LINDSEY BROOK
FLOOD MITIGATION
for the
CITY OF ROCKLAND, MAINE

October 2008

WRIGHT-PIERCE
Engineering a Better Environment

LINDSEY BROOK
FLOOD MITIGATION
FOR THE
CITY OF ROCKLAND, MAINE

OCTOBER 2008

Prepared By:

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Topsham, Maine 04086

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LINDSEY BROOK FLOOD MITIGATION

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SECTION 1

LINDSEY BROOK FLOOD MITIGATION

1.1 INTRODUCTION

Lindsey Brook is fed by three tributaries which in past studies have been identified as Tributary A, B, and C. Tributary A is the southern tributary and Tributary B, and C are the two northern tributaries. Figure 1 defines the watershed and the various subcatchments that were used in modeling the watershed. In the late 1990s a study was completed by Wright-Pierce which was focused on quantifying the flows and developing a strategy for intercepting the flows. This study concluded that a major interceptor the length of Rankin Street would be needed to intercept flows from the two northern tributaries and convey them to the harbor. While this approach certainly would mitigate the downtown flooding that has plagued the Lindsey Brook watershed it also carried with it substantial cost which has continued to escalate since the late 1990s. The purpose of this report is to highlight incremental improvements that the City has accomplished in the Lindsey Brook watershed, update the hydrologic model for the watershed, and identify further incremental improvements that can be made with existing funds.

1.2 LINDSEY BROOK IMPROVEMENTS COMPLETED

In the years that have passed since the 1999 report the City has made a number of improvements to the Lindsey Brook system. The following projects have been completed:

1. Lawn Avenue detention basin and routing of flows from the detention basin to Tributary B.
2. Culvert replacement at Summer Street.
3. Culvert replacement at Gay Street.
4. Tributary A diversion at Pleasant Street.
5. Replacement of the subgrade granite channel at the intersection of Pleasant and Franklin Streets.
6. Debris removal from the channel between Gay Street and Broadway.
7. Replacement of the Maple Street culvert.
8. Replacement of the Granite Street culvert with a box culvert and the resetting of granite channel blocks.

1.3 RECOMMENDED APPROACH TO IMPROVEMENTS

Previous approaches to flood mitigation, for the two northern tributaries, concluded that the best approach was to divert both tributaries utilizing a Rankin Street interceptor. This still remains the best approach with respect to ultimately fully addressing the conveyance issues that exist in the downtown particularly when looking at 25 year storm flows. These conveyance issues are particularly magnified when coupled with a high tide and storm surge which further reduce what limited hydraulic gradient exists. Although as previously discussed the cost of this approach is prohibitive. Therefore we have re-evaluated and looked at smaller projects that would mitigate flooding while working with existing conveyance restraints. Our approach was to evaluate through modeling techniques the effect that incremental storage volumes in the middle reaches of the watershed would have on peak flows at the confluence of the tributaries in the downtown. We expected that mid-reach storage would provide for enough of a delay in downstream peaks to allow for rainfall in the immediate downtown to rapidly exit the system before upstream peaks reached the downtown. What our analysis concluded was that modest storage volumes in the middle reaches of Tributary B did offer a small degree of mitigation to peak flows reaching the confluence in the downtown. We have included results of this modeling effort as an appendix to this report. What our modeling efforts show is that incremental improvements can be made through storage and through partial diversion. We will address each Tributary in turn, outlining the options explored, and the proposed approach to mitigation.

1.3.1 Tributary A

Considerable improvements have already been realized on Tributary A with the installation of the diversion at Pleasant Street. This diversion at Pleasant Street shaves peak flows from Tributary A during storm events which result in an excess of 10 CFS in the tributary. A diversion structure was installed at the corner of Pleasant and Franklin which dumps flows in excess of 10 CFS into a 36 inch storm drain which outfalls in Harbor Park. A second diversion for Tributary A was conceptually planned for Holmes Street. This diversion would go down Main Street to Harbor Park as well. This project would be done in concert with the Maine Department of Transportation when and if Main Street storm drainage was separated from Main Street sanitary sewers.

1.3.2 Tributary B

There are very limited opportunities to address Tributary B while at the same time Tributary B has for the most part more open channels and better conveyance than the other Tributaries. In reviewing the contributing watershed for Tributary B there are still significant areas of open space in this watershed. Some important work has already been accomplished on Tributary B as it relates to the storm water detention pond located on Lawn Avenue. This pond was refitted with a controlled outlet structure in order to maximize its storage volume and ability to mitigate peak flows as they make their way along the old railroad grade from Nightingale subdivision and the former MBNA office building and City recreation fields.

Tributary B is located westerly of tributary C and as such the distances for interception of flows to be conveyed to the harbor prove too costly. Without interception as an option we focused on storage as the least expensive approach to flood mitigation. There are a couple of areas where storage may be an option. The first of these locations is above Rankin Street. There is a broad open flood plain associated with Tributary B in this area. In order to both slow down flows and allow for storage the City may be able to buy a storage easement for the flood plain portion of the Tributary in this area (as a flood plain the land has little developable use). Utilization of this storage area could be accomplished through the use of an inlet structure to the culvert at Rankin Street. This inlet structure would be designed with a multi-stage outlet to allow for both base flows and the storage of peak flows followed by an extended discharge of the storage volume.

