

# Preliminary Design Report

Hathan Bog Bridge #3271  
over  
Lower Hathan Bog

Chain of Ponds Twp, Maine

STP-1787(100)X  
WIN 017871.00



Maine Department of Transportation



## Bridge Program



## BACKGROUND INFORMATION

TOWN - Chain of Ponds Twp      WIN - 017871.00      BRIDGE NO. - 3271

FUNDING - Federal Bridge / State      STATE ROUTE - 27

### BIENNIAL CAPITAL WORK PLAN:

YEAR <u>12/13</u>	ESTIMATE	\$ <u>390,000</u>
	TOTAL	\$ <u>390,000</u>

PROGRAM SCOPE - Bridge Culvert Rehabilitation

**PROGRAM DESCRIPTION** – Bridge Culvert Rehabilitation: Hathan Bog Bridge (#3271) over Hathan Bog. Located 0.94 of a mile southerly of the Coburn Gore town line.

**PROJECT BACKGROUND** – Structure is in overall poor condition with heavy pitting, large 1”+ rust nodules and small holes throughout the bottom below flowline. Funding included in the 2012-2013 Biennial Capital Work Plan for culvert replacement. In 2003 or 2004, the road was paved and new guardrail installed

HIGHWAY  
SYSTEM - State Highway

FUNCTIONAL  
CLASSIFICATION - Major Collector

URBAN/RURAL - Rural

FHWA SUFFICIENCY RATING - 62.8

LOAD POSTING - N/A

POSTED SPEED - 50 mph

STRUCTURALLY DEFICIENT - Yes

FUNCTIONALLY OBSOLETE - N/A

TRAFFIC - 2011    AADT 590

ACCIDENT DATA, CRF - 1.47

2031    AADT 710

DHV 121

Note: High number of accidents with animals. Four in the last three years.

# Location Map

Chain of Ponds Twp

Hathan Bridge #3271

(Route 27 over Lower Hathan Bog)

WIN 017871.00



Latitude 45<sup>0</sup> 22' 34.32" N  
Longitude 70<sup>0</sup> 44' 23.70" W

## **HYDROLOGY REPORT**

The Drainage Basin Characteristics for Hathan Bog Bridge #3271 in Chain of Ponds Twp. on Route 27 over Lower Hathan Bog were provided by the Maine Department of Transportation Office of the Environment-Hydrology Section. The flows were computed using the 1999 USGS full regression equation. No other flow data is available such as gage data, existing studies, or reports from local residents. Therefore the hydrology data was used as provided and as follows:

### **Summary**

Drainage Area = 8.96 square miles  
Fish passage flow (low) = 1.77 cfs  
Fish passage flow (high) = 39.33 cfs  
Ordinary High Water ( $Q_{1.1}$ ) = 128.0cfs  
10 Year Flood ( $Q_{10}$ ) = 519 cfs  
25 Year Flood ( $Q_{25}$ ) = 667.8 cfs  
Design Discharge ( $Q_{50}$ ) = 487 cfs  
Check Discharge ( $Q_{100}$ ) = 910.8cfs

Reported By: Michael Wight  
Date: April 25, 2011

## **HYDRAULICS REPORT** (Existing Bridge)

Hathan Bog Bridge #3271 is located in Chain of Ponds Twp. on Route 27 over Lower Hathan Bog. The existing bridge consists of a 13' diameter by 116' long steel structural plate pipe built in 1971. The downstream end of culvert is undermined about 6'. The culvert is hanging at the downstream end about 9" +/- . Downstream of the pipe are two pools surrounded by rock (possible bedrock ?) before the stream slopes. The first visible drop downstream from the pipe is about 1'-9" +/--high. The sideslopes at both ends of the culvert are stable.

### **Existing Culvert Summary**

Culvert invert elevation @ inlet = 1298.91'  
Culvert invert elevation @ outlet = 1297.508'  
Total drop along culvert = 1.402'  
Culvert length along invert = 116'  
Culvert slope = 1.4'/116' = 1.2%

The existing bridge was analyzed using the HY-8 program version 7.2. The tailwater conditions in HY8 are modeled as an irregular channel that is located about 35' downstream from the outlet. The cross section is located at the apparent choke point of the stream.

At Q50 the headwater to depth ratio is 0.85 which is slightly less than 0.9 used for design. At Q100 the freeboard based on the edge of shoulder is about 5.1'. The slope protection at both ends of the culvert appears to be relatively stable. Fish passage is an issue at low flows, because the water depth is very shallow and the outlet velocities are greater than 2 fps.

**SUMMARY**  
(Existing Bridge)

	<u>Existing Structure</u> 13'diameter steel pipe
Total Area of Waterway Opening	133 ft <sup>2</sup>
Headwater Elevation @ low fish passage flow	1299.11 ft
Headwater Elevation @ high fish passage flow	1300.83 ft
Headwater Elevation @ Q <sub>1.1</sub>	1302.34 ft
Headwater Elevation @ Q <sub>10</sub>	1307.00 ft
Headwater Elevation @ Q <sub>25</sub>	1308.09 ft
Headwater Elevation @ Q <sub>50</sub>	1308.97 ft
Headwater Elevation @ Q <sub>100</sub>	1309.9 ft
HW/D @ Q <sub>50</sub>	0.85
Outlet Velocity @ low fish passage flow	2.78 ft/s
Outlet Velocity @ high fish passage flow	5.71 ft/s
Outlet Velocity @ Q <sub>1.1</sub>	8.47 ft/s
Outlet Velocity @ Q <sub>10</sub>	7.03 ft/s
Outlet Velocity @ Q <sub>25</sub>	7.72 ft/s
Outlet Velocity @ Q <sub>50</sub>	8.25 ft/s
Outlet Velocity @ Q <sub>100</sub>	8.81 ft/s
Outlet Depth @ low fish passage flow	0.06 ft
Outlet Depth @ high fish passage flow	1.23 ft

Note: All elevations based on North American Vertical Datum (NAVD) of 1988.

Reported By: Michael Wight  
Date: April 26, 2011

## HYDRAULIC REPORT (Proposed)

The bridge was analyzed using the HY-8 program version 7.2. The tailwater conditions in HY8 are modeled as an irregular channel that is located about 35' downstream from the outlet. The cross section is located at the apparent choke point of the stream.

According to John Perry, MaineDOT Biologist, the bankfull width is 25'. The 1.2 bankfull width is about 30'.

**Alternative #1** -The first option considered was an invert lining. The invert lining can be 5" thick concrete (shotcrete or cast in place) or 2" thick FRP. The concrete would extend up the side of the pipe arch about 6" above the limits of the rust. The hydraulic analysis was performed assuming a 5" thick concrete invert is used. Weirs are needed inside the pipe to maintain fish passage. The weirs inside the pipe will have a maximum spacing of 42', based on a drop of 6" between weirs. A minimum of 3 weirs are needed inside the culvert. A concrete pool and weir system with 3 pools is also needed at the downstream end for fish passage. Each pool will have a minimum size of 9.5' x 9.5' by 3' deep so that the energy dissipation factor at the high fish passage flow is less than 5.0. Heavy riprap aprons will be built as both ends of the culvert. At Q50 the headwater to depth ratio is 0.80 which is slightly less than 0.9 used for design.

