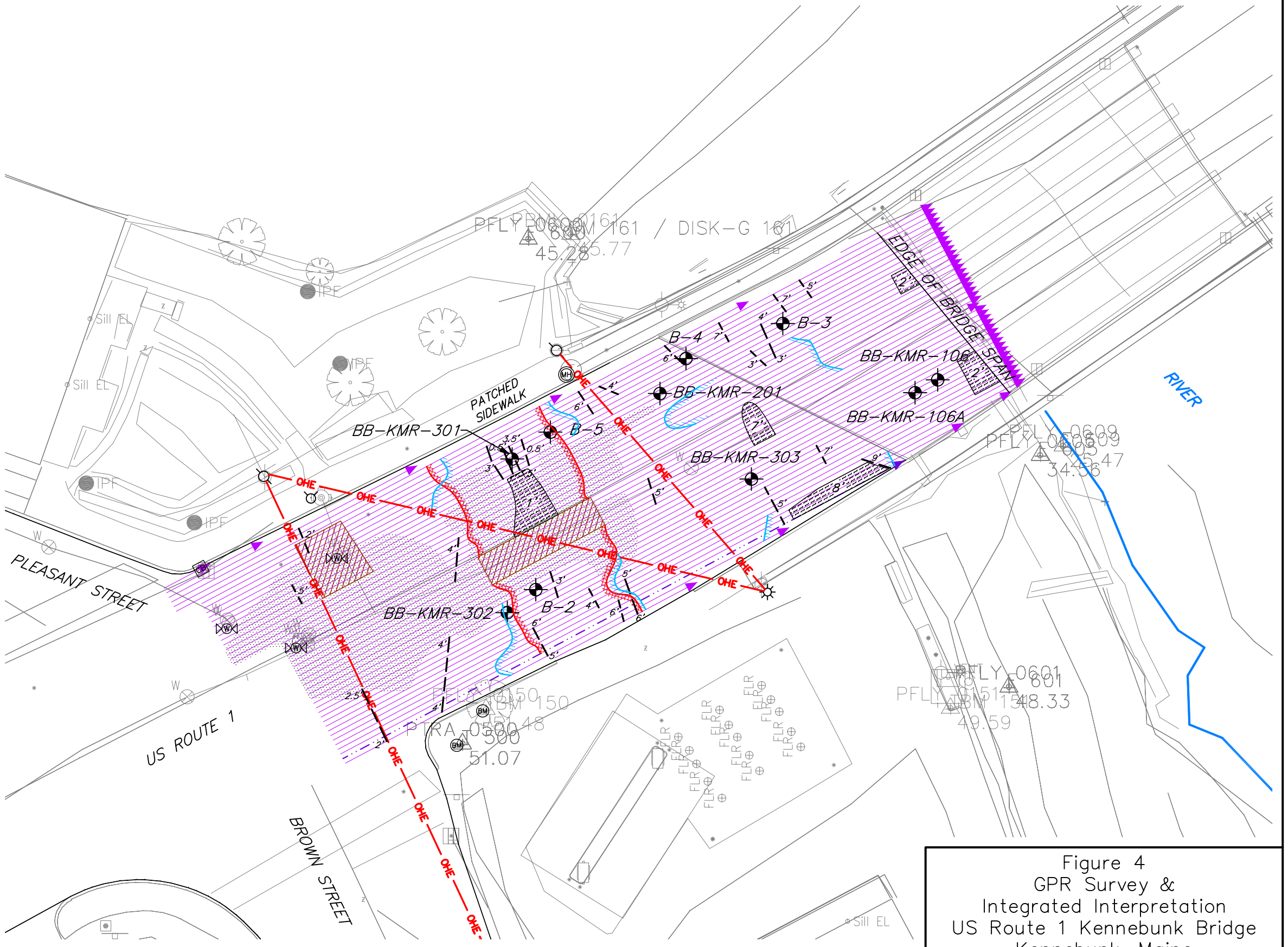
HAGER-RICHTER GEOSCIENCE, INC.
Salem, New Hampshire

N

H.R

LEGEND

- GPR TRAVERSE
- GPR TRAVERSE SHOWN IN FIGURE 5
- EDGE OF FILLED DEPRESSION AT ~1 FOOT DEPTH
- EDGE OF FILLED DEPRESSION AT ~3 FOOT DEPTH
- FLAT TOPPED STRUCTURE DEPTH SHOWN
- 5' — — — 6' LINEAR FEATURE OR UTILITY WITH DEPTH IN FEET
- SHALLOW BURIED PATCHED PAVEMENT
- AREA OF LIMITED GPR SIGNAL PENETRATION (SEE TEXT)
- OHE — OVERHEAD ELECTRIC LINE
- LIGHT POLE
- UTILITY POLE
- MH MANHOLE
- CB CATCH BASIN
- HYDRANT
- W WATER GATE
- BORING
- BM SURVEYOR BENCH MARK



SCALE (feet)

0 20 40

NOTE:

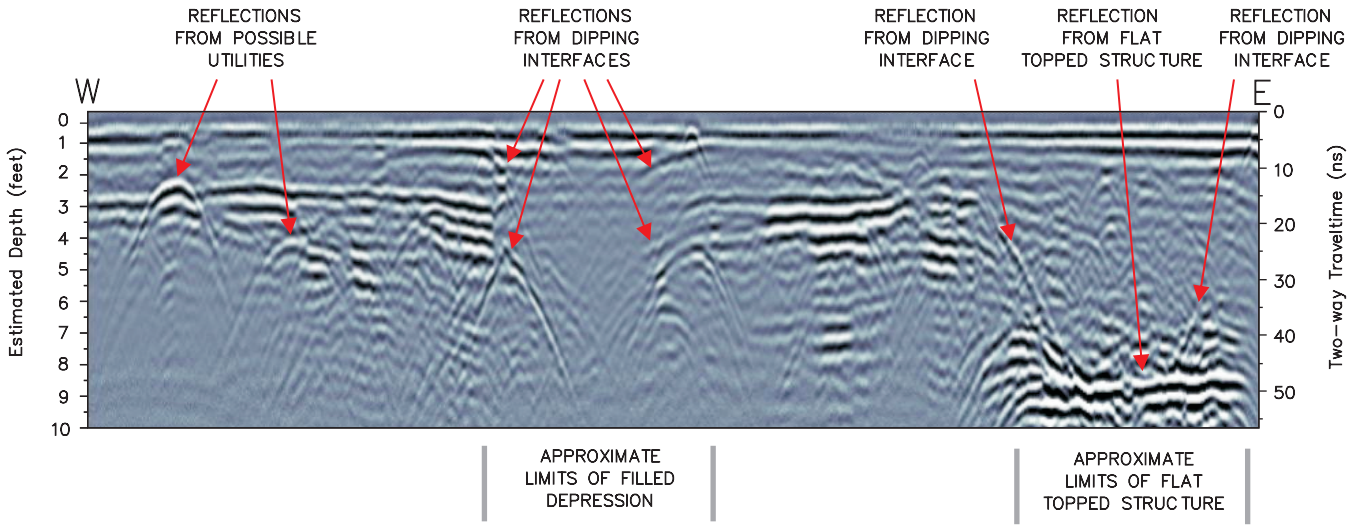
Modified from site plan provided by GZA GeoEnvironmental, Inc.

Figure 4
GPR Survey &
Integrated Interpretation
US Route 1 Kennebunk Bridge
Kennebunk, Maine

File 10J44 | August, 2010

HAGER–RICHTER GEOSCIENCE, INC.
Salem, New Hampshire

GPR TRAVERSE FROM SOUTHERN EDGE OF ROUTE 1



NOTES:

1. GPR data were acquired using a Sensors and Software Noggin Smart Cart.
2. Estimated depths represent distance below ground surface.
3. Estimated depth scale shown on the GPR records was calculated using a GPR signal propagation velocity of 0.348/ns, as calibrated from analyses of hyperbolic reflections.
4. Location of example profile shown on Figure 4.