Based on the amount of open space on Tributary B and the marginal nature of the Tributary's capacity the City should consider planning measures which call for a reduction in peak storm flows for the 2, 10, and 25 year storm events for future development in this watershed. This will reduce the strain on the Tributary's conveyance constraints as open land is developed. This control of runoff can be accomplished through a combination of Low Impact Development measures and detention structures.

1.3.3 Tributary C

In looking at Tributary C, the topography and location of the Tributary, allow for both storage and interception. As previously indicated we expected to see some benefits from storage in the vicinity of Gay Street and Rankin Street especially during the 2 year storm event. We modeled available storage volumes for this stretch of Tributary C allowing for inundation during larger storms, i.e. the 10 year, or 25 year event. The results of this modeling indicated that there were some benefits to mid reach storage. Although the benefits of storage may not justify the cost particularly as some real estate easements would be necessary. The detailed breakdown of these flows is summarized in Table 2. This additional storage resulted in a modest reduction in peak flows in the downtown. In order to achieve larger reductions it is necessary to consider an interceptor/bypass.

With this in mind we propose interception of Tributary C at Summer Street with a large diameter storm drain. This storm drain would be installed from Lindsey Brook out Summer Street to Main Street (US Route 1) across Main Street and down to a new outfall between the MDOT ferry terminal and the apartment building.

A second alternative point for interception is on Rankin Street. This alternative after field review did not appear financially viable because of the number of buried utilities and their location along with the increased length of pipe. In addition there would be a deep cut in the section from Foggs Street to Main Street.

The flood mitigation benefits of these various approaches were evaluated utilizing Hydro-CAD modeling software. Hydro-CAD utilizes the Soil Conservation Services TR-20 methodology for calculating hydrographs with Time to Concentration approximations made by the TR-55 methodology. The following table illustrates main stem flow at the point of interception for both the 10 year, and 25 year storms. The table highlights pre-conditions (no bypass), and post conditions (with bypass) at the confluence (POI) in the downtown.

TABLE 1-1

Affect of Bypass on Confluence (POI) Peak Flows			
	2 Year	**10 Year**	**25 Year**
Preconstruction Confluence (POI)	41 CFS	79 CFS	102 CFS
Summer Street Postconstruction Confluence (POI)	37 CFS	40 CFS	45 CFS

Based on the modeling the (Summer St) interceptor provides approximately a 50% reduction in Tributary C flows at the confluence in the downtown during a 25 year storm event.

As previously discussed we modeled the effects of storage on peak flows in Tributary C in two locations. The first location that appeared to warrant further investigation was between Broadway and Gay Street. The second location was between Gay Street and Rankin Street. As you are aware Public Works has recently replaced the culverts at both of these locations. In order to convert these areas into storage areas hydraulic control structures were evaluated at the inlet of each of these culverts. The inlet structure would be a multi-stage flow structure consisting of an orifice for normal flow located at the base of the structure along with an elevated weir plate. The elevated weir plate would not allow passage of flow until the storage volume at an elevation below the weir plate was full of water. At this point flow would begin to spill over the weir. The weir would be sized to allow for 1 foot of freeboard as measured form the elevation of the road during a 25 year storm event. The table below shows the pre and post flows using proposed hydraulic control structures at Gay Street and Rankin Street.

TABLE 1-2

Affect of Storage and Bypass on Pre and Post Flows at Rankin and Gay Streets			
Preconstruction	**2 Year**	**10 Year**	**25 year**
Rankin	28 CFS	49 CFS	63 CFS
Gay	27 CFS	49 CFS	62 CFS
Confluence (POI)	41 CFS	79 CFS	102 CFS
Postconstruction			
Rankin (P25)	15 CFS	35 CFS	59 CFS
Gay (P24)	15 CFS	27 CFS	46 CFS
Confluence (POI)	33 CFS	43 CFS	46 CFS

Based on the modeling of the storage with the bypass there are modest improvements during the smaller storm events to those provided by just the bypass. The storage during the larger events is inundated and provides little or no dampening of the peak flows.

1.4 PLANNING LEVEL COST ESTIMATES

Planning level cost estimates for construction of proposed mitigation measures are attached. These projects are broken down as follows:

1. Installation of diversion pipe on Tributary C.
2. Installation of hydraulic control structure at Gay Street.
3. Installation of hydraulic control structure at Rankin Street
4. A review of planning standards for future development in Tributary B watershed.

1.5 CONCLUSIONS

Based on the various options that were evaluated it appears that the most cost effective option is to install an interceptor on Summer Street. The minimal number of existing utilities on Summer Street, coupled with the shorter distance, and the lack of ledge found during exploration make it the most cost-effective solution. The modeling indicated modest improvements during smaller storms through the use of storage above Gay Street and Rankin Street. These modest improvements do not appear to justify the additional cost associated with the installation of the hydraulic structures and the gathering of the necessary real estate easements.

The Summer Street interceptor could be undertaken through a combination of existing Lindsey Brook Flood mitigation funds coupled with grant monies through the CDBG public infrastructure program. The City will be eligible again for the CDBG public infrastructure grant program in 2010. With the availability of existing Lindsey Brook flood mitigation dollars to meet the City's portion of the programs match requirements a strong grant application could be written improving the likelihood that the project would receive funding.