### Invert Lining

Culvert invert elevation @ inlet =1299.33'=1298.91' + 0.42'

Culvert invert elevation @ outlet =1297.928'=1297.508' + 0.42'

**Alternative #2** - The second option considered was a slip lining using an 11'-6" diameter aluminum pipe. The annular space will be about 9 inches around the new pipe and will cause the invert to rise up about 9 inches (6" minimum). 11'6" diameter is the largest corrugated pipe that can fit. Weirs are needed inside the pipe to maintain fish passage. The weirs inside the pipe will have a maximum spacing of 42', therefore a minimum of 3 weirs are needed inside the pipe. A concrete pool and weir system with 3 pools is also needed at the downstream end for fish passage. Each pool will have a minimum size of 9.5' x 9.5' by 3' deep so that the energy dissipation factor at the high fish passage flow is less than 5.0. Heavy riprap aprons will be built as both ends of the culvert. At Q50 the headwater to depth ratio is 0.85 which is slightly less than 0.9 used for design.

The bridge culvert was built in 1971 therefore the current age is only 40 years old. Because the existing steel pipe did not last 50 years, the MaineDOT Bridge Design Guide recommends that any metal pipe be made of aluminum and this would include any pipes used for sliplining.

### **Sliplining**

Culvert invert elevation @ inlet =  $1299.66' = 1298.91' + 0.75'$

Culvert invert elevation @ outlet =  $1298.258' = 1297.508' + 0.75'$

**Alternative #3** – The third option is a single 20' span by 10' rise by 116' long rectangular precast concrete box culvert with headwalls and precast toe walls. The ends of the box culvert shall be slope tapered and flared. A 20' span by 10' rise precast concrete box is the largest practical size/weight to be transported as a single piece. The box culvert will be embedded 2' below the streambed. 1.5' tall sediment traps will be located inside the box culvert at regular intervals to help retain the streambed material. Heavy riprap aprons will be built at both ends of the culvert. A 20' span structure will require some work to the stream channel immediately downstream from the structure. The current streambed is much narrower than 20'. The narrow point in the stream downstream of the existing bridge is only about 5' wide. At least 50 linear feet of stream channel and stream banks would have to be widened and realigned.

**Alternative #4** – The fourth option is a single 30' span by 10' rise by 116' long rectangular precast concrete box culvert with headwalls and precast toe walls. The ends of the box culvert shall be slope tapered and flared. A 30' span is the maximum span for a single opening box culvert, due to weight and shipping limitations. The box culvert will be embedded 2' below the streambed. 1.5' tall sediment traps will be located inside the box culvert at regular intervals to help retain the streambed material. Heavy riprap aprons will be built at both ends of the culvert. A 30' span structure will require substantial work to the stream channel immediately downstream from the structure. The current streambed is much narrower than 30'. The narrow point in the stream downstream of the existing bridge is only about 5' wide. At least 75 linear feet of stream channel and stream banks would have to be widened and realigned.

A formal hydraulic analysis has not been performed for alternatives #3 & 4. Both of these alternatives will have improved hydraulic performance when compared to the existing pipe. Due to the high velocities at the design flows, heavy riprap is needed for slope protection and the riprap aprons.

From a pure hydraulics standpoint, the preferred alternative is a large single opening such as alternative #3 or #4. The final decision on what alternative to use will be based on other factors such as constructability, initial cost and life cycle cost.

**SUMMARY**

	Invert Lining	Slipline With 11.5' diameter Aluminum Pipe
Total Area of Waterway Opening	125 ft <sup>2</sup>	104 ft <sup>2</sup>
Headwater Elevation @ low fish passage flow	1299.44 ft	1299.86 ft
Headwater Elevation @ high fish passage flow	1301.19 ft	1301.59 ft
Headwater Elevation @ Q <sub>1.1</sub>	1302.08 ft	1302.67 ft
Headwater Elevation @ Q <sub>10</sub>	1305.74 ft	1306.76 ft
Headwater Elevation @ Q <sub>25</sub>	1307.20 ft	1308.26 ft
Headwater Elevation @ Q <sub>50</sub>	1308.37 ft	1309.43 ft
Headwater Elevation @ Q <sub>100</sub>	1309.37 ft	1311.52 ft
HW/D @ Q <sub>50</sub>	0.80	0.85
Outlet Velocity @ low fish passage flow	3.10 fps	2.63 fps
Outlet Velocity @ high fish passage flow	8.01 fps	5.81 fps
Outlet Velocity @ Q <sub>1.1</sub>	11.19 fps	4.01 fps
Outlet Velocity @ Q <sub>10</sub>	15.57 fps	12.2 fps
Outlet Velocity @ Q <sub>25</sub>	16.66 fps	12.79 fps
Outlet Velocity @ Q <sub>50</sub>	17.33 fps	14.09 fps
Outlet Velocity @ Q <sub>100</sub>	17.93 fps	10.81 fps
Outlet Depth @ low fish passage flow	0.06 ft	0.07 ft
Outlet Depth @ high fish passage flow	0.72 ft	1.32 ft

Reported By: Michael Wight  
Date: June 7, 2011

Note: All elevations based on North American Vertical Datum (NAVD) of 1988.

Project Name: Chain of Ponds  
 Stream Name: Hathan Bog Bridge  
 Bridge Name: 27  
 Route No. AWMann  
 Analysis by:

PIN: 17871.00  
 Town: Chain of Ponds  
 Bridge No. 3271  
 USGS Quad:  
 Date: 12/13/2010

### Peak Flow Calculations by USGS Regression Equations (Hodgkins, 1999)

Enter data in blue cells only!

A	km <sup>2</sup>	23.21	mi <sup>2</sup>	8.96	ac	5734.9
W		2.79		1.08		689.3
P <sub>c</sub>		361803		5029620		
County		Franklin				
pptA		45.6				
SG		0.00				

Enter data in [mi<sup>2</sup>]

Watershed Area  
 Wetlands area (by NWI)  
 watershed centroid (E, N; UTM 19N; meters)  
 choose county from drop-down menu  
 mean annual precipitation (inches; by look-up)  
 sand & gravel aquifer as decimal fraction of watershed A

Worksheet prepared by:  
 Charles S. Hebson, PE  
 Environmental Office  
 Maine Dept. Transportation  
 Augusta, ME 04333-0016  
 207-557-1052  
[Charles.Hebson@maine.gov](mailto:Charles.Hebson@maine.gov)

A (km <sup>2</sup> )	23.21
W (%)	12.02
Conf Lvl	0.67

Ret Pd	Peak Flow Estimate	Lower	Upper
T (yr)	Q <sub>T</sub> (m <sup>3</sup> /s)		
1.1		3.62	
2	5.29	7.41	10.37
5	8.25	11.59	16.28
10	10.35	14.70	20.87
25	13.13	18.91	27.24
50	15.24	22.22	32.40
100	17.47	25.79	38.08
500	22.69	34.61	52.79

Q <sub>T</sub> (ft <sup>3</sup> /s)
128.0
261.6
409.3
519.0
667.8
784.7
910.8
1222.1

**Reference:**

Hodgkins, G., 1999.  
 Estimating the magnitude of peak flows for streams in Maine for selected recurrence intervals  
 Water-Resources Investigations Report 99-4008  
 US Geological Survey, Augusta, Maine  
 $Q_T = b \times A^a \times 10^{-ww}$

Project Name:	Chain of Ponds	PIN:	17871.00
Stream Name:	0	Town:	Chain of Ponds
Bridge Name:	Hathan Bog Bridge	Bridge No.:	3987
Route No.:	27	USGS Quad:	
Analysis by:	AWMann	Date:	12/1/2008