HORIZONTAL SCALE (feet)

0 10 20

Figure 5
Example GPR Section
US Route 1 Kennebunk Bridge
Kennebunk, Maine

FILE 10J44 | August, 2010

HAGER-RICHTER GEOSCIENCE, INC.
Salem, New Hampshire

APPENDIX 1
BORING LOGS

R.W. Gillespie & Associates, Inc.
Geotechnical Engineering•Geohydrology•Materials Testing Services

Project: Sink Hole Evaluation
Location: Kennebunk, Maine
Client: Town of Kennebunk
Project No. 317-04

Boring Log: B-2
Surface Elevation:
Observed Water Depth: 10
Date Completed: 10/18/04

DEPTH, FT.	SYMBOL	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
0				ASPHALTIC PAVEMENT (8 inches).					
			S-1	GRAVELLY SAND (SW); Very dense, damp, gravelly sand, trace silt, brown.	19	18 38 21	59		
			S-2	GRAVELLY SAND (SW); Very dense, damp, gravelly sand, little to trace silt, lenses of brown and dark gray-brown soil.	16	17 23 30 29	59		
5			S-3	SAND WITH SILT AND GRAVEL (SM); Medium dense, damp, sand, little silt and gravel, brown.		24			
			S-4	-FILL-	14	9 6 5	4		
			S-5	SILTY SAND (SM); Medium dense to loose, moist, medium to fine sand, some silt, trace gravel, gray-brown.	21	6 3 3	5		
10			S-6	SILTY SAND WITH CLAY (SM); Very loose, wet, silty sand, little clay and gravel, with pieces of brick, trace organics, gray.	7	2 2 2 1 1 1	2		
15			S-7	SILTY SAND WITH CLAY (SM); Loose, wet, silty sand, little clay, trace gravel, gray with pieces of angular rock and light-colored wood fibers. -FILL IN PROBABLE VOID-	4	1 2 3 2	5		
20				Auger resistance indicates coarse-grained soil at 20'. -PROBABLE GLACIAL TILL-					
25				Very hard auger resistance at 24'. -PROBABLE WEATHERED ROCK-					
				Bottom of Exploration at 25'; Not refusal. Borehole backfilled with granular soil, tamped, and layer of cold patch asphalt place to ground surface.					
30									
35									

R.W. Gillespie & Associates, Inc.
Geotechnical Engineering•Geohydrology•Materials Testing Services

Project: Sink Hole Evaluation
Location: Kennebunk, Maine
Client: Town of Kennebunk
Project No. 317-04

Boring Log: B-3
Surface Elevation:
Observed Water Depth: Not Obs.
Date Completed: 10/18/04

DEPTH, FT.	SYMBOL	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
0			S-1	ASPHALTIC PAVEMENT (6 inches). GRAVELLY SAND (SW); Very dense grading to medium dense, damp, gravelly sand, trace silt, brown.	18	33 44 38	82		
			S-2		16	30 23	21		
5			S-3	FILL; Medium dense, damp, CINDERS, trace amount of medium to fine sand, black and gray.	15	12 9 10 6	23		
			S-4	SAND WITH GRAVEL AND SILT (SP); Medium dense grading to loose, dry to damp, medium to fine sand, trace gravel and silt, with trace organic fibers and angular gravel, brown and dark brown.	16	15 8 8 6	7		
10			S-5	-FILL-	8	4 3 4 13	14		
			S-6		6	8 6 10 12	22		
				Moist.		9 13			
15			S-7		4	8 26/ 0.4" 50/0"	26+		
				WEATHERED ROCK; Very dense, rock fragments, dry, dark gray. Bottom of Exploration at 15.9'; Auger refusal on probable bedrock. Borehole backfilled with granular soil, tamped, and layer of cold patch asphalt placed to ground surface.					
20									
25									
30									
35									

R.W. Gillespie & Associates, Inc.
Geotechnical Engineering•Geohydrology•Materials Testing Services

Project:	Sink Hole Evaluation	Boring Log:	B-4
Location:	Kennebunk, Maine	Surface Elevation:	
Client:	Town of Kennebunk	Observed Water Depth:	9.5
Project No.	317-04	Date Completed:	10/18/04

DEPTH, FT.	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
0		S-1	ASPHALTIC PAVEMENT (6 inches).	18	35	108		
			GRAVELLY SAND (SW); Very dense, dry to damp, gravelly sand, trace silt, brown.		62 47			
		S-2			51 35	26		
			Medium dense, damp, CINDERS, black and gray.		15 11			
5		S-3		8	9 7	21		
			SAND WITH GRAVEL AND SILT (SM); Medium dense to loose, damp, medium to fine sand, trace to little silt and gravel, brown, light brown, and		13			
		S-4	orange-brown.	12	8 5	4		
			SAND WITH SILT (SM); Very loose to loose, moist, medium to fine sand, some silt, trace clay, brown and light orange-brown, with angular rock		3 2			
10			fragments, plant stem, and wood fibers, stratified.		2			
		S-5	-FILL-	6	2 11	6		
		S-6		6	3 3	7		
					2 3			
		S-7		10	4 3	94+		
15			SILTY SAND WITH GRAVEL (SM); Dense, wet, sand, some silt and angular rock fragments, brown mottled.		2 42			
			-GLACIAL TILL-		52/ 0.4"			
			WEATHERED ROCK; Very dense, dry, rock fragments, dark gray and orange-brown.		50/0"			
			Bottom of Exploration at 14.9'; Spoon refusal on probable bedrock.					
20			Borehole backfilled with granular soil, tamped, and layer of cold patch asphalt placed to ground surface.					
25								
30								
35								

R.W. Gillespie & Associates, Inc.
Geotechnical Engineering • Geohydrology • Materials Testing Services

Project: Sink Hole Evaluation
Location: Kennebunk, Maine
Client: Town of Kennebunk
Project No. 317-04

Boring Log: B-5
Surface Elevation:
Observed Water Depth: 14
Date Completed: 10/18/04

DEPTH, FT.	SYMBOL	SAMPLES	SAMPLE NUMBER	DESCRIPTION OF MATERIAL	SAMPLE RECOVERY, IN.	BLOWS PER 6"	SPT-N BLOWS PER FT.	MOISTURE CONTENT %	LAB TESTS
0			S-1	ASPHALTIC PAVEMENT (2 inches). GRAVELLY SAND (SW); Medium dense, damp, gravelly sand, trace silt, brown.	19	11 18 13 11	21		
5			S-2		5	1 1	3		
			S-3	SILTY SAND (SP); Very loose, wet, medium to fine sand, little silt, dark brown, occasional rock fragments and seams of black soil, brown, grading at 7.5' to very loose, wet, silty fine sand, little clay, dark brown and gray, with particles of ceramic pipe. -FILL-	12	2 2 2 1 1 1	2		
10			S-4		8	48 11 5 13/3"	16+		
				SILTY CLAY (CL); Stiff, wet, silty clay, gray. Wood layer from approximately 11.6' (Spoon refusal at 11.7').		50/0"			
				SAND (SP); Very loose, wet, medium to fine sand, brown and dark brown. -FILL IN PROBABLE VOID-					
15			S-5		16	2 10 15 13	25		
				Wood layer from approximately 17.7' to 17.8'.					
20				SILTY SAND WITH GRAVEL (SM); Medium dense to dense, wet, silty sand, little gravel and clay. -GLACIAL TILL-					
				Bottom of Exploration at 19'; Not refusal. Borehole backfilled with granular soil, tamped, and layer of cold patch asphalt placed to ground surface.					
25									
30									
35									

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Kennebunk Bridge Replacement
Location: Kennebunk, ME

Boring No.: BB-KMR-201
PIN: 15098.00

Driller:	Maine Test Boring	**Elevation (ft.)**	48.3	**Auger ID/OD:**	NA
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Split
Logged By:	Eric Baron	**Rig Type:**	Truck	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	06/01/10-06/01/10	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ
Boring Location:	Sta. 14+70, 10.5' L	**Casing ID/OD:**	4"/4.5"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐	Rope & Cathead ☒	