October 3, 2008

City of Rockland
Tributary C Diversion
Summer Street to Lermond Cove
Planning Level Estimate

Item No.	Item	Quantity No. Units	Unit Measure	Cost Per Unit	Subtotal
1	Aggregate Base Course	200	CY	$ 30.00	$6,000
2	Hot Bituminous Pavement (Machine)	154	Ton	$ 200.00	$30,800
3	36 inch Storm Drain	1,000	LF	$ 160.00	$160,000
4	Catch Basins 6ft Diameter	65	VF	$ 350.00	$22,750
5	Outlet Control Structure 6ft Diameter	8	VF	$ 500.00	$4,000
6	Sidewalk	750	LF	$ 60.00	$45,000
7	Curbing	750	LF	$ 20.00	$15,000
8	Ledge Removal	25	CY	$ 125.00	$3,125
9	Temp. Erosion Control	1	LS	$ 5,000.00	$5,000
10	Loaming and Seeding	1,200	SY	$ 2.00	$2,400
11	Riprap Ditch Stabilization	50	CY	$ 65.00	$3,250
12	Erosion Control Matting	0	SY	$ 2.25	$0
13	Signing / Pavement Markings	1	LS	$ 3,500.00	$3,500
14	Flaggers/Traffic Control	1	LS	$ 5,000.00	$5,000
15	Outfall	1	LS	$ 8,000.00	$8,000
16	Trench Excavation Beyond 5ft	2,090	CY	$ 7.00	$14,630
	SUB-TOTAL				$328,455
	Contingency & Fees				$80,000
	CONSTRUCTION TOTAL				**$408,000**

October 3, 2008

City of Rockland
Tributary C Storage
Gay Street Hydraulic Control Structure
Planning Level Estimate

Item No.	Item	Quantity: No. Units	Quantity: Unit Measure	Cost Per Unit	Subtotal
1	Hydraullic Control Structure	1	EA	$ 15,000.00	$15,000
2	Hot Bituminous Pavement (Machine)	2	Ton	$ 200.00	$400
3	Easement	1	EA	$ 75,000.00	$75,000
4	Legal	1	EA	$ 5,000.00	$5,000
	SUB-TOTAL				$95,400
	Contingency & Fees				$25,000
	CONSTRUCTION TOTAL				**$120,000**

City of Rockland
Tributary C Storage
Rankin Street Hydraulic Control Structure
Planning Level Estimate

Item No.	Item	Quantity: No. Units	Quantity: Unit Measure	Cost Per Unit	Subtotal
1	Hydraullic Control Structure	1	EA	$ 15,000.00	$15,000
2	Hot Bituminous Pavement (Machine)	2	Ton	$ 200.00	$400
3	Easement	1	EA	$ 75,000.00	$75,000
4	Legal	1	EA	$ 5,000.00	$5,000
	SUB-TOTAL				$95,400
	Contingency & Fees				$25,000
	CONSTRUCTION TOTAL				**$120,000**

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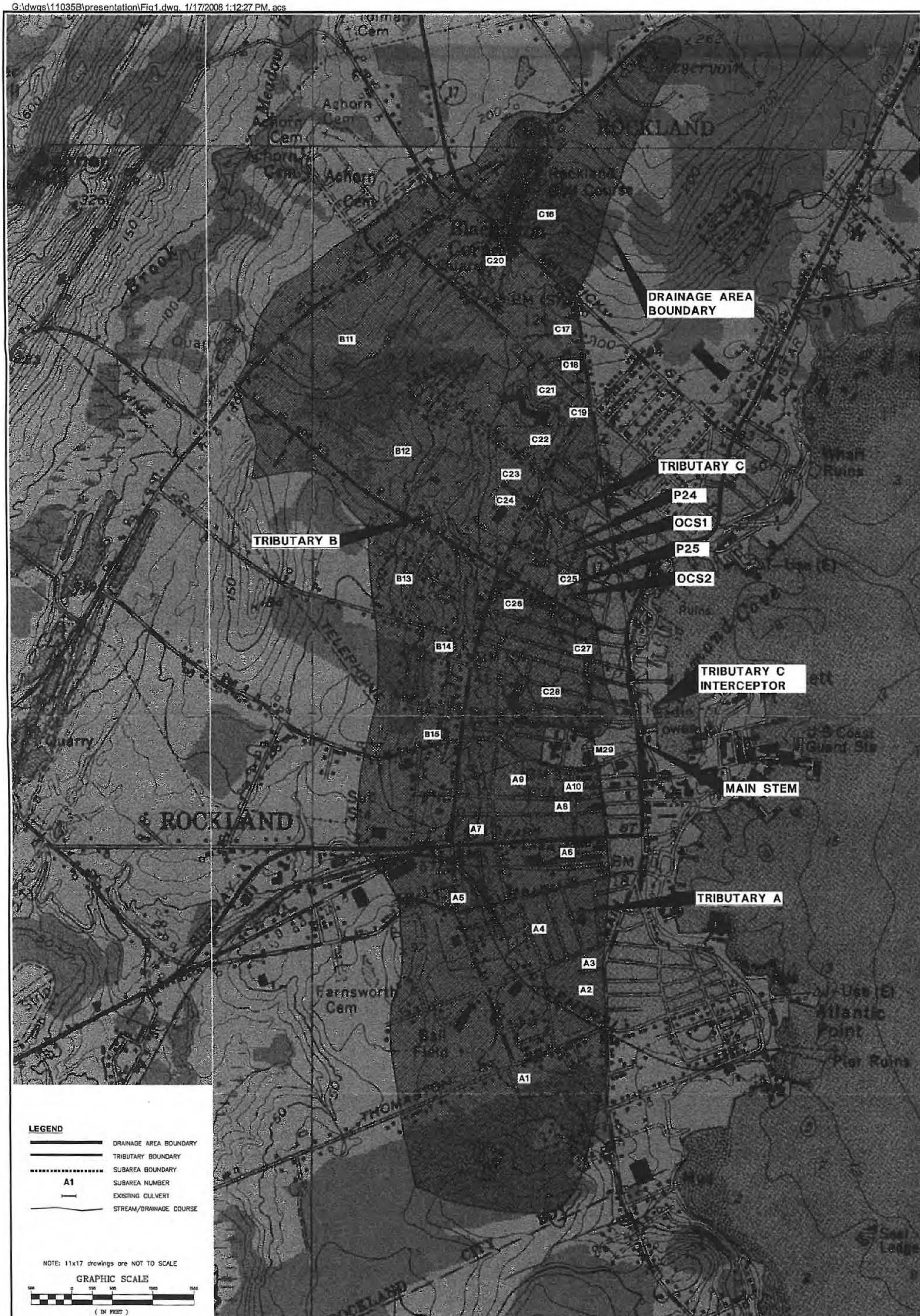