**DO NOT ENTER ANY DATA ON THIS PAGE; EVERYTHING IS CALCULATED**

**MAINE MONTHLY MEDIAN FLOWS BY USGS REGRESSION EQUATIONS (2004)**

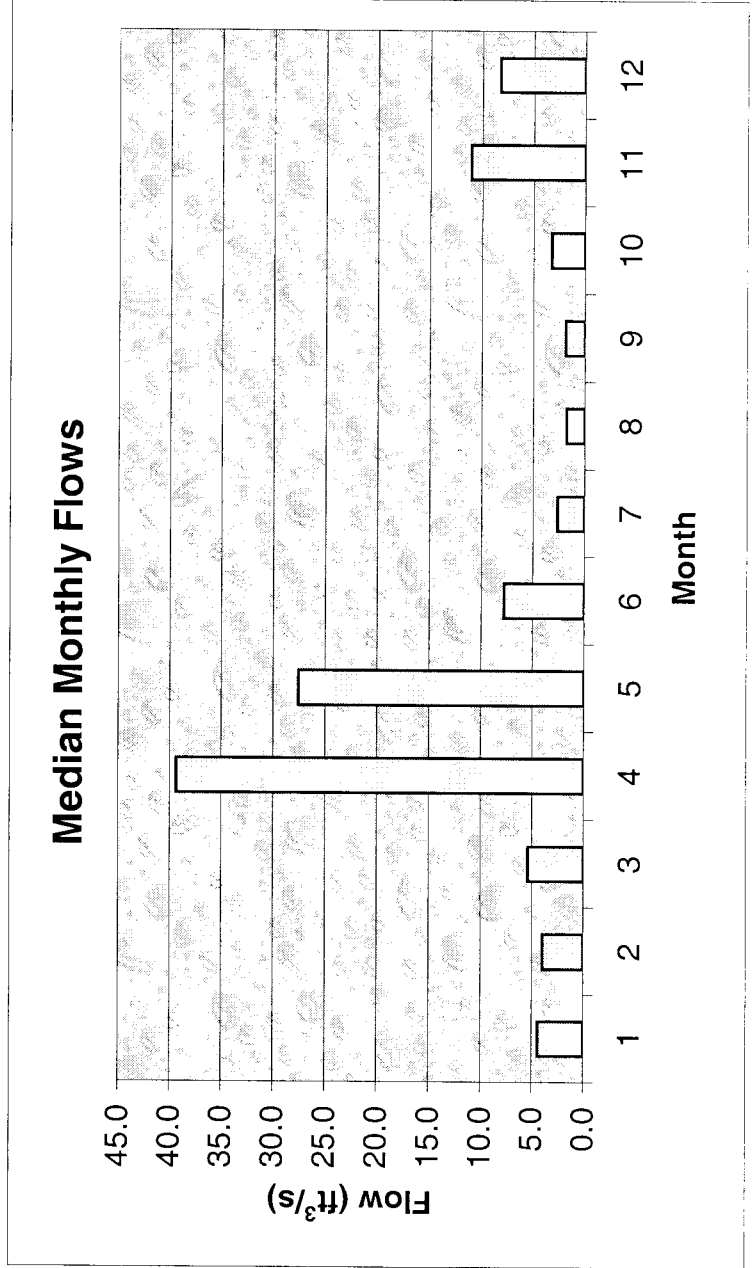
**Worksheet prepared by:**  
 Charles S. Hebson, PE  
 Chief Hydrologist  
 Maine Dept. Transportation  
 Augusta, ME 04333-0016  
 207-624-3073  
[Charles.Hebson@maine.gov](mailto:Charles.Hebson@maine.gov)

Value	Variable	Explanation
8.961	A	Area (mi <sup>2</sup> )
361803	P <sub>c</sub>	Watershed centroid (E,N; UTM; Zone 19; meters)
149.61	DIST	Distance from Coastal reference line (mi)
45.6	pptA	Mean Annual Precipitation (inches)
0.00	SG	Sand & Gravel Aquifer (decimal fraction of watershed area)

Month	Q <sub>median</sub> (ft <sup>3</sup> /s)	(m <sup>3</sup> /s)
Jan	4.42	0.1253
Feb	3.94	0.1117
Mar	5.39	0.1528
Apr	39.33	1.1145
May	27.54	0.7805
Jun	7.77	0.2202
Jul	2.61	0.0739
Aug	1.77	0.0502
Sep	1.86	0.0526
Oct	3.24	0.0917
Nov	11.05	0.3130
Dec	8.24	0.2334

high →  
 low →

Q<sub>br</sub> 51.9  
 ann avg 18.5  
 ann med 9.7  
 Q<sub>1,002</sub> 55.9  
 Q<sub>1,01</sub> 75.1



$Q_{1.05}$  107.0

$W_{6r}$  23.8

# **APPENDIX F**

# HY-8 Analysis Results

## Culvert Summary Table - Existing

Culvert Crossing: Hathan Bog Bridge

	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
Low Fish Flow	1.77	1.77	1299.11	0.20	0.0*	1-S2n	0.06	0.06	0.06	0.80	2.78	1.06
high Fish Flow	39.33	39.33	1300.83	1.92	0.0*	1-S2n	1.23	1.33	1.23	2.96	5.71	2.36
Q1.1	128.00	128.00	1302.34	3.43	0.0*	1-S2n	2.15	2.40	2.19	4.51	8.47	2.69
	206.28	206.28	1303.31	4.40	0.0*	1-S2n	2.80	3.06	2.85	5.44	9.50	3.00
	284.56	284.56	1304.13	5.22	0.0*	1-S2n	3.27	3.65	3.34	6.21	10.48	3.24
	362.84	362.84	1304.86	5.95	0.0*	1-S2n	3.74	4.14	3.75	6.90	11.39	3.43
	441.12	441.12	1305.53	6.62	0.0*	1-S2n	4.14	4.57	4.16	7.52	12.00	3.59
Q10	519.00	519.00	1307.00	7.26	8.09	1-S1t	4.50	5.00	7.08	8.09	7.03	3.73
	519.40	519.40	1307.00	7.26	8.09	1-S1t	4.51	5.00	7.08	8.09	7.03	3.73
	597.68	597.68	1307.55	7.86	8.64	1-S1t	4.87	5.39	7.62	8.63	7.39	3.85
Q25	667.80	667.80	1308.09	8.37	9.18	1-S1t	5.19	5.70	8.07	9.08	7.72	3.94
	675.96	675.96	1308.16	8.43	9.25	1-S1t	5.23	5.73	8.12	9.13	7.76	3.94
	754.24	754.24	1308.75	8.97	9.84	1-S1t	5.54	6.08	8.59	9.60	8.11	4.01
Q50	784.70	784.70	1308.97	9.17	10.06	1-S1t	5.67	6.21	8.77	9.78	8.25	4.03
Q100	910.80	910.80	1309.90	10.01	10.99	1-S1t	6.17	6.72	9.46	10.47	8.81	4.09