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	18/18	0.5 - 2.0	40-38-36	74	74	Auger	47.8		Asphalt. (0.5) Brown, dry, very dense, gravelly fine to coarse SAND, trace silt. -FILL- Top 12": Same as 1D.	
	2D	24/16	2.0 - 4.0	13-16-7-6	23	23		45.3		(3.0) Bottom 4": Black/brown, dry, dense, fine to coarse Sandy GRAVEL, coal/wood. -FILL- Brown/gray, layered, moist, loose fine to coarse SAND, some Gravel, trace Silt.	
	3D	24/14	4.0 - 6.0	6-5-5-7	10	10	12				
5							13				
	4D	24/15	6.0 - 8.0	5-3-3-3	6	6	13			Top 2": Brown, moist, loose, silty fine to coarse SAND, trace Gravel, nested. Bottom 14": Brown, moist, loose, fine to coarse SAND, some Gravel, trace Silt, areas with fine SAND only then fine to coarse SAND, layered.	
							14	40.3		(8.0) Gray/brown, mottled, moist, loose, fine to medium Sandy SILT, trace Gravel, fine sand lenses, rootlets present. (Former surface layer/possibly reworked.)	
	5D	24/18	8.0 - 10.0	2-2-4-6	6	6	18				
							14	38.3		-MARINE DEPOSIT- (10.0) Gray/brown, mottled, moist, medium dense, silty, fine to medium SAND, little Gravel, nested. -GLACIAL TILL- Gray/brown, moist, medium dense, silty fine to medium SAND, trace Gravel.	
10	6D	24/21	10.0 - 12.0	6-7-8-13	15	15	14				
							15				
	7D	24/22	12.0 - 14.0	21-10-11-35	21	21	22				
							21			Same as 7D with weathered rock fragments.	
	8D	8/8	14.0 - 14.7	45-50/0.2			RC	33.6		(14.7) -WEATHERED ROCK-	
15	R1	60/58	15.7 - 20.7	RQD = 50%				32.6		(15.7) Rolled to 15.7' to set casing in sound rock for coring. Gray, fine grained, metamorphic PHYLLITE, hard fresh, weak along foliation. Primary joints are low angle, close to moderate, partially open, undulating, rough, fresh, quartz/calcite banding. Secondary joints are moderately dipping, wide, partially open. Rock Mass Quality= Fair.	
20	R2	14/13	20.7 - 21.9	RQD = 0%						Same as R1. Primary joints are very close to close.	
	R3	48/48	21.9 - 25.9	RQD = 54%						Gray, fine grained, metamorphic PHYLLITE, hard, fresh, weak along foliation. Primary joints are low angle, close to moderate spacing, partially open, undulating, rough, fresh, quartz/ calcite banding. Secondary joints are moderately dipping to high angle, close to moderate spacing, partially open, undulating, rough, fresh. Highly	
25											

Remarks:

DRAFT

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Kennebunk Bridge Replacement
Location: Kennebunk, ME

Boring No.: BB-KMR-201
PIN: 15098.00

Driller:	Maine Test Boring	**Elevation (ft.)**	48.3	**Auger ID/OD:**	NA
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Split
Logged By:	Eric Baron	**Rig Type:**	Truck	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	06/01/10-06/01/10	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ
Boring Location:	Sta. 14+70, 10.5' L	**Casing ID/OD:**	4"/4.5"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25								22.4		fractured zone from approximately 24.8- 25.9' due to breaks when removing from core barrel.	
										25.9'	
										Bottom of Exploration at 25.90 feet below ground surface.	
30											
35											
40											
45											
50											

Remarks:

DRAFT

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Kennebunk Bridge Replacement
Location: Kennebunk, ME

Boring No.: BB-KMR-301
PIN: 15098.00

Driller:	Maine Test Boring	**Elevation (ft.)**	49.2	**Auger ID/OD:**	NA
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Split
Logged By:	Eric Baron	**Rig Type:**	Mobile B 53 Truck Rig	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	06/02/10-06/02/10	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ
Boring Location:	Sta. 14+40, 12.5' L	**Casing ID/OD:**	3"/3.5"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐	Rope & Cathead ☒	

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0							Auger			Asphalt.	
	1D	18/14	1.4 - 2.9	20-29-24	53	53		47.8		1.4 Brown, dry, very dense, gravelly fine to coarse SAND, trace Silt. -FILL-	
	2D	24/24	3.0 - 5.0	13-13-9-9	22	22				Brown/dark brown, layered, dry, medium dense, fine to coarse SAND, little Gravel, trace Silt, layering of fine to coarse sand and fine sand. -FILL-	
5	3D	24/21	5.0 - 7.0	4-5-4-5	9	9	8	44.2		5.0 Top 3": Brown, moist, loose, fine to medium SAND, layered with Sandy Clay. Bottom 18": Gray/brown, moist, fine to medium Sandy CLAY, appeared reworked. -FILL-	
							6				
	4D	24/16	7.0 - 9.0	4-3-8-9	11	11	10			Gray/brown, moist, fine to medium Sandy CLAY. -FILL-	
							13				
	5D	24/8	9.0 - 11.0	5-4-3-4	7	7	15	39.9		Top 4": Gray/brown, moist, medium stiff, fine to coarse Sandy CLAY.	
10							9			9.3 Bottom 4": Gray, moist, loose, silty fine SAND, poorly graded, non plastic, organic fibers within.	
	6D	24/9	11.0 - 13.0	4-2-2-3	4	4	10	37.5		Top 7": Blue/gray, medium stiff, fine to coarse Sandy CLAY, brick fragments within.	
							12	37.3		11.7 Horizontal grained wood in tip.	
	7D	19/9	13.0 - 14.6	2-1-46-50/0.1'	47	47	15	36.2		11.9 Apparent void from 11.9' to 13.0'.	
								36.0		13.0 Top: Horizontal grained wood.	
15	8D	24/8	15.0 - 17.0	8-4-3-3	7	7	18			13.2 Bottom: Light gray/white, moist, medium SAND, little Silt, probable voids. -FILL-	
							20			Gray, wet, medium dense, fine to coarse SAND, some Clay, trace Gravel. -FILL-	
	9D	24/10	17.0 - 19.0	1-1-25-7	26	26	21	31.5		Top 8": Gray, wet, soft, medium SAND, trace Silt.	
							35	31.3		Probable voids from 17 to 17.7'. 1911 penny in recovery. 17.7	
	10D	7/1	19.0 - 19.6	30-50/0.1'			RC			Bottom 2": Wood, horizontal grained. 17.9	
20								29.6		Piece of Gravel/ledge. 19.6	
								28.2		Rolled to 21' below ground surface. Consistent resistance in probable bedrock from 19.6 to 21.0'. 21.0	
										Bottom of Exploration at 21.00 feet below ground surface.	
25											

Remarks:

DRAFT

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Kennebunk Bridge Replacement
Location: Kennebunk, ME

Boring No.: BB-KMR-302
PIN: 15098.00

Driller:	Maine Test Boring	**Elevation (ft.)**	49.6	**Auger ID/OD:**	NA
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Split
Logged By:	Eric Baron	**Rig Type:**	Truck	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	06/03/10-06/03/10	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ
Boring Location:	Sta. 14+25, 13.1' R	**Casing ID/OD:**	3"/3.5"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐	Rope & Cathead ☒	

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	18/10	0.5 - 2.0	11-22-20	42	42	Auger	49.1		Asphalt. 0.5	
										Brown, dense, fine to coarse SAND, some Gravel, trace Silt. -FILL- Top 6": Brown, dry, fine to medium SAND, little Gravel, trace Silt. Bottom 4": Brown, dry, dense, Sandy GRAVEL, little Silt.	
	2D	24/10	2.0 - 4.0	8-16-26-28	42	42					
								45.6		4.0	
	3D	24/2	4.0 - 6.0	18-13-10-13	23	23				Brown, dry, dense, fine to medium SAND, trace Silt.	
5											
	4D	24/18	6.0 - 8.0	16-18-16-23	34	34	22	42.9		Top 8": Brown, moist, dense, fine to coarse SAND, some Silt, trace Gravel. 6.7	
							14			Bottom 10": Brown/gray, wet, dense, GRAVEL, little Silt, little Sand, angular. -FILL- Top 1": Brown/gray, wet, GRAVEL, little Sand and Silt, angular. 8.1	
	5D	24/24	8.0 - 10.0	8-10-6-6	16	16	18	41.5			
							42			Bottom 23": Brown/gray, mottled, wet, very stiff, fine to coarse Sandy SILT, little Gravel. -GLACIAL TILL- Olive, wet, medium dense, fine to coarse SAND, some Silt, trace Gravel, nested. Olive/brown, wet, medium dense, fine to coarse SAND, some Silt and Clay, trace Gravel, nested. Transition of color to Gray.	
10	6D	24/14	10.0 - 12.0	16-17-13-13	30	30	21				
							26				
	7D	24/24	12.0 - 14.0	10-10-10-12	20	20	OH				
										Gray, wet, dense, fine to coarse SAND, some Silt and Clay, trace Gravel, nested.	
	8D	24/24	14.0 - 16.0	11-12-20-20	32	32					
15											
	9D	24/24	16.0 - 18.0	14-13-16-17	29	29	RC			Gray, wet, medium dense, fine to coarse SAND, some Silt and Clay, trace Gravel, nested. -GLACIAL TILL-	
										Rolled ahead to 28.1'. Consistent resistance to 25.6'.	
20											
25											