FIGURE 1	CITY OF ROCKLAND LINDSEY BROOK DRAINAGE STUDY PROPOSED SUB-DRAINAGE AREA	Wright-Pierce

DRAWN BY JVM/RJW
CHECKED BY
DATE 10/07/99
APPROVED BY
DATE
BOOK NO.
PROJECT NO. 11035B
SCALE AS SHOWN

NO	REVISIONS	APP'D	DATE
1			
2			
3			
4			
5			

PROGRESS PRINTS
ISSUED FOR REVIEW:
ISSUED FOR BIDDING:
VAULT LOCATION:
LAST WORKED ON:
FILENAME:

Legend

- Culvert
- Catchbasin
- Interceptor
- Stream

ELEVATION

- 50' Contour
- 10' Contour

0 100 200 400 Feet

N

Source: All base mapping data obtained from the Maine Office of GIS.

Lindsey Brook
Rockland, Maine

PROJ NO:	DATE:	FIGURE:
11035A	Oct 2008	2

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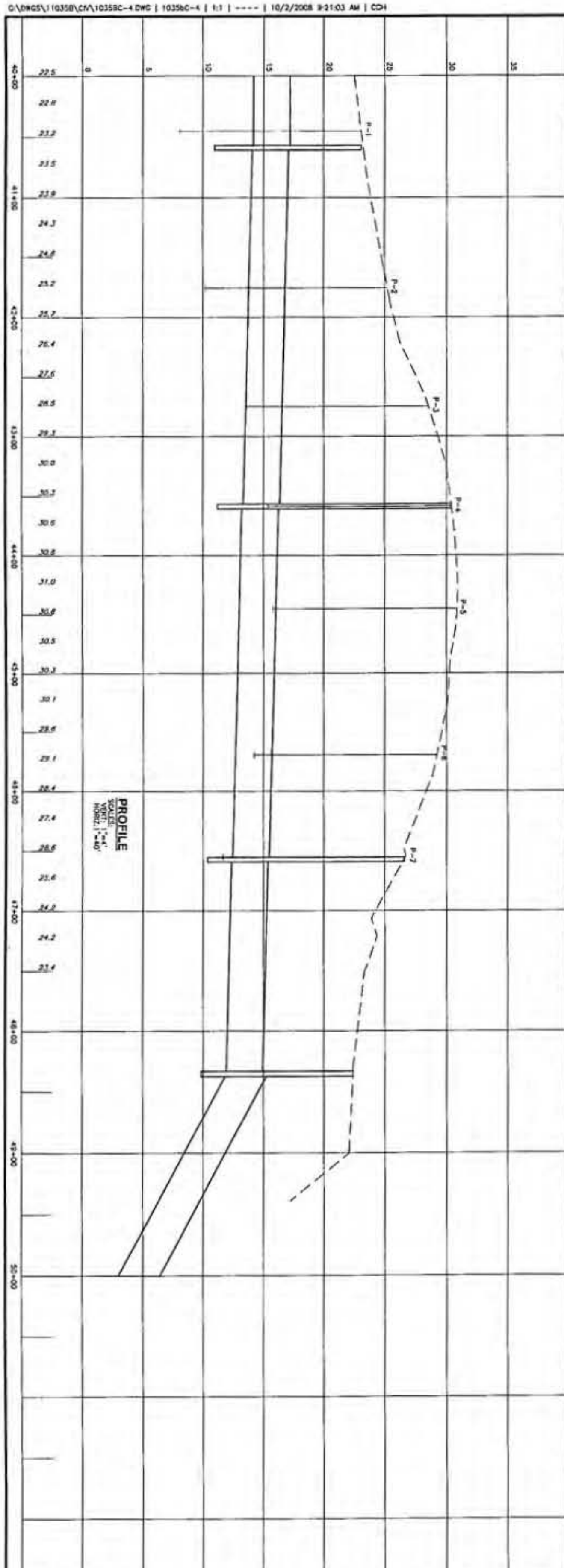
APPENDIX A
HydroCAD Modeling Results

(Separately Bound Document)