# HY-8 Analysis Results

## Culvert Summary Table - Sliplining with 11.5 ft diameter

Culvert Crossing: Hathan Bog Bridge-Proposed

	Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
Low Fish Flow	1.77	1.77	1299.86	0.20	0.0*	1-S2h	0.07	0.07	0.07	0.80	2.63	1.06
High Fish Flow	39.33	39.33	1301.59	1.93	0.0*	1-S2h	1.26	1.33	1.32	2.96	5.81	2.36
Q1.1	92.67	92.67	1302.67	3.01	0.0*	1-S2h	1.91	2.10	1.99	4.01	7.56	2.52
	128.00	128.00	1303.23	3.57	0.0*	1-S2h	2.32	2.49	2.32	4.51	8.55	2.69
	183.58	183.58	1303.97	4.31	0.0*	1-S2h	2.73	2.99	2.78	5.19	9.37	2.92
	274.48	274.48	1305.00	5.34	0.0*	1-S2h	3.41	3.71	3.41	6.12	10.62	3.21
	365.38	365.38	1305.92	6.26	0.0*	1-S2h	3.93	4.31	3.95	6.92	11.51	3.44
Q10	456.28	456.28	1306.76	7.10	0.0*	1-S2h	4.45	4.85	4.47	7.63	12.20	3.62
	519.00	519.00	1307.30	7.64	0.0*	1-S2h	4.78	5.18	4.81	8.09	12.61	3.73
	547.19	547.19	1307.53	7.87	0.0*	1-S2h	4.92	5.33	4.95	8.29	12.79	3.77
Q25	638.09	638.09	1308.26	8.60	0.0*	1-S2h	5.37	5.80	5.39	8.89	13.34	3.90
	667.80	667.80	1308.49	8.83	0.0*	1-S2h	5.51	5.93	5.52	9.08	13.53	3.94
	728.99	728.99	1308.98	9.32	0.0*	1-S2h	5.81	6.20	5.81	9.45	13.85	3.99
Q50	784.70	784.70	1309.43	9.77	0.0*	1-S2h	6.07	6.45	6.08	9.78	14.09	4.03
Q100	910.80	910.80	1311.52	10.83	11.86	5-S1t	6.66	6.99	8.71	10.47	10.81	4.09

**REPORT FROM BRIDGE MAINTENANCE SUPERVISOR**

**TOWN:** Chain of Ponds

**BRIDGE NO. & NAME:**Hathan Bog # 3271

**CLEAR SPAN:** \_\_\_13 feet

**CLEARANCE TO WATER (upstream side):** \_\_\_10 feet in the summer

**AVERAGE DEPTH OF WATER (upstream side):** \_1 to 2 feet in the summer

**SPAN AND RISE DOWNSTREAM:** \_\_\_\_\_  
(if significantly different from above)

**EVIDENCE OF SCOUR:** none \_\_\_X\_\_\_ slight \_\_\_\_\_ much \_\_\_\_\_

**EVIDENCE OF LENGTH:**  
unlikely \_\_\_\_\_ likely \_\_\_\_\_ positive \_\_\_\_\_ uncertain \_\_\_\_\_

**ADEQUACY OF OPENING:**  
undersized \_\_\_\_\_ appropriate \_\_\_X\_\_\_ oversized \_\_\_\_\_ uncertain \_\_\_\_\_

**HIGH WATER INFORMATION**

**Has water been over the road?** \_\_\_no\_\_\_ **Date (if known)** \_\_\_\_\_

**Estimated Depth over the road:** \_\_\_\_\_

**Reliability of Estimate:** poor \_\_\_\_\_ fair \_\_\_\_\_ good \_\_\_X\_\_\_

**Highest known water elevation relative to bottom of bridge:** \_\_\_\_\_  
**Date (if known)** \_\_\_\_\_

**Was high water caused by a downstream constriction:**  
no \_\_\_\_\_ likely \_\_\_\_\_ positive \_\_\_\_\_ uncertain \_\_\_\_\_