Remarks:

DRAFT

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Kennebunk Bridge Replacement
Location: Kennebunk, ME

Boring No.: BB-KMR-302
PIN: 15098.00

Driller:	Maine Test Boring	**Elevation (ft.)**	49.6	**Auger ID/OD:**	NA
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Split
Logged By:	Eric Baron	**Rig Type:**	Truck	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	06/03/10-06/03/10	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ
Boring Location:	Sta. 14+25, 13.1' R	**Casing ID/OD:**	3"/3.5"	**Water Level*:**	
Hammer Efficiency Factor:	0.6	**Hammer Type:**	Automatic ☐ Hydraulic ☐ Rope & Cathead ☒		

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample Information: Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
25								24.0		25.6	
										Apparent weathered rock (based on drill action and cuttings). Consistent resistance in probable bedrock from 25.6 to 28.1'	
								21.5		28.1	
										Bottom of Exploration at 28.10 feet below ground surface.	
30											
35											
40											
45											
50											

Remarks:

DRAFT

Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
* Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

Maine Department of Transportation

Soil/Rock Exploration Log
US CUSTOMARY UNITS

Project: Kennebunk Bridge Replacement
Location: Kennebunk, ME

Boring No.: BB-KMR-303
PIN: 15098.00

Driller:	Maine Test Boring	**Elevation (ft.)**	48.3	**Auger ID/OD:**	NA
Operator:	Brad Enos	**Datum:**	NAVD 88	**Sampler:**	Standard Split
Logged By:	Eric Baron	**Rig Type:**	Truck	**Hammer Wt./Fall:**	140#/30"
Date Start/Finish:	06/03/10-06/03/10	**Drilling Method:**	Cased Wash Boring	**Core Barrel:**	NQ
Boring Location:	Sta. 14+78, 12.6' R	**Casing ID/OD:**	3"/3.5"	**Water Level*:**	
Hammer Efficiency Factor: 0.6		**Hammer Type:**	Automatic ☐ Hydraulic ☐	Rope & Cathead ☒	

Definitions:
D = Split Spoon Sample
MD = Unsuccessful Split Spoon Sample attempt
U = Thin Wall Tube Sample
MU = Unsuccessful Thin Wall Tube Sample attempt
V = Insitu Vane Shear Test
MV = Unsuccessful Insitu Vane Shear Test attempt
R = Rock Core Sample
SSA = Solid Stem Auger
HSA = Hollow Stem Auger
RC = Roller Cone
WOH = weight of 140lb. hammer
WOR = weight of rods
WO1P = Weight of one person
S_u = Insitu Field Vane Shear Strength (psf)
T_v = Pocket Torvane Shear Strength (psf)
q_p = Unconfined Compressive Strength (ksf)
N-uncorrected = Raw field SPT N-value
Hammer Efficiency Factor = Annual Calibration Value
N_{60} = SPT N-uncorrected corrected for hammer efficiency
N_{60} = (Hammer Efficiency Factor/60%)*N-uncorrected
$S_{u(lab)}$ = Lab Vane Shear Strength (psf)
WC = water content, percent
LL = Liquid Limit
PL = Plastic Limit
PI = Plasticity Index
G = Grain Size Analysis
C = Consolidation Test

Depth (ft.)	Sample No.	Pen./Rec. (in.)	Sample Depth (ft.)	Blows (/6 in.) Shear Strength (psf) or RQD (%)	N-uncorrected	N_{60}	Casing Blows	Elevation (ft.)	Graphic Log	Visual Description and Remarks	Laboratory Testing Results/ AASHTO and Unified Class.
0	1D	18/14	0.6 - 2.1	27-30-35	65	65	Auger	47.7		Asphalt. 0.6 Brown, dry, very dense, gravelly fine to coarse SAND, trace Silt. -FILL-	
	2D	24/18	2.0 - 4.0	21-16-12-6	28	28		45.8		Top 6": Same as 1D. 2.5 Bottom 12": Dark brown, dry, fine to coarse SAND, some Silt, little Gravel. -FILL-	
	3D	24/16	4.0 - 6.0	3-5-5-4	10	10				Brown, dry, loose, fine to coarse SAND, some Gravel, little Silt. -FILL-	
5	4D	24/24	6.0 - 8.0	3-4-7-10	11	11	9			Brown, moist, medium dense, fine to coarse SAND, little Silt, trace Gravel. Chunks of Silt/loam. -FILL-	
	5D	24/9	8.0 - 10.0	17-19-11-6	30	30	18 34			Top 3": Brown, moist, dense, fine to coarse SAND, little Silt, little Gravel. Bottom 6": Gray, moist, silty fine to medium SAND, trace Gravel. Very small, horizontally grained Wood pieces within.	
10	6D	24/9	10.0 - 12.0	11-10-10-9	20	20	41 58	38.3		10.0 Brown/gray, mottled, moist, medium dense, silty fine to medium SAND, little Gravel. -GLACIAL TILL-	
	7D	24/20	12.0 - 14.0	10-12-47-56	59	59	26 29			Top 13": Brown/gray, moist, medium dense, fine to medium SAND, little Silt, little Gravel.	
	8D	5/5	14.0 - 14.4	75/0.4			36 RC	35.2		13.1 Bottom 7": Gray, wet, very dense, GRAVEL, trace Sand, trace Silt, probable weathered rock. Weathered Rock fragments. Rolled from 14.4 to 16.5' with consistent resistance through probable weathered rock. Roller cone refusal at 16.5'.	
15								31.8		16.5 **Bottom of Exploration at 16.50 feet below ground surface.**	
20											
25											

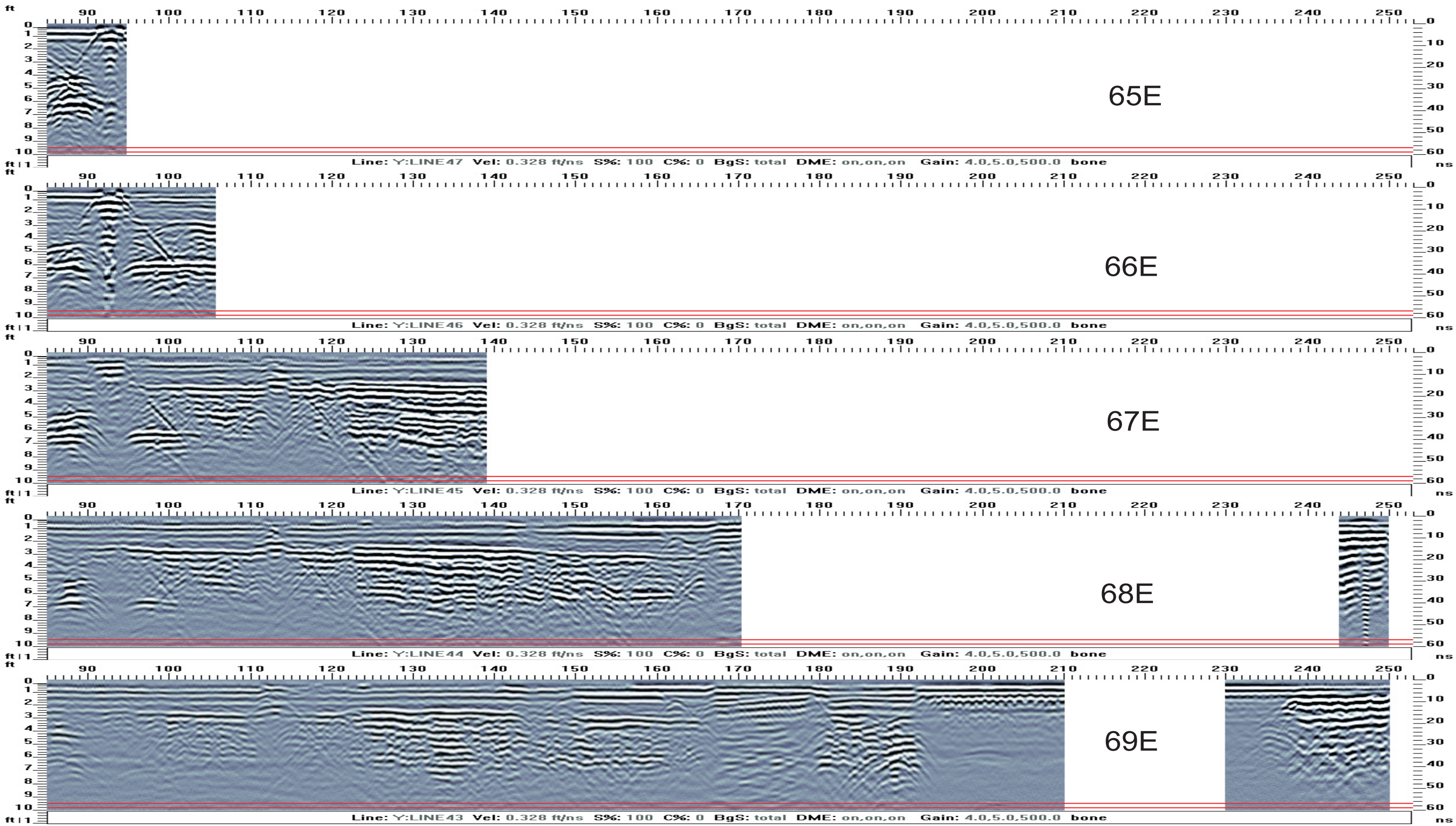
Remarks:

DRAFT

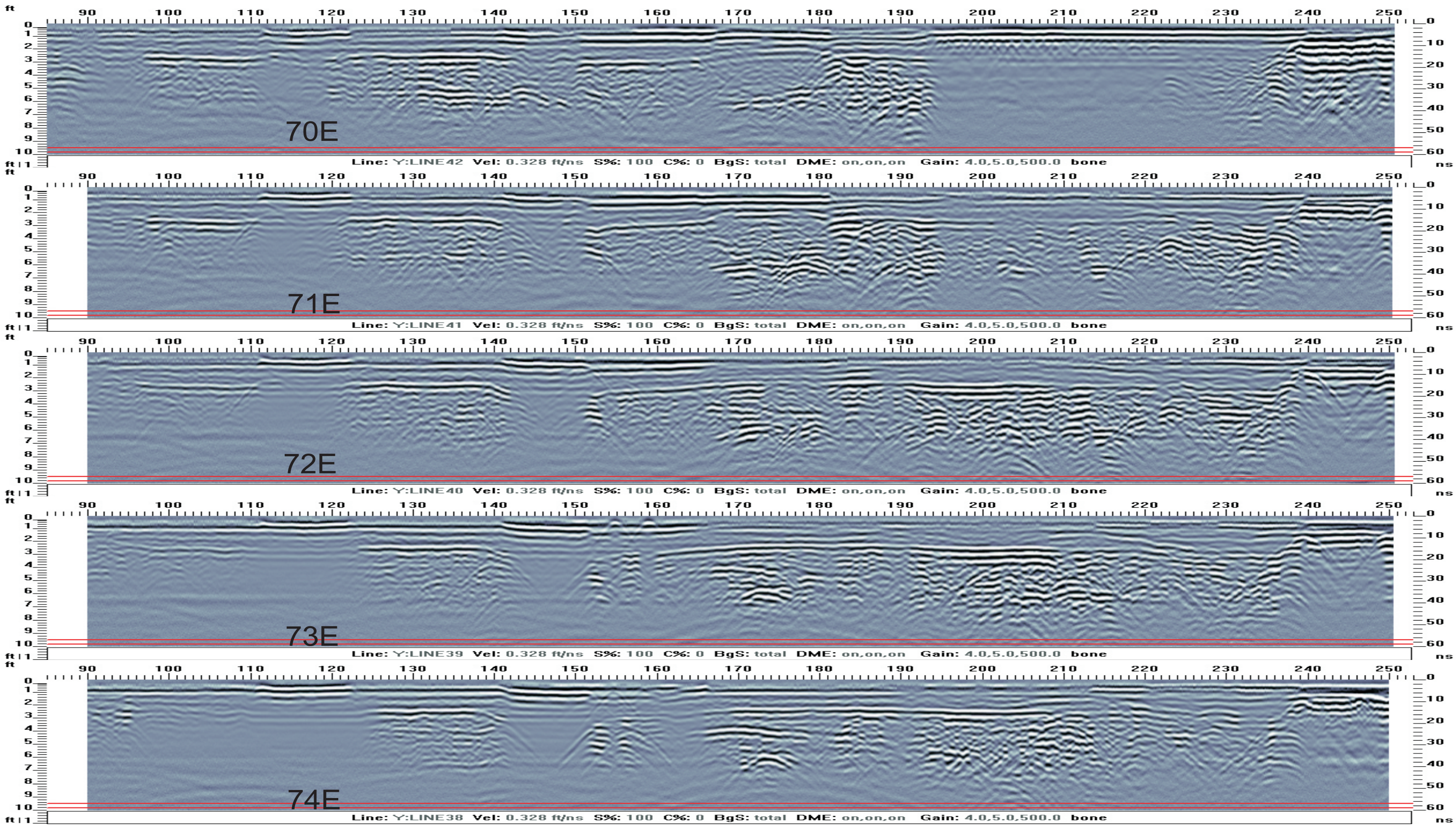
Stratification lines represent approximate boundaries between soil types; transitions may be gradual.
*Water level readings have been made at times and under conditions stated. Groundwater fluctuations may occur due to conditions other than those present at the time measurements were made.