APPENDIX B
Summer Street Site Plan



DRAWING C-4

TOWN OF ROCKLAND, MAINE
LINDSEY BROOK

PLAN & PROFILE: SUMMER STREET
STA 40+00 TO STA 47+27

WRIGHT-PIERCE
Engineering a Better Environment

Offices Throughout New England
888.621.8156 | www.wright-pierce.com

DRAWN BY CDH
CHECKED BY JLG
DATE 3/25/08
APPROVED BY MEV
DATE
BOOK NO.
PROJECT NO. 110358
SCALE AS NOTED

NO.	SUBMISSIONS/REVISIONS	APP'D	DATE
1			
2			
3			
4			
5			
6			

APPENDIX C
Boring Logs

East Coast Explorations

16 Maple Street
Hallowell, Maine 04347
Telephone: (207) 623-4358
Fax: 1-(775) 307-9002

SHEET 1 OF 1
DATE 05/6/08
HOLE NO. B-7
LINE & STA. ______
OFFSET ______
SURF. ELEV. ______

TO Wright Pierce
ADDRESS 99 Main street Topsham ME
PROJECT NAME Lindsey Brook
LOCATION Rockland , Maine
REPORT SENT TO Jamie Garland
PROJ. NO. 11035B
SAMPLES SENT TO ______
OUR JOB NO. J 08-05

GROUND WATER OBSERVATIONS

At Dry after one half Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	split spoon	
Size I.D.	Probe Auger		
Hammer Wt.	300lbs	140lbs	BIT
Hammer Fall	30"	30"	

	Date	Time
START		
COMPLETE		

TOTAL HRS.:
BORING FOREMAN Christopher Palmer
INSPECTOR ______
SOILS ENGR.

LOCATION OF BORING: Right hand side of woods road approximately 250' in from the Gilman Pond Road.

DEPTH	Casing Blows per foot	Sample Depths From - To	TYPE	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density of Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Rock-color, type condition, hardness, Drilling time, seams and etc.	SAMPLE #	Pen.	Rec.
									8"of Pavement			
								18"	Gravel to 18" then Olive brown Clay No split spoon samples taken Drillers Observatoins			
									Bottom of boring @ 15'. No Refusal.			

GROUND SURFACE TO 15' USED Probe Auger : THEN Terminate Boring.

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" OD Sampler		SUMMARY
D=Dry C=Cored W=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring
UP=Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP=Test Pit A=Auger V=Vane Test	some 20 to 35%	10-30 Med. Dense	4-8 M/Stiff	Samples
UT=Undisturbed Thinwall	and 35 to 50%	30-50 Dense	8-15 Stiff	
		50 + Very Dense	15-30 V-Stiff	HOLE NO. B-7

East Coast Explorations

16 Maple Street
Hallowell, Maine 04347
Telephone: (207) 623-4358
Fax: 1-(775) 307-9002

SHEET 1 OF 1
DATE 05/6/08
HOLE NO. B-6
LINE & STA. ____
OFFSET ____
SURF. ELEV. ____

TO Wright Pierce
ADDRESS 99 Main street Topsham ME
PROJECT NAME Lindsey Brook
LOCATION Rockland, Maine
REPORT SENT TO Jamie Garland
PROJ. NO. 11035B
SAMPLES SENT TO ____
OUR JOB NO. J 08-05

GROUND WATER OBSERVATIONS

At Dry after one half Hours

At ____ after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	split spoon	
Size I.D.	Probe Auger		
Hammer Wt.	300lbs	140lbs	BIT
Hammer Fall	30"	30"	

	Date	Time
START		
COMPLETE		

TOTAL HRS.:
BORING FOREMAN Christopher Palmer
INSPECTOR ____
SOILS ENGR. ____

LOCATION OF BORING: Right hand side of woods road approximately 250' in from the Gilman Pond Road.

DEPTH	Casing Blows per foot	Sample Depths From - To	TYPE	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density of Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Rock-color, type condition, hardness, Drilling time, seams and etc.	SAMPLE #	Pen.	Rec.
									6"of Pavement			
								18"	Gravel to 18" then Olive brown Clay			
									No split spoon samples taken			
									Drillers Observatoins			
									Bottom of boring @ 15'. No Refusal.			

GROUND SURFACE TO 15' USED Probe Auger : THEN Terminate Boring.

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" OD Sampler		SUMMARY
D=Dry C=Cored W=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring
UP=Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP=Test Pit A=Auger V=Vane Test	some 20 to 35%	10-30 Med. Dense	4-8 M/Stiff	Samples
UT=Undisturbed Thinwall	and 35 to 50%	30-50 Dense	8-15 Stiff	
		50 + Very Dense	15-30 V-Stiff	HOLE NO. B-6

East Coast Explorations

16 Maple Street
Hallowell, Maine 04347
Telephone: (207) 623-4358
Fax: 1-(775) 307-9002

SHEET 1 OF 1
DATE 05/6/08
HOLE NO. B-5
LINE & STA.
OFFSET
SURF. ELEV.

TO Wright Pierce
ADDRESS 99 Main street Topsham ME
PROJECT NAME Lindsey Brook
LOCATION Rockland, Maine
REPORT SENT TO Jamie Garland
PROJ. NO. 11035B
SAMPLES SENT TO
OUR JOB NO. J 08-05

GROUND WATER OBSERVATIONS

At Dry after one half Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	split spoon	
Size I.D.	Probe Auger		
Hammer Wt.	300lbs	140lbs	BIT
Hammer Fall	30"	30"	

	Date	Time
START		
COMPLETE		
TOTAL HRS.:		

BORING FOREMAN Christopher Palmer
INSPECTOR
SOILS ENGR.

LOCATION OF BORING: Right hand side of woods road approximately 250' in from the Gilman Pond Road.