**Was high water caused by ice:**  
no \_\_\_\_\_ likely \_\_\_\_\_ positive \_\_\_\_\_ uncertain \_\_\_\_\_

**GENERAL COMMENTS:** \_\_\_We have not had any maintenance issues on this. \_\_\_\_\_  
\_\_\_\_\_

**COMMENTS PERTAINING TO UPSTREAM OR DOWNSTREAM BRIDGES:**  
\_\_\_\_\_  
\_\_\_\_\_

**DEGREE OF FAMILIARITY WITH SUBJECT BRIDGE:**  
negligible \_\_\_\_\_ some \_\_\_\_\_ considerable \_\_\_\_\_

**Reported by:** Herb Noyes \_\_\_\_\_ **Date:** 4/29/2011





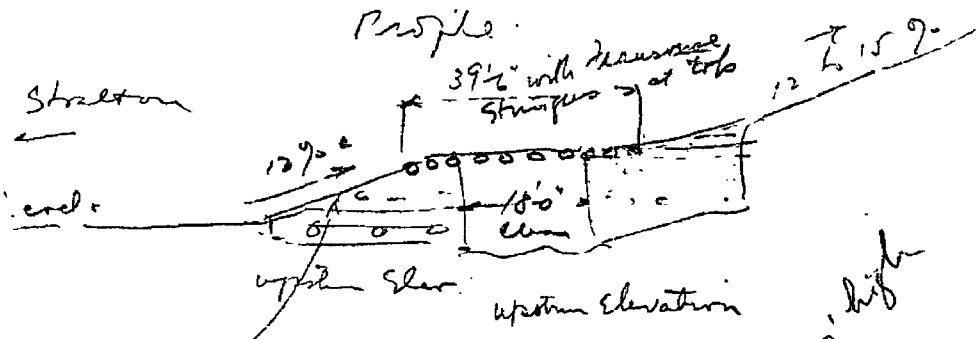


# **APPENDIX G**

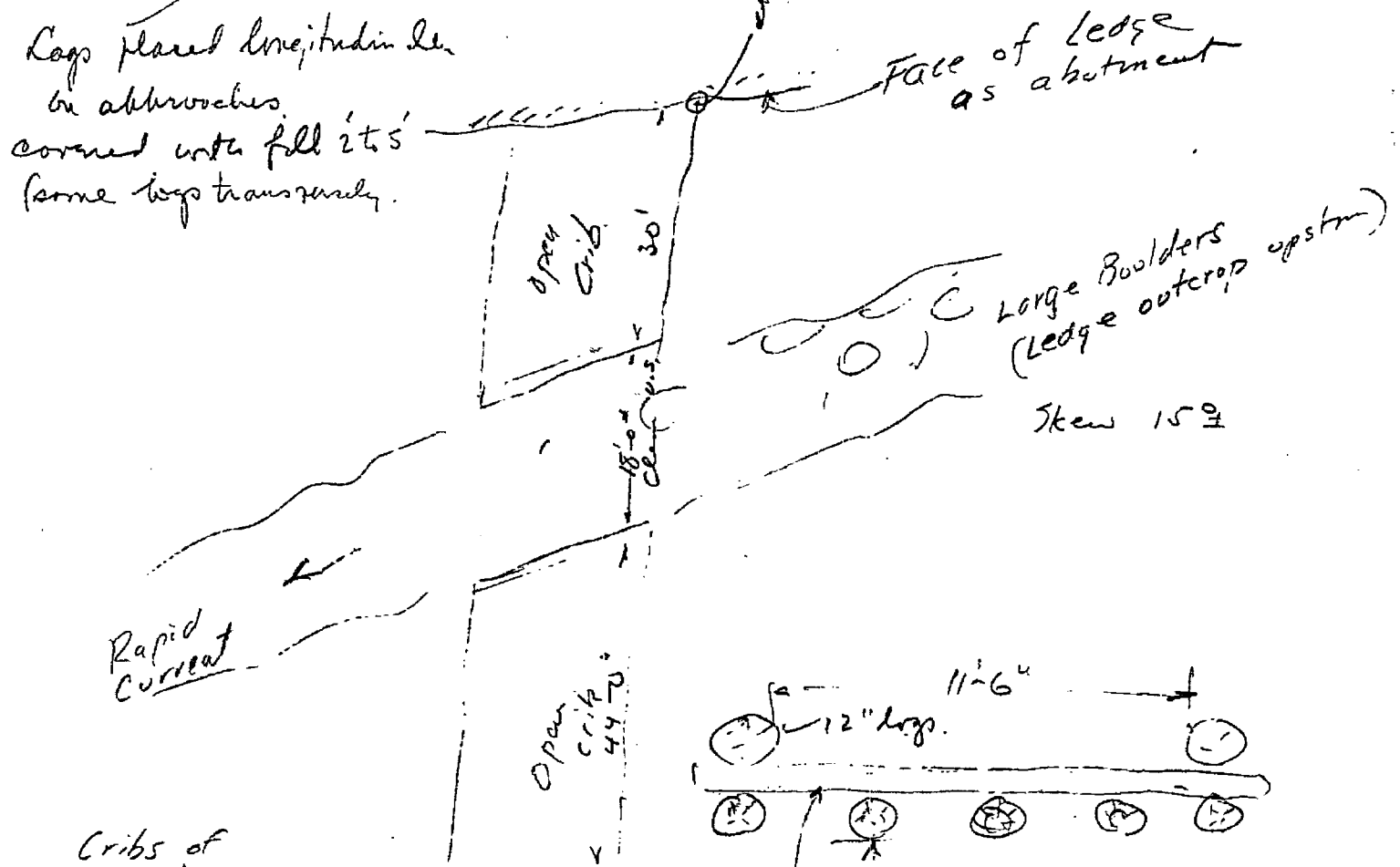
STATE OF MAINE  
State Highway Commission  
BRIDGE DIVISION

INSPECTION REPORT

04-33	<u>Chain of Ponds</u>	TOWN
		COUNTY
3271	<u>Hathorn Bog</u>	BRIDGE
	<u>Hathorn Bog Stream</u>	WATERWAY
	<u>Aug. 15 1935</u>	DATE
	<u>Rau</u>	INSPECTOR

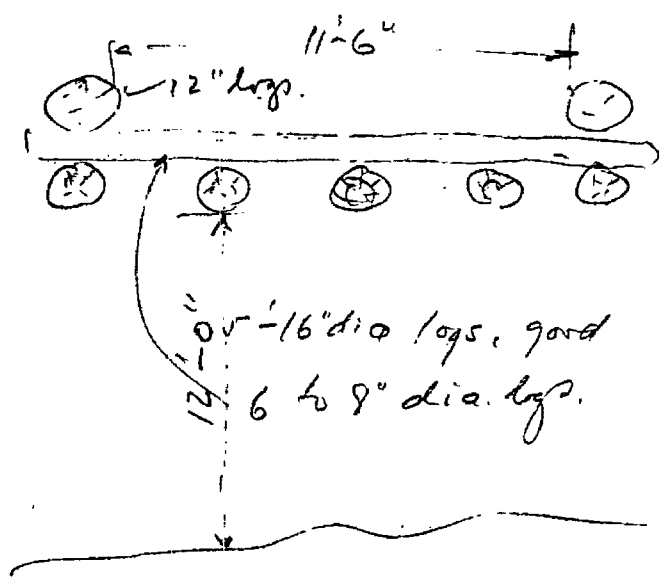


Logs placed longitudinally  
 in approaches  
 covered with fill 2 to 3'  
 (some logs transversely)



Cribs of good logs.

Grades splintered  
 Six quadrants, put on outside  
 Cut timbers on bridge  
 Clean off every year  
 Renew ties where necessary.



October 20, 1970

M.C. Rissel, Engr. of Maint. & S.A.

State Highway Commission

A.R. Sirois, Bridge Maint. Engr.

State Highway Commission

Hathan Bog Bridge - Chain of Ponds No. 3271

We have been maintaining this bridge since 1936. It is located on Route 27.

1947 - Replaced log crib abutments with one new log crib and one concrete abutment.

Replaced log stringer super-structure with 60' steel I - beams.

Replaced wood plank floor system.

1963-64 - Replaced log crib abutment

Replaced some portions of the super-structure.

This bridge is in critical condition. Recommend a structural plate pipe be further investigated, and if feasible, one ordered. Immediate installation.

It does not appear feasible to spend \$15,000 for repairs at this time, and remain with a log crib abutment.

Whether by contract or by our own forces, this would have to be completed this Fall.

ARS/jd

# STATE OF MAINE

Inter-Departmental Memorandum Date June 8, 1971

To Martin Rissel, Engr. of M & SA

Dept. Maintenance & State Aid

From A. R. Sirois, Br. Maint. Engineer *ARS*

Dept. Bridge Maintenance & Highway

Subject

Hathan Bog Bridge, Chain of Ponds

---

---

A location and brief history of the subject bridge is outlined on my attached memo to you dated October 20, 1970. As you recall it was verbally agreed by the Commission at that time that an attempt would be made to negotiate with a Contractor for the installation of a structural plate pipe. Availability of the pipe and weather conditions did not permit this work to be completed last fall and winter. Temporary repairs were made to the existing structure. It is presently, rapidly approaching a critical condition.

In light of our present work load in launching our inspection program, we do not have the office staff to proceed thru negotiations with a Contractor to do this project. It is, therefore, recommended that this project be referred to Bridge Design and set up as a formal contract for completion this Fall.

The 1968 ADT was 320 vehicles, with a large percentage being heavy loads (wood products).

ARS:jb  
Attachments

# STATE OF MAINE

Inter-Departmental Memorandum Date June 2, 1971

To A. R. Sirois, Br. Maint. Engr. Dept. Bridge Maintenance - Highway  
From E. B. Barnard, Asst. Br. Maint. Engr. EBB Dept. Bridge Maintenance - Highway  
Subject Hathan Bog, Chain of Ponds

Some action should be taken on the subject bridge as soon as possible due to its condition and load capacity.

If contracting is not possible before this winter, I believe we should order the pipe and install it with maintenance forces and/or force account this fall.

EBB:jb

Traffic 320 ADT  
1968

# STATE OF MAINE

Inter-Departmental Memorandum Date December 8, 1970

To A. R. Sirois, Br. Maint. Engineer

Dept. Bridge Maintenance - Highway

From Everett B. Barnard, Asst. Br. Maint. Engr.

Dept. Bridge Maintenance - Highway

Subject Hathan Bog Bridge, Chain of Ponds

As you requested recommendations and estimate for the subject bridge has been made. These recommendations call for replacing the existing 60 ft. steel and wood structure with a 13 ft. structural plate pipe. Approach work has been kept to a minimum by maintaining the same line and only a minimum change in grade over the pipe.

The essential plans for the pipe has been completed but only the finish roadway grades and typical cross section are shown for the approaches. None of these plans or the required pipe size has been checked.

Repair or reconstruction should be scheduled before next winter, as the existing bridge is rather light and is in poor condition.