APPENDIX 2
GPR RECORDS

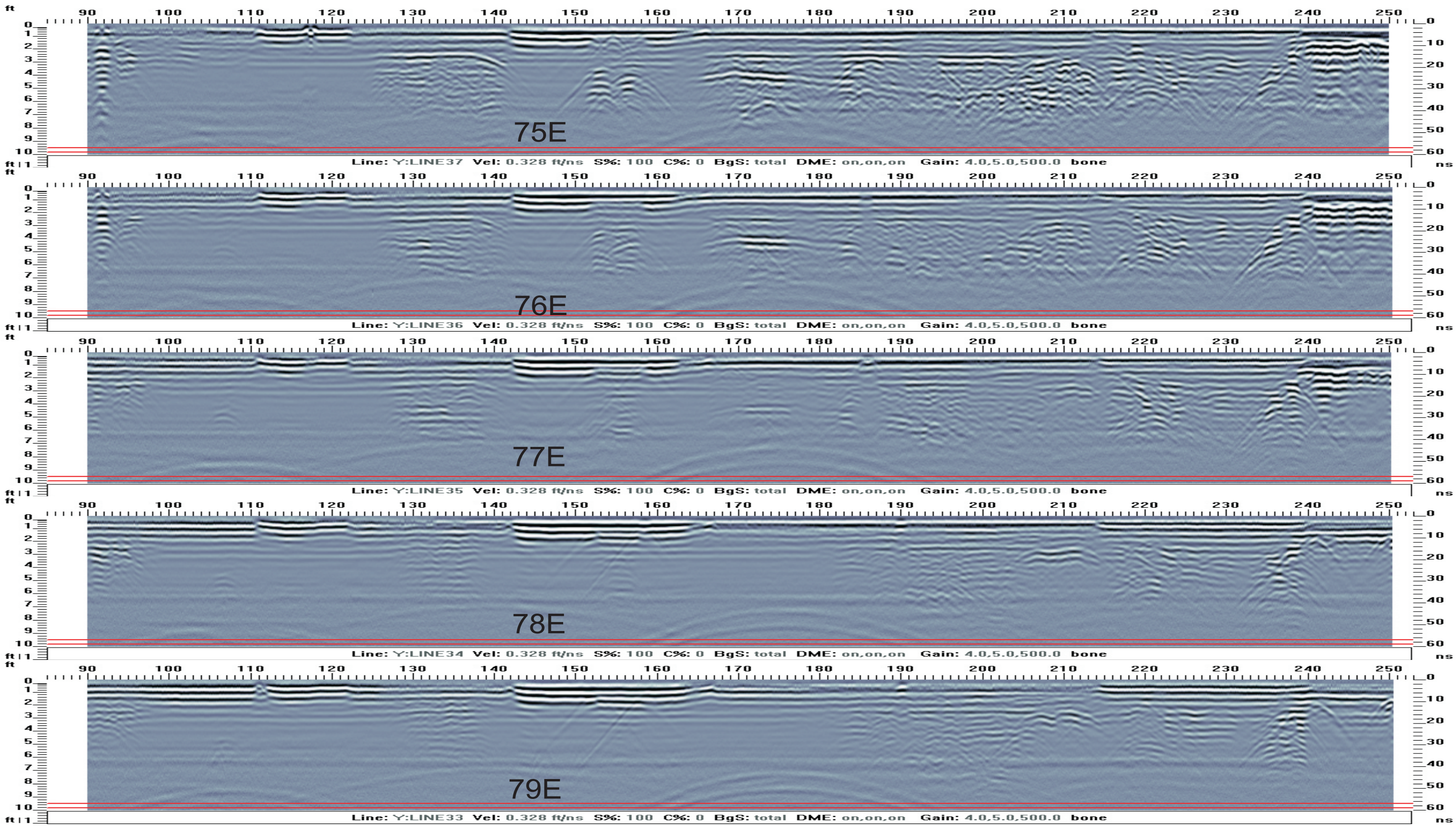
APPENDIX 2: GPR Sections



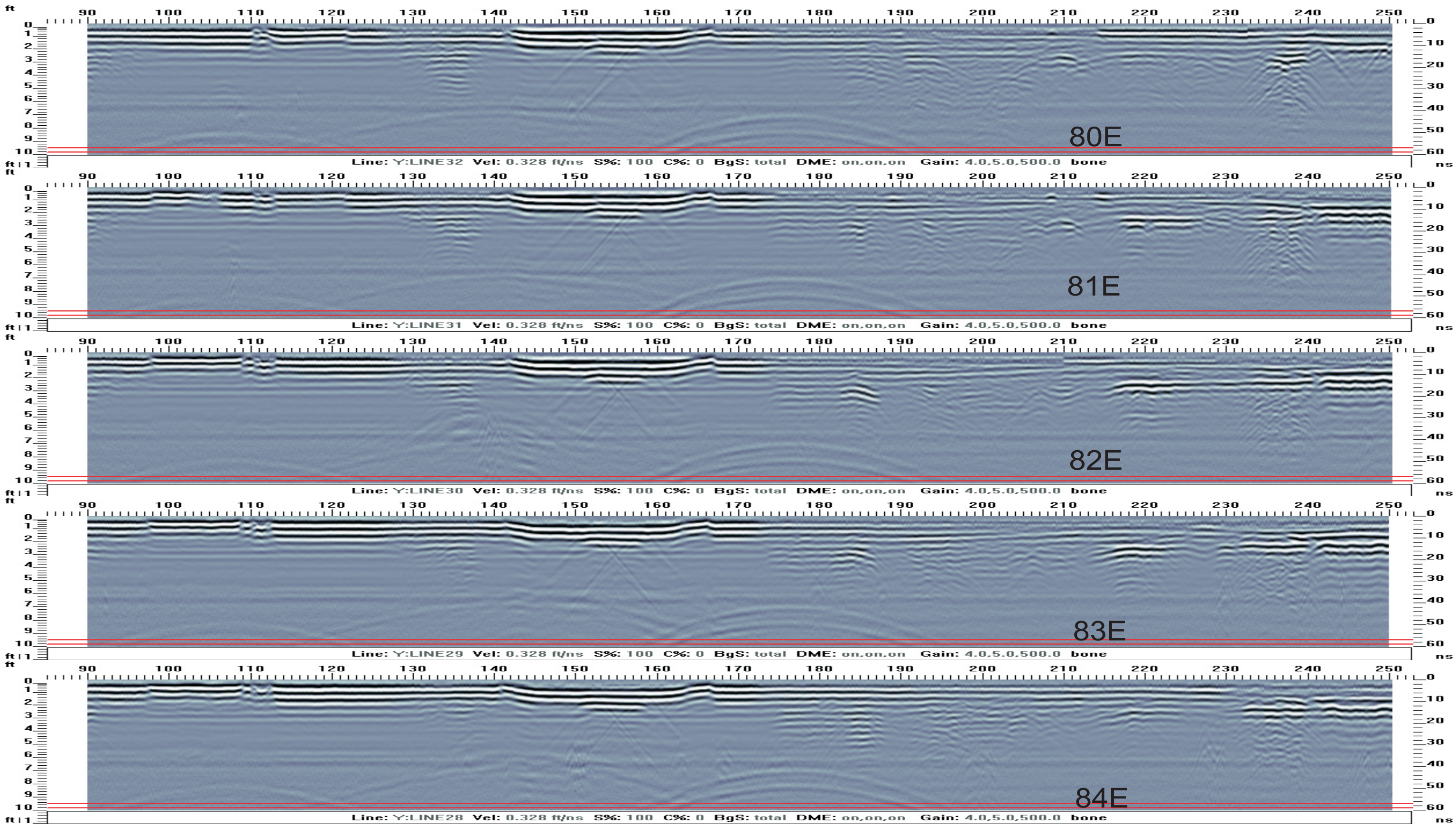
APPENDIX 2: GPR Sections



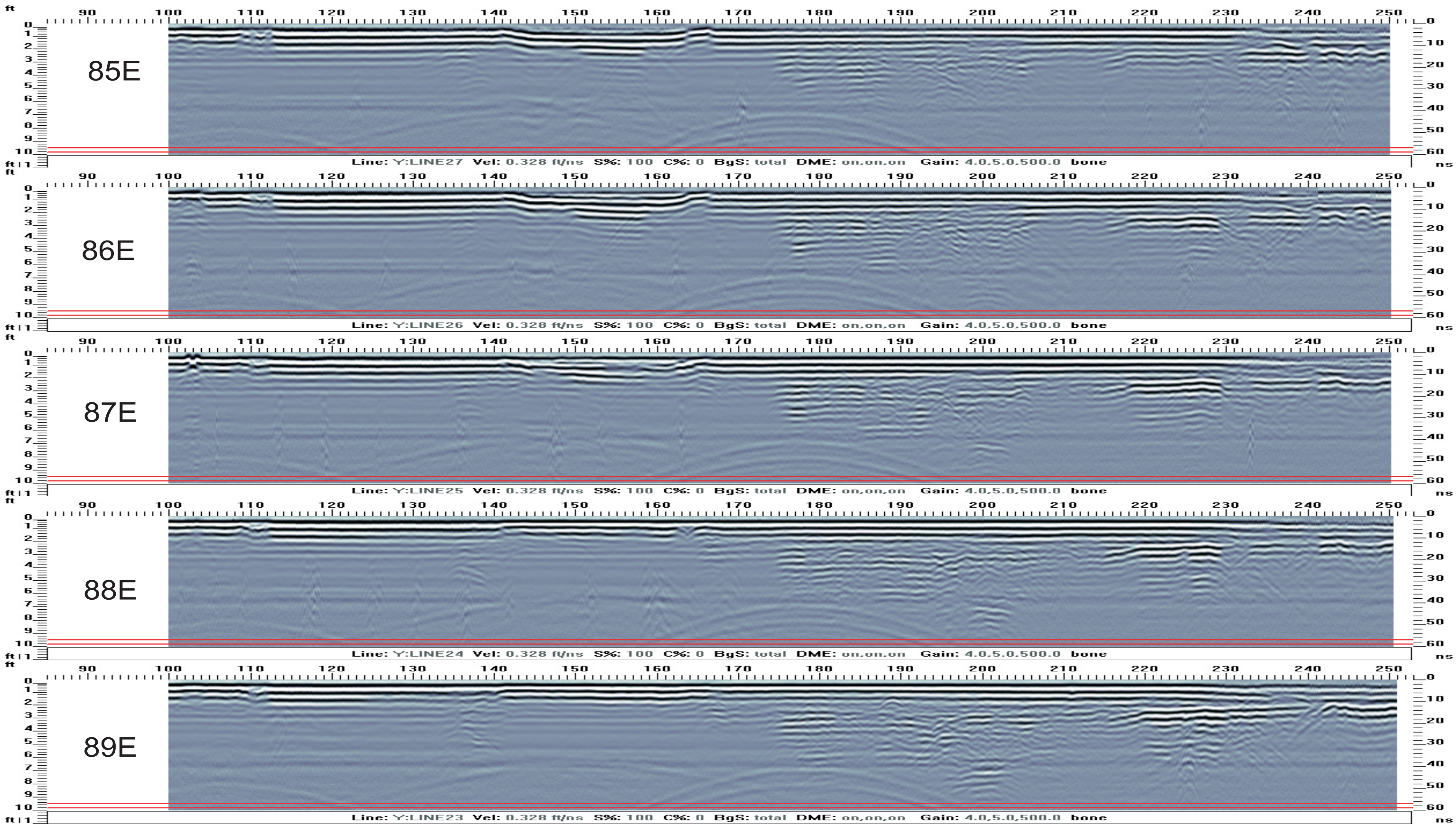