DEPTH	Casing Blows per foot	Sample Depths From - To	TYPE	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density of Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Rock-color, type condition, hardness, Drilling time, seams and etc.	SAMPLE #	Pen.	Rec.
									5"of Pavement			
								2'	Gravel to 2' then Olive brown Clay			
									No split spoon samples taken			
									Drillers Observatoins			
									Bottom of boring @ 15'. No Refusal.			

GROUND SURFACE TO 15' USED Probe Auger : THEN Terminate Boring.

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" OD Sampler		SUMMARY
D=Dry C=Cored W=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring
UP=Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP=Test Pit A=Auger V=Vane Test	some 20 to 35%	10-30 Med. Dense	4-8 M/Stiff	Samples
UT=Undisturbed Thinwall	and 35 to 50%	30-50 Dense	8-15 Stiff	
		50 + Very Dense	15-30 V-Stiff	HOLE NO. B-5

East Coast Explorations

16 Maple Street
Hallowell, Maine 04347

Telephone: (207) 623-4358
Fax: 1-(775) 307-9002

SHEET 1 OF 1
DATE 05/6/08
HOLE NO. B-4
LINE & STA. ______
OFFSET ______
SURF. ELEV. ______

TO Wright Pierce
PROJECT NAME Lindsey Brook
REPORT SENT TO Jamie Garland
SAMPLES SENT TO ______

ADDRESS 99 Main street Topsham ME
LOCATION Rockland, Maine
PROJ. NO. 11035B
OUR JOB NO. J 08-05

GROUND WATER OBSERVATIONS

At Dry after one half · Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	split spoon	
Size I.D.	Probe Auger		
Hammer Wt.	300lbs	140lbs	BIT
Hammer Fall	30"	30"	

	Date	Time
START		
COMPLETE		

TOTAL HRS.:
BORING FOREMAN Christopher Palmer
INSPECTOR ______
SOILS ENGR.

LOCATION OF BORING: Right hand side of woods road approximately 250' in from the Gilman Pond Road.

DEPTH	Casing Blows per foot	Sample Depths From - To	TYPE	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density of Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Rock-color, type condition, hardness, Drilling time, seams and etc.	SAMPLE #	Pen.	Rec.
									6"of Pavement			
								18"	Gravel to 18" then Olive brown Clay No split spoon samples taken Drillers Observatoins			
									Bottom of boring @ 15'. No Refusal.			

GROUND SURFACE TO 15' USED Probe Auger : THEN Terminate Boring.

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" OD Sampler		SUMMARY
D=Dry C=Cored W=Washed UP=Undisturbed Piston TP=Test Pit A=Auger V=Vane Test UT=Undisturbed Thinwall	trace 0 to 10% little 10 to 20% some 20 to 35% and 35 to 50%	Cohesionless Density 0-10 Loose 10-30 Med. Dense 30-50 Dense 50 + Very Dense	Cohesive Consistency 0-4 Soft 30 + Hard 4-8 M/Stiff 8-15 Stiff 15-30 V-Stiff	Earth Boring Rock Coring Samples HOLE NO. B-4

East Coast Explorations

16 Maple Street
Hallowell, Maine 04347

Telephone: (207) 623-4358
Fax: 1-(775) 307-9002

SHEET 1 OF 1
DATE 05/6/08
HOLE NO. B-3
LINE & STA. ______
OFFSET ______
SURF. ELEV. ______

TO Wright Pierce
ADDRESS 99 Main street Topsham ME
PROJECT NAME Lindsey Brook
LOCATION Rockland, Maine
REPORT SENT TO Jamie Garland
PROJ. NO. 11035B
SAMPLES SENT TO ______
OUR JOB NO. J 08-05

GROUND WATER OBSERVATIONS

At Dry after one half Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	split spoon	
Size I.D.	Probe Auger		
Hammer Wt.	300lbs	140lbs	BIT
Hammer Fall	30"	30"	

	Date	Time
START		
COMPLETE		

TOTAL HRS.:
BORING FOREMAN Christopher Palmer
INSPECTOR ______
SOILS ENGR.

LOCATION OF BORING: Right hand side of woods road approximately 250' in from the Gilman Pond Road.

DEPTH	Casing Blows per foot	Sample Depths From - To	TYPE	Blows per 6" on Sampler From 0-6	To 6-12	12-18	Moisture Density of Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Rock-color, type condition, hardness, Drilling time, seams and etc.	SAMPLE #	Pen.	Rec.
									6"of Pavement			
								18"	Gravel to 18" then Olive brown Clay No split spoon samples taken Drillers Observatoins			
									Bottom of boring @ 15'. No Refusal.			

GROUND SURFACE TO 15' USED Probe Auger : THEN Terminate Boring.

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" OD Sampler		SUMMARY
D=Dry C=Cored W=Washed UP=Undisturbed Piston TP=Test Pit A=Auger V=Vane Test UT=Undisturbed Thinwall	trace 0 to 10% little 10 to 20% some 20 to 35% and 35 to 50%	Cohesionless Density 0-10 Loose 10-30 Med. Dense 30-50 Dense 50 + Very Dense	Cohesive Consistency 0-4 Soft 30 + Hard 4-8 M/Stiff 8-15 Stiff 15-30 V-Stiff	Earth Boring Rock Coring Samples HOLE NO. B-3

East Coast Explorations

16 Maple Street
Hallowell, Maine 04347

Telephone: (207) 623-4358
Fax: 1-(775) 307-9002

SHEET 1 OF 1
DATE 05/6/08
HOLE NO. B-2
LINE & STA.
OFFSET
SURF. ELEV.