EBB:jb

# STATE OF MAINE

Inter-Departmental Memorandum Date October 19, 1970

To A. R. Sirois, Bridge Maint. Engineer

Dept. Bridge Maintenance - Highway

From Everett B. Barnard, Asst. Bridge Maint. Engr. Dept. <sup>EBB</sup> Bridge Maintenance - Highway

Subject Hathen Bog Bridge, Chain of Ponds

---

---

A detail inspection of the subject bridge on October 16, has revealed that it is not feasible to replace only the wood planking that is in extremely poor condition without extensive repairs to the remaining superstructure.

Inspection of this bridge under live load conditions prompted me to evaluate the structural capacity of this bridge and make the following recommendations for revising the superstructure. The design capacity based on 18,000 psi allowable steel stress of the existing stringers is about an H 6. Field observations indicate that heavy loads may have exceeded the yield point of these stringers. I would recommend that this bridge be revised by placing two additional 60 feet stringers, and 15" intermediate stringers supported on diaphragms, and place a 6" plank floor with 6" x 8" nailers. This system would give about an H 16 rating.

About 15 weeks would be required to do the above work at an estimated cost of \$15,000.00. This cost includes some work required on the one log crib abutment.

Rough figures indicate that the bridge could be replaced with a 16'-3" x 10'-16" structural pipe arch or a 13 ft. pipe. This could be done under contract or with our maintenance forces. This work would require removing the existing superstructure and installing the structural pipe. The roadway approach work to raise the roadway grade about 4 feet would require about 5,000 cubic yards of fill and gravel in 800 feet of roadway. The estimated cost is as follows:

Pipe (in place)	=	\$12,500.00
Fill and Gravel	=	\$12,500.00
Mis. 20%	=	<u>5,000.00</u>
Total		\$30,000.00

As the condition of this structure is critical and our maintenance forces have moved in some material and equipment, a prompt discussion on what procedure is to be followed is essential.

EBB:jb

ESTIMATED COST

① Revision of Existing System -

Scope: Add two additional 60 ft stringers and add 15" intermediate stringers supported on diaphragms. Renew wood deck with 6x8" members & 6" plank floor.

Time: 15 weeks

Cost: \$15,000<sup>00</sup>

② Structural Plate Pipe or Pipe Arch

Scope: Remove existing superstructure. Install structural plate pipe or pipe arch. Raise grade feet more or less. Approach work to include about 5000 cu. yds of gravel in 1000 ft of roadway.

Time: 15 weeks

Cost:

Pipe =	\$12,500 <sup>00</sup>	
Fill & Gravel =	12,500 <sup>00</sup>	
Misc. 20% =	5,000 <sup>00</sup>	Guard Rail, Tables, etc.

DESIGN CONSIDERATIONS

Existing Structure

Design Rating based on 18,000 psi allowable stress = H 6. Heavy loads exceeds the yield point of the stringers. Field inspection indicates this.

Revised Design

Design Rating based on 18,000 psi allowable stress = H 16. This rating can be considered adequate.

Structural Plate Pipe

As PER SOILS DEPT.

Drainage Area = 6.219 Acres  
 = 9.72 Sq. Miles  
 Storage Index = 13.7 %

Benson's slope = 65' / mile

Storage = 8.64 Acres

Drop = 1183' ± in Distance of 23,760 ft.

Benson -

70°-45'  
 45°-20'

D.F. = 1.05  
 T.F. = 4.5  
 R.F. = 4.2

$Q_{50} = 1.05 \times 4.2 \times 4.5 = 1984.5$

Potter's Series

RI = 1.70

$Q_{50} = 450$  cfs.

Average =  $\frac{450 + 1984.5}{2} = 1217$

13°

Pipe Arch = 16'-3" x 10'-10" } 135°

Pipe C.M. = 156" = 13 ft. }

Pipe Arch

16'-3" x 10'-10" Gage 547 HC = 2'

$$\text{Weight / ft.} = \frac{554}{4.77} = 516 \text{ \#/ft.}$$

Length =

$$\text{Railway} = \frac{30 + 6}{2(3 \times 1.75)} = \frac{36'}{4.7'}$$

$$D_{90} = 43' + 2(1.1) = 6.5 \text{ ft. bottom length}$$

$$D = \frac{65}{\cos \Delta} = \frac{65}{\cos 37^{\circ}30'} = \frac{65}{.793353} = 82 \text{ ft.}$$

$$L = \frac{43 + 4.1}{.793353} = \frac{54}{.793353} = 68 \text{ ft.}$$

$$\text{Weight} = 68 \times 516 = 35,088 \text{ lbs.}$$

$$\text{Est. Cost} = 35,088 \times .35 = \$12,280$$

Pipe

156 unch. - Gage 748

$$\text{Weight} = \frac{446}{4.12} = 429 \text{ \#/ft.}$$

$$\text{Length} = \frac{T + 2(1.3)}{.793353} = 92 \text{ bottom length}$$

$$L = \frac{43 + 1.3}{.793353} = 70.6 \text{ } 72 \text{ ft.}$$

$$\text{Weight} = 72 \times 429 = 30,888 \text{ lbs.}$$

$$\text{Est. Cost} = 30,888 \times .35 = \$10,810.80$$

57  
35  
28  
26

# STATE OF MAINE

Inter-Departmental Memorandum Date October 16, 1970

To Everett Barnard Dept. Highway Maintenance (Bridges)

From Raymond Woodman Dept. Materials & Research

Subject Drainage Study, Coburn Gore

Attached is one copy of the drainage study for the stream crossing Route 27 below Lower Hathan Bog, and drainage map, as requested by telephone 10/16/70.

slf

Attach.

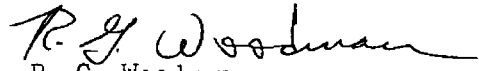
cc: F. M. Boyce, Jr.  
~~W. D. Harris~~  
M. W. Morgan

DRAINAGE STUDY  
ROUTE 27, COBURN GORE  
(HATHAN BOG STREAM)

OCTOBER 1970

Attached are hydrologic data for the bridge site on Route 27, Coburn Gore, at the crossing of the outlet stream of Upper and Lower Hathan Bogs and Crosby Pond.

Data were determined by delineating the ridge lines on enlarged U.S.G.S. topographic maps of the Arnold Pond and Chain Lakes quadrangles having the scale of 1" = 2640' (1" = 0.5 mile), there being no airphoto coverage of the area in the files of the Materials and Research Division.