APPENDIX 2: GPR Sections



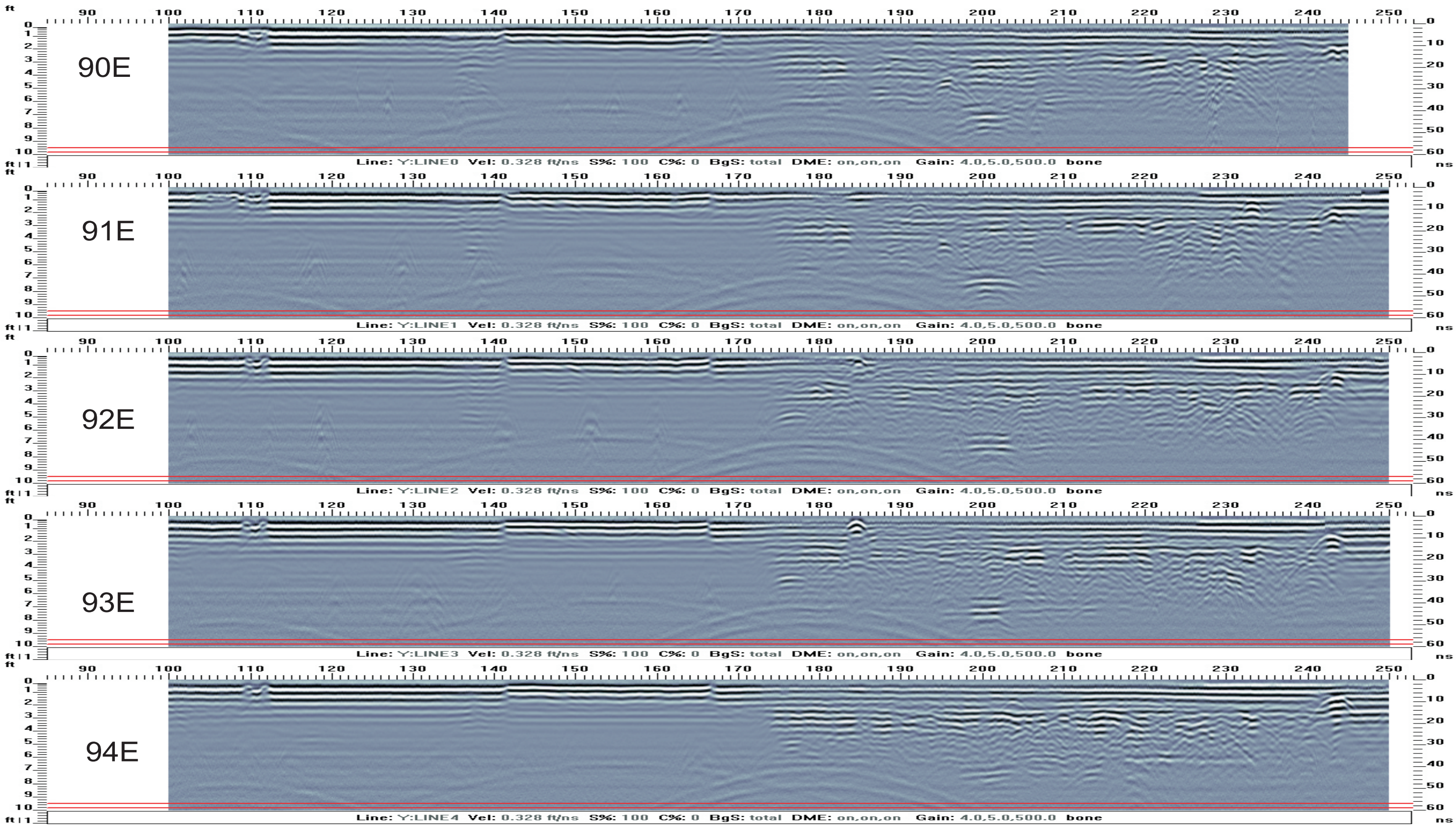
APPENDIX 2: GPR Sections



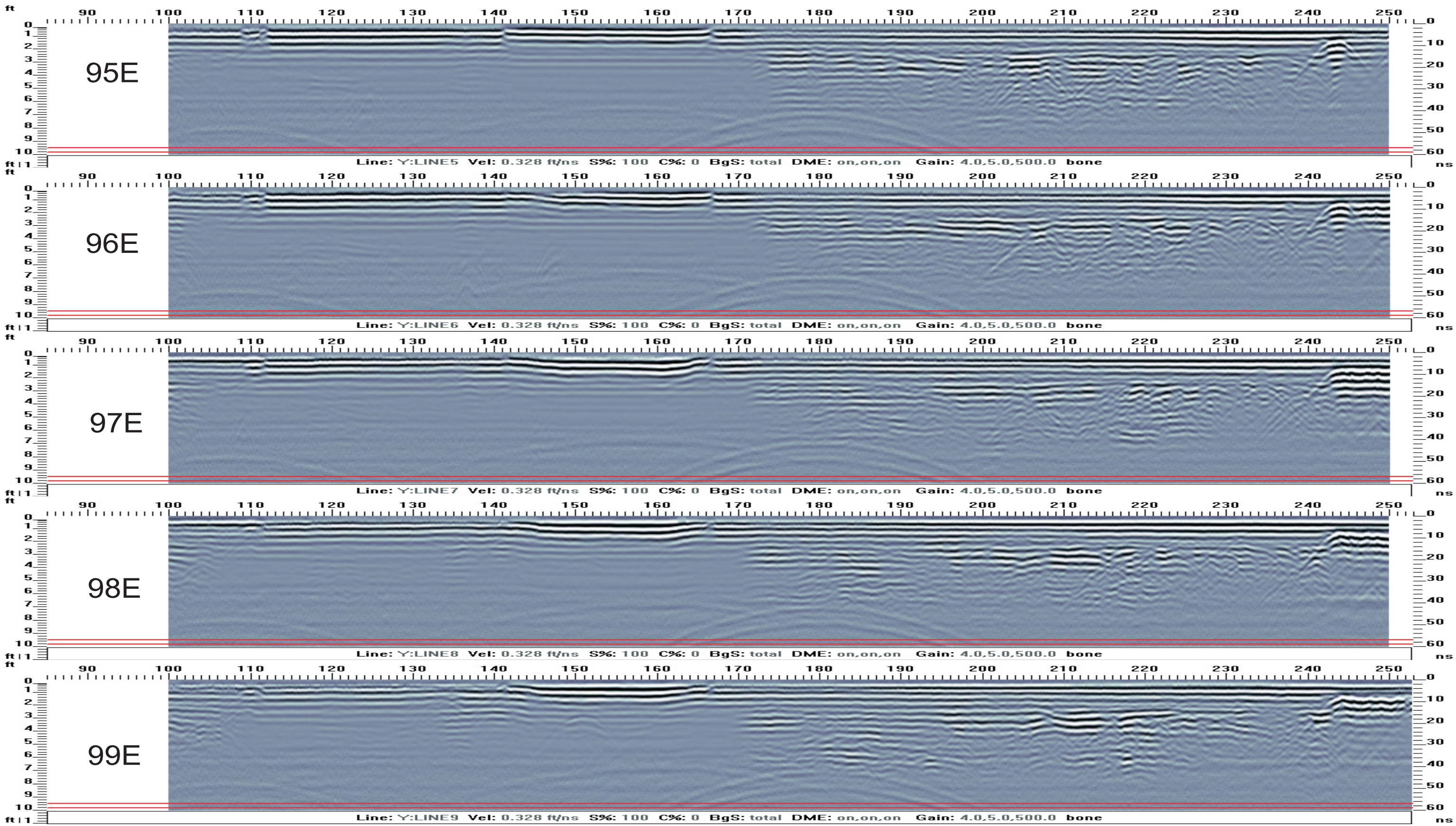
APPENDIX 2: GPR Sections



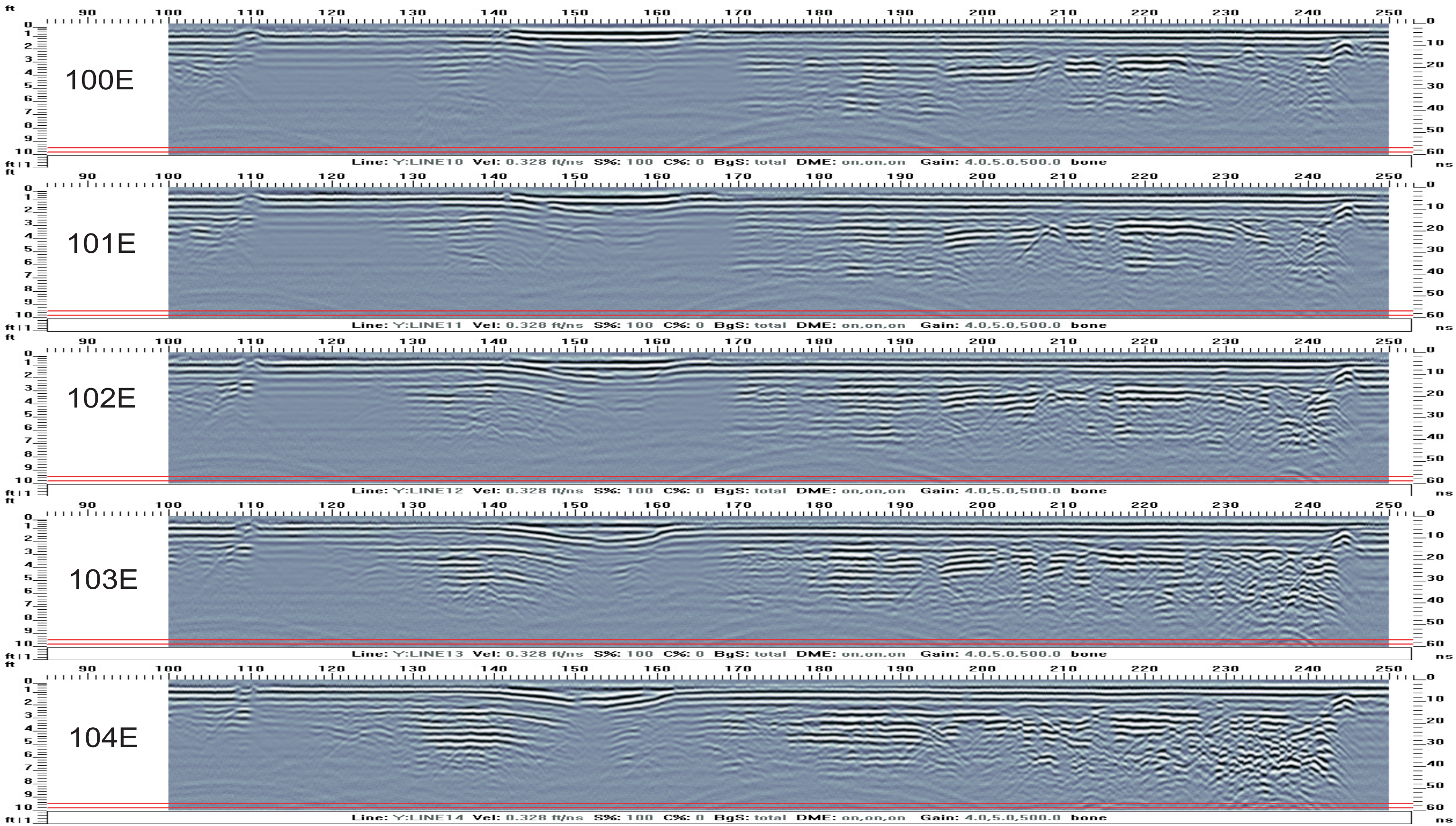