TO Wright Pierce
PROJECT NAME Lindsey Brook
REPORT SENT TO Jamie Garland
SAMPLES SENT TO

ADDRESS 99 Main street Topsham ME
LOCATION Rockland, Maine
PROJ. NO. 11035B
OUR JOB NO. J 08-05

GROUND WATER OBSERVATIONS

At Dry after one half Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	split spoon	
Size I.D.	Probe Auger		
Hammer Wt.	300lbs	140lbs	BIT
Hammer Fall	30"	30"	

	Date	Time
START		
COMPLETE		

TOTAL HRS.:
BORING FOREMAN Christopher Palmer
INSPECTOR
SOILS ENGR.

LOCATION OF BORING: Right hand side of woods road approximately 250' in from the Gilman Pond Road.

DEPTH	Casing Blows per foot	Sample Depths From - To	TYPE	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density of Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Rock-color, type condition, hardness, Drilling time, seams and etc.	SAMPLE #	Pen.	Rec.
									9"of Pavement			
								18"	Gravel to 18" then Blue Clay No split spoon samples taken Drillers Observatoins			
									Bottom of boring @ 3'.Refusal. Hit a storm drain but did NOT puncture it. Moved to B-3			

GROUND SURFACE TO 15' USED Probe Auger : THEN Terminate Boring.

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt. x 30" fall on 2" OD Sampler

Cohesionless Density		Cohesive Consistency	
0-10	Loose	0-4	Soft
10-30	Med. Dense	4-8	M/Stiff
30-50	Dense	8-15	Stiff
50 +	Very Dense	15-30	V-Stiff
		30 +	Hard

SUMMARY
Earth Boring
Rock Coring
Samples

HOLE NO. B-2

East Coast Explorations

16 Maple Street
Hallowell, Maine 04347
Telephone: (207) 623-4358
Fax: 1-(775) 307-9002

SHEET 1 OF 1
DATE 05/6/08
HOLE NO. B-1
LINE & STA.
OFFSET
SURF. ELEV.

TO Wright Pierce
PROJECT NAME Lindsey Brook
REPORT SENT TO Jamie Garland
SAMPLES SENT TO

ADDRESS 99 Main street Topsham ME
LOCATION Rockland, Maine
PROJ. NO. 11035B
OUR JOB NO. J 08-05

GROUND WATER OBSERVATIONS

At Dry after one half Hours

At ____ after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	split spoon	
Size I.D.	Probe Auger		
Hammer Wt.	300lbs	140lbs	BIT
Hammer Fall	30"	30"	

	Date	Time
START		
COMPLETE		

TOTAL HRS.:
BORING FOREMAN Christopher Palmer
INSPECTOR
SOILS ENGR.

LOCATION OF BORING: Right hand side of woods road approximately 250' in from the Gilman Pond Road.

DEPTH	Casing Blows per foot	Sample Depths From - To	TYPE	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density of Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Rock-color, type condition, hardness, Drilling time, seams and etc.	SAMPLE #	Pen.	Rec.
									8"of Pavement			
								18"	Gravel to 18"			
									No split spoon samples taken			
									Drillers Observatoins			
								6'	Cobble at 6' then Olive brown Clay			
									Bottom of boring @ 15'. No Refusal.			

GROUND SURFACE TO 15' USED Probe Auger : THEN Terminate Boring.

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" OD Sampler		SUMMARY
D=Dry C=Cored W=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring
UP=Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP=Test Pit A=Auger V=Vane Test	some 20 to 35%	10-30 Med. Dense	4-8 M/Stiff	Samples
UT=Undisturbed Thinwall	and 35 to 50%	30-50 Dense	8-15 Stiff	
		50 + Very Dense	15-30 V-Stiff	HOLE NO. B-1

East Coast Explorations

16 Maple Street
Hallowell, Maine 04347
Telephone: (207) 623-4358
Fax: 1-(775) 307-9002

SHEET 1 OF 1
DATE 05/6/08
HOLE NO. B-3A
LINE & STA.
OFFSET
SURF. ELEV.

TO Wright Pierce
PROJECT NAME Lindsey Brook
REPORT SENT TO Jamie Garland
SAMPLES SENT TO
ADDRESS 99 Main street Topsham ME
LOCATION Rockland, Maine
PROJ. NO. 11035B
OUR JOB NO. J 08-05

GROUND WATER OBSERVATIONS

At Dry after one half Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	split spoon	
Size I.D.	Probe Auger		
Hammer Wt.	300lbs	140lbs	BIT
Hammer Fall	30"	30"	

	Date	Time
START		
COMPLETE		
TOTAL HRS.:		

BORING FOREMAN Christopher Palmer
INSPECTOR
SOILS ENGR.

LOCATION OF BORING: Right hand side of woods road approximately 250' in from the Gilman Pond Road.

DEPTH	Casing Blows per foot	Sample Depths From - To	TYPE	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density of Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Rock-color, type condition, hardness, Drilling time, seams and etc.	SAMPLE #	Pen.	Rec.
									4" of Pavement			
								18"	Gravel to 18"			
									No split spoon samples taken			
									Drillers Observatoins			
									Bottom of boring @ 15'. No Refusal.			

GROUND SURFACE TO 15' USED Probe Auger : THEN Terminate Boring.