  
R. G. Woodman  
Soils Research Scientist

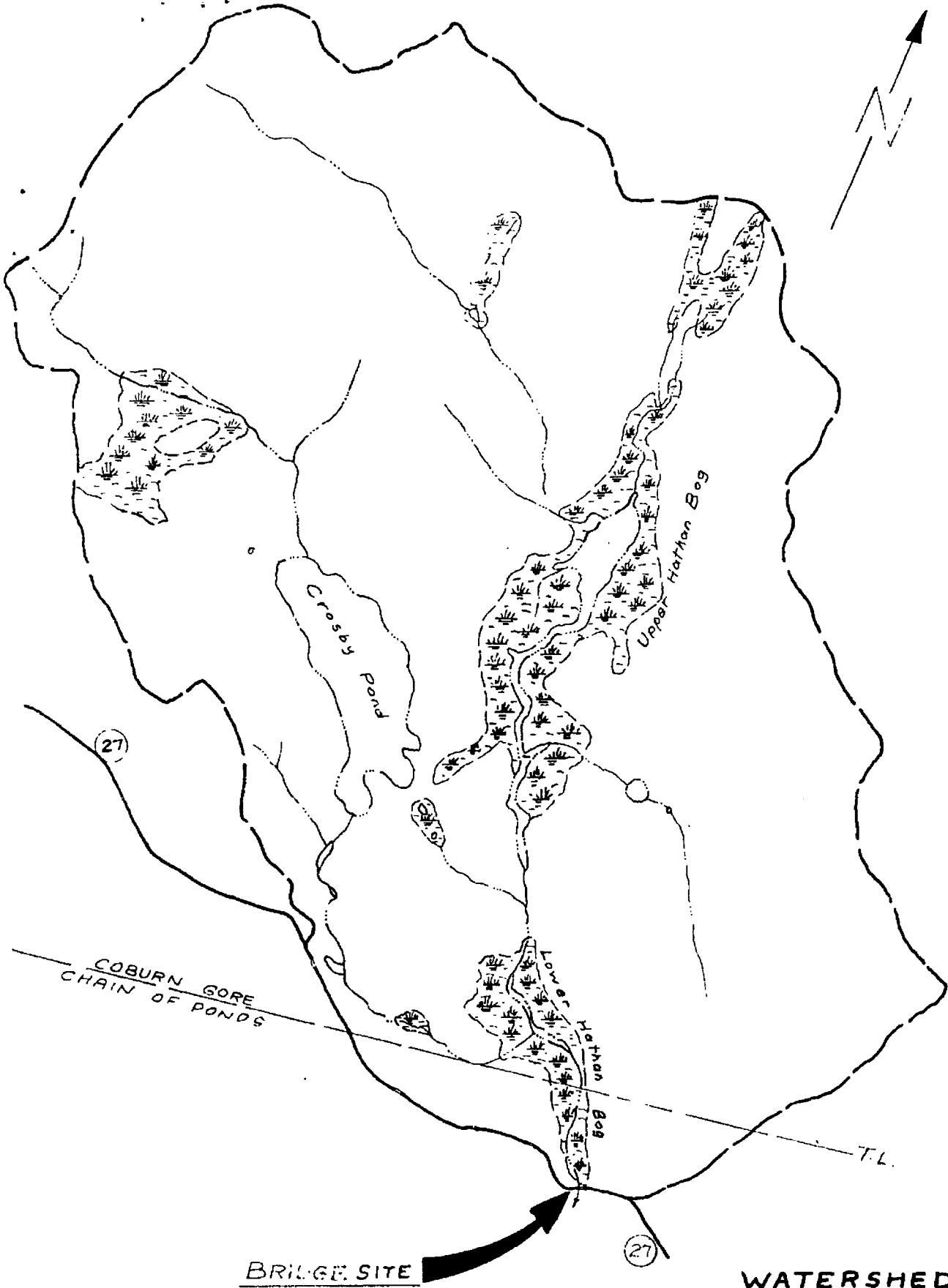
Encl:

Data Sheet  
Drainage Map

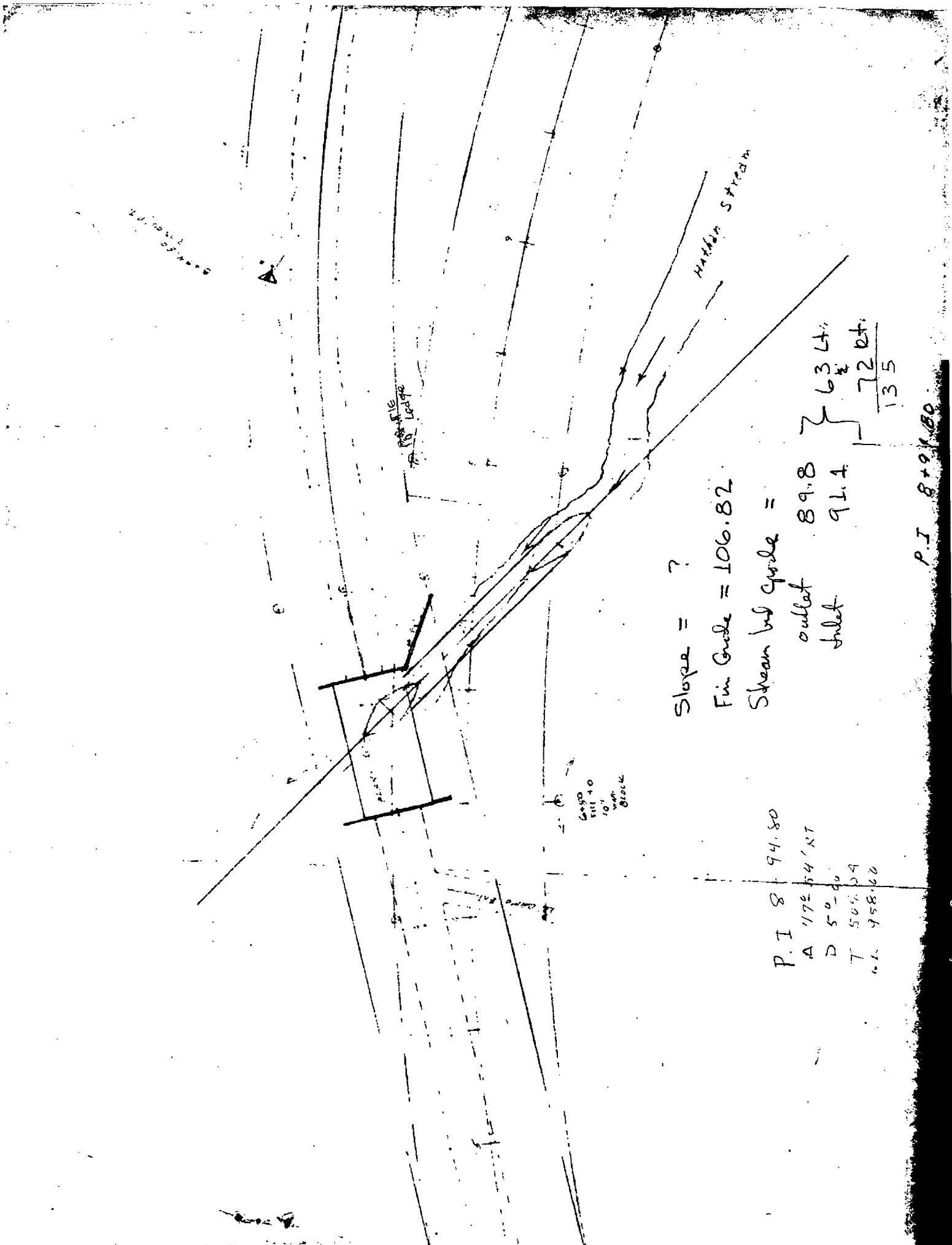
**APPENDIX B  
DRAINAGE STUDY**

"Hathan Bog Stream"  
Coburn Gore, Route 27 October 1970

AREA NO.	STATION	AREA		POTTER STOP. IND. %	1021 LF	BENSON		RATIONAL			REMARKS	
		ACRES	SA. MI.			SLOPE (FT./MI)	STOR. (ACRES)	ELEV. DROP (FT.)	DIST. (FT.)	RUNOFF COEF. C		CHAN. TYPE FACTOR
---	---	6219	9.72	13.7	---	65	864	1183±	23,760	---	1	Watershed for "Hathan Bog Stream" crossing of Route 27. Storage area includes Upper and Lower Hathan Bogs, Crosby Pond, a large bog one-half mile northwest of Crosby Pond and several smaller bogs and small ponds. Refer to attached drainage map. Watershed has moderate slope except for upper 12 percent, on steep slopes of Louise Mtn.