APPENDIX 2: GPR Sections



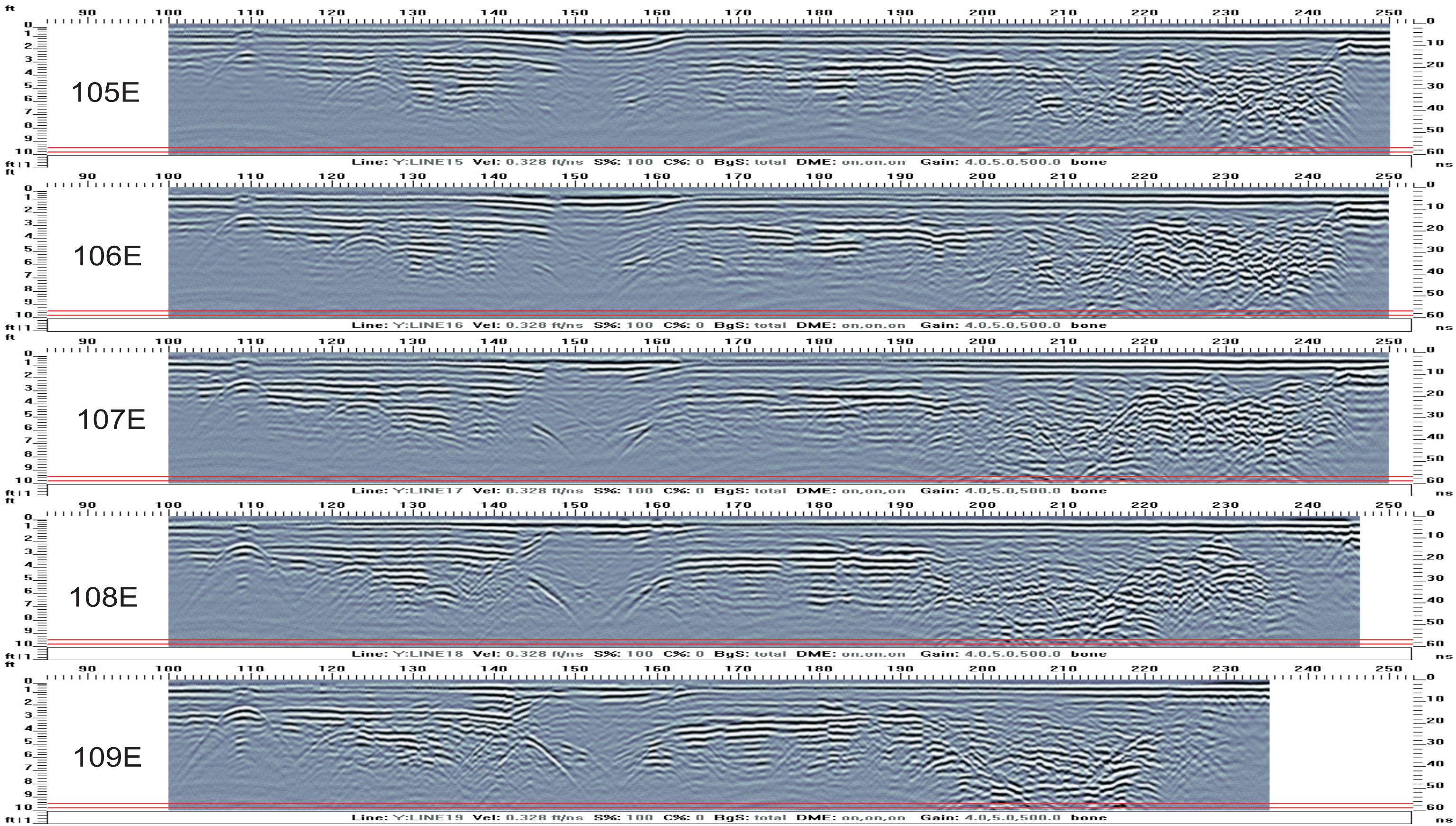
APPENDIX 2: GPR Sections



APPENDIX 2: GPR Sections



APPENDIX 2: GPR Sections



APPENDIX 2: GPR Sections