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" OD Sampler		SUMMARY
D=Dry C=Cored W=Washed	trace 0 to 10%	Cohesionless Density	Cohesive Consistency	Earth Boring
UP=Undisturbed Piston	little 10 to 20%	0-10 Loose	0-4 Soft 30 + Hard	Rock Coring
TP=Test Pit A=Auger V=Vane Test	some 20 to 35%	10-30 Med. Dense	4-8 M/Stiff	Samples
UT=Undisturbed Thinwall	and 35 to 50%	30-50 Dense	8-15 Stiff	
		50 + Very Dense	15-30 V-Stiff	HOLE NO. B-3A

East Coast Explorations

16 Maple Street
Hallowell, Maine 04347
Telephone: (207) 623-4358
Fax: 1-(775) 307-9002

SHEET 1 OF 1
DATE 05/6/08
HOLE NO. B-2A
LINE & STA. ____
OFFSET ____
SURF. ELEV. ____

TO Wright Pierce
ADDRESS 99 Main street Topsham ME
PROJECT NAME Lindsey Brook
LOCATION Rockland, Maine
REPORT SENT TO Jamie Garland
PROJ. NO. 11035B
SAMPLES SENT TO ____
OUR JOB NO. J 08-05

GROUND WATER OBSERVATIONS

At Wet after one half Hours

At ____ after ____ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	split spoon	
Size I.D.	Probe Auger		
Hammer Wt.	300lbs	140lbs	BIT
Hammer Fall	30"	30"	

	Date	Time
START		
COMPLETE		
TOTAL HRS.:		

BORING FOREMAN Christopher Palmer
INSPECTOR ____
SOILS ENGR.

LOCATION OF BORING: Right hand side of woods road approximately 250' in from the Gilman Pond Road.

DEPTH	Casing Blows per foot	Sample Depths From - To	TYPE	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density of Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Rock-color, type condition, hardness, Drilling time, seams and etc.	SAMPLE #	Pen.	Rec.
									7" of Pavement			
								18"	Gravel to 18" No split spoon samples taken Drillers Observatoins			
									Bottom of boring @ 15'. No Refusal.			

GROUND SURFACE TO 15' USED Probe Auger : THEN Terminate Boring.

Sample Type	Proportions Used	140 lb Wt. x 30" fall on 2" OD Sampler		SUMMARY
D=Dry C=Cored W=Washed UP=Undisturbed Piston TP=Test Pit A=Auger V=Vane Test UT=Undisturbed Thinwall	trace 0 to 10% little 10 to 20% some 20 to 35% and 35 to 50%	Cohesionless Density 0-10 Loose 10-30 Med. Dense 30-50 Dense 50 + Very Dense	Cohesive Consistency 0-4 Soft 30 + Hard 4-8 M/Stiff 8-15 Stiff 15-30 V-Stiff	Earth Boring Rock Coring Samples HOLE NO. B-2A

East Coast Explorations

16 Maple Street
Hallowell, Maine 04347
Telephone: (207) 623-4358
Fax: 1-(775) 307-9002

SHEET 1 OF 1
DATE 05/6/08
HOLE NO. B-A1
LINE & STA.
OFFSET
SURF. ELEV.

TO Wright Pierce
ADDRESS 99 Main street Topsham ME
PROJECT NAME Lindsey Brook
LOCATION Rockland, Maine
REPORT SENT TO Jamie Garland
PROJ. NO. 11035B
SAMPLES SENT TO
OUR JOB NO. J 08-05

GROUND WATER OBSERVATIONS

At Dry after one half Hours

At ______ after ______ Hours

	CASING	SAMPLER	CORE BAR.
Type	NW	split spoon	
Size I.D.	Probe Auger		
Hammer Wt.	300lbs	140lbs	BIT
Hammer Fall	30"	30"	

	Date	Time
START		
COMPLETE		
TOTAL HRS.:		

BORING FOREMAN Christopher Palmer
INSPECTOR
SOILS ENGR.

LOCATION OF BORING: Right hand side of woods road approximately 250' in from the Gilman Pond Road.

DEPTH	Casing Blows per foot	Sample Depths From - To	TYPE	Blows per 6" on Sampler From 0-6	6-12	To 12-18	Moisture Density of Consist.	Strata Change Elev.	SOIL IDENTIFICATION Remarks include color, gradation, type of soil, etc. Rock-color, type condition, hardness, Drilling time, seams and etc.	SAMPLE #	Pen.	Rec.
									7" of Pavement			
								18"	Gravel to 18"			
									No split spoon samples taken			
									Drillers Observatoins			
								2.5'	Cobbles then Gray Clay			
									Bottom of boring @ 15'. No Refusal.			

GROUND SURFACE TO 15' USED Probe Auger : THEN Terminate Boring.

Sample Type
D=Dry C=Cored W=Washed
UP=Undisturbed Piston
TP=Test Pit A=Auger V=Vane Test
UT=Undisturbed Thinwall

Proportions Used
trace 0 to 10%
little 10 to 20%
some 20 to 35%
and 35 to 50%

140 lb Wt. x 30" fall on 2" OD Sampler

Cohesionless Density
0-10 Loose
10-30 Med. Dense
30-50 Dense
50 + Very Dense

Cohesive Consistency
0-4 Soft
4-8 M/Stiff
8-15 Stiff
15-30 V-Stiff
30 + Hard

SUMMARY
Earth Boring
Rock Coring
Samples

HOLE NO. B-1A