**WATERSHED**  
 "HATHAN BOG STREAM"  
 COBURN GORE  
 SCALE 1"=2640'  
 OCT. 1970



Slope = ?

Fin Grade = 106.82

Stream bed grade =

outlet 89.8

inlet 91.1

63 Lts  
 72 Lts  
 135

P.I. 8 94.80

A 172 54' RT

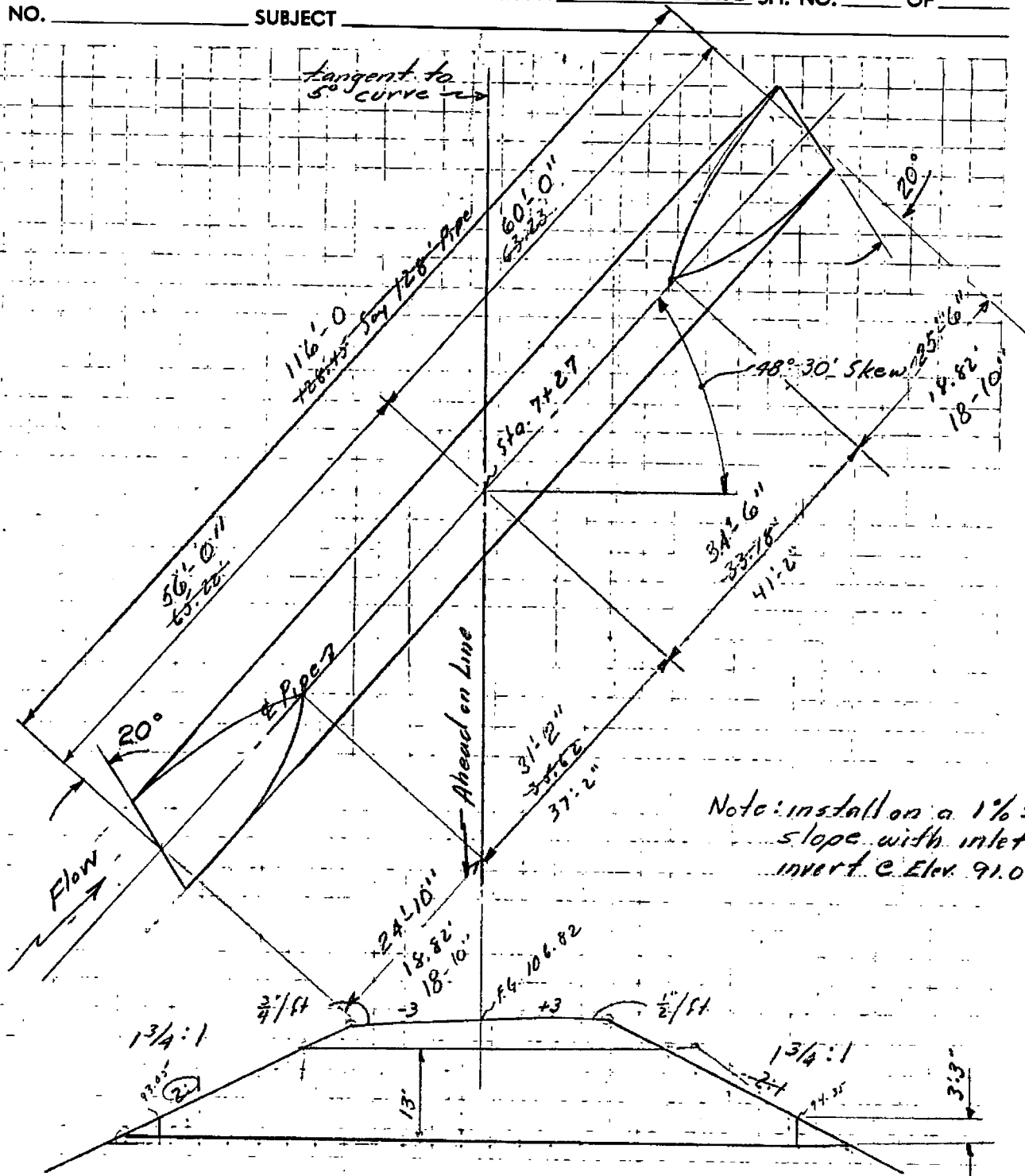
D 50-00

T 50% 04

W.L. 958.00

P.I. 8+91.80

5 Feb 17



Note: install on a 1% ± slope with inlet invert c. Elev. 91.00 ±

Typ Section  
(looking back on line)

Scale 1" = 20'

# REQUEST FOR PROJECT FUNDS

*m+sa 4*

REQUESTED BY M.C. Rissel DATE SUBMITTED: 9-1-71 SHC APPROVED: 9-1-71

PROJECT  REVISED  FUNDS BASED ON: PRELIM. EST.  ENGR. EST.  CONTR. EST.

DETAILED LOCATION OF PROJECT: ON STATE  U.S.  INTERSTATE  ROUTE # 27 BEG.

The State Aid Project will begin approx. 0.90 miles southeast of the Coburn Gore Town Line, thence, southeasterly approx. 1700 feet. This structure is located within afore-said project limits and will be built as a separate force account bridge maintenance project.

**DETAILED DESCRIPTION OF PROJECT:**

Replacement of Hathan Bog Bridge with 13'0" Structural Multi-Plate Pipe. This will be done in conjunction with a Joint Fund State Aid Project for reconstruction of the approaches.

**TYPE OF PROPOSED PROJECT:**

ROAD  BRIDGE  SIGNALS  XING   
 INCLUDING INTERCH.  RAMP  BRIDGE  (OTHER-SPECIFY)  
 GRAVEL  S.T.G.  MIX. BIT.  BIT. MAC  BIT. CONC.  PORT. CEM.  NONE

TOWN:	CHAIN OF PONDS	CONTROL SECTION	SYSTEM	FED. ROUTE NO	LENGTH
		04023	2	237	0.00 MI.

	ESTIMATED COST	DATE		P.E. ON PROJ. NO.
		STARTING	ENDING	
PRELIM. ENG.	\$ 500.00			R/W ON PROJ. NO.
RIGHT OF WAY	\$			RESIDENT. ENGINEER John Flint
CONST. ENG.	\$			CONTRACTOR
CONST. AWARD	\$			AMOUNT OF CONTRACT \$
UTILITIES	\$			AWARD DATE
	\$			WORKING DAYS
FORCE ACCOUNT	\$ 16,000.00	9-1-71	6-30-72	THIS A-3 INCREASE \$
NON - PART.	\$			THIS A-3 DECREASE \$
TOTAL COST	\$ 16,500.00	FED. SHARE \$		

PROG. YEAR 19	ITEM NO.	ORIGINAL AMOUNT	\$
PROG. YEAR 19	ITEM NO.	AMOUNT	\$
PROG. 19 YEAR	ITEM NO.	AMOUNT	\$
STATE AID \$	BR. \$	RESERVE \$	\$
		TOTAL	\$

DISTRIBUTION: ORIGINAL: DATA PROC. COPIES TO: ACCOUNTING; ORIGINATING DIV; FIELD DIV; M & R; PLANNING; R/W A-3 REV (4/69)

APPROP. 90 PROJECT NUMBER 3271