DOMINION SOIL INVESTIGATION LIMITED
CONSULTING SOIL & FOUNDATION ENGINEERS
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REPORT ON SUBSURFACE INVESTIGATION
JONES FALLS LOCK STRUCTURES
MORTON, ONTARIO

Ref. No. 77-2-1

April 1977

Prepared For:

Parks Canada
Ontario Region
Department of Indian Affairs
and Northern Development
P.O. Box 1359
Cornwall, Ontario
Contract No. CR76-168
File No. 350-4478-666

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SUMMARY

The boreholes have revealed that the structures are supported partly on rock and partly on rubble consisting of granite cobbles and boulders and layers of sand and silt. Much of the mortar encountered in the masonry is in poor condition or has been washed out. The condition of the structures below the water line at the lower end of Locks 39 and 42 should be examined in more detail after dewatering these locks.

The inverts and sills of all the locks should be repaired or replaced and it is proposed that permanent downstream cut-offs be placed at Locks 39 and 42 to prevent or minimize erosion. Pressure grouting under the new floors and sills is proposed.

After completion of the repairs to the foundations, the masonry structures should be pressure washed and grouted.

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1.0 INTRODUCTION

Dominion Soil Investigation Limited was retained by Parks Canada, Ontario Region, to conduct a subsurface investigation at Locks 39, 40, 41 and 42 at Jones Falls on the Rideau Canal. The work was carried out in accordance with Department of Indian Affairs and Northern Development Contract No. CR76-168 dated February 22, 1977 and subsequent amendments thereto.

The terms of reference for the work were defined in a communication from Parks Canada dated December 1976. The scope of the work involved an investigation of the condition of the masonry in the structures, and an appraisal of the nature and condition of the supporting strata and backfill materials prior to the carrying out of restorative work. A historic plaque placed on the site indicates that the structures are approximately 100 years old.

To assist in the investigation the client supplied copies of Drawings RC7379, RCJF73/3, CJF72/3 and RC7388 and extracts from a report entitled "Rideau Waterway, Assessment of Structures" dated in 1975.

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2.0 FIELD WORK

The field work was done during the period February 16 to March 23, 1977 and consisted of twenty-three boreholes at the locations shown on Drawings #1 and 2. These holes bear numbers in a discontinuous series from 1 to 46. Also shown on Drawing #2 are the locations of boreholes drilled during a previous investigation of Lock 39, carried out in 1970. These holes are denoted V1, V2 or B1, B2, etc.

The boreholes in the present investigation were drilled using a BBS1 diamond drill and a portable Winkie core drill. Most holes were started in NXL size with subsequent reduction to BXL and AX where necessary.

The holes drilled through the backfill adjacent to the structures were lined with BX casing and in these holes the overburden was sampled by the Standard Penetration test method.

Boreholes 3, 5 and 8 through the floor of Lock 42 were drilled from the surface of the ice which had formed over 7 to 8 feet of water in this lock. The three other locks were relatively dry and the drilling equipment was set up on the floor of these locks. On completion of the drilling programme the holes were filled with Ciment Fondu grout.

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Details of all observations made during drilling are shown on the Borehole Logs on Enclosures 1 to 23. Continuous observations of drill head pressure and washwater return are recorded as are the presence of soft zones and voids. Elevations are referred to the geodetic datum.

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3.0 SUBSURFACE CONDITIONS

Details of the stratification encountered at each borehole are shown on the Borehole Logs and a general picture of subsurface conditions is shown in the form of inferred profiles and cross-sections on Drawings #1 and 2. The materials encountered can be classified in four broad categories as masonry, rubble, bedrock and backfill. A general description of each of these materials follows.

(a) Masonry

The walls of the structure consist of quarried blocks of red, grey and white sandstone. Between the blocks are mortar joints generally spaced at 2 feet vertically and 3 to 4 feet horizontally. Sandstone blocks have also been used to line the floors of the locks and to form the gate sills. Occasional cobbles (3-inch to 8-inch diameter) and boulders (more than 8-inch diameter) of granite were found incorporated in the masonry.

The material recovered from the mortar joints was generally brown in colour and flecked with white, having the appearance of a sand-lime or sand-cement-lime mortar. In places the mortar was recovered as a hard cemented intact material; elsewhere it could be easily crumbled between the fingers or consisted entirely of loose sand particles with no cementation; elsewhere no mortar was recovered between the sandstone blocks and at times the washwater being used to flush the drill hole failed to return to the surface of the hole, having been lost through channels in the masonry. While coring in Borehole 18, for example, water was lost at a depth of 1.5 feet below the top of the lock wall and could be seen discharging through a joint 9 feet away. Traces of roots were found within the mortar in the upper 3 feet of this borehole. In Borehole 39 there was no return of washwater between depths of 8.7 and 16.8 feet and from 27.7 to 36.0 feet within the masonry.

Traces of dense, hard, grey mortar, apparently the result of recent remedial work, were encountered in Boreholes 3, 34 and 37. The records of drill head pressure and washwater return shown on the Borehole Logs give a quantitive measure of the porosity of the masonry. Voids or porous zones several inches in size were encountered quite frequently in all boreholes.

(b) Rubble

Below the masonry and above the bedrock at Locks 40, 41 and 42, there is a layer of mainly granular material up to 12 feet in thickness which has been classified as rubble. It consists in part of granite cobbles and boulders which appear to have been placed or rearranged on the sloping bedrock surface to provide a horizontal grade

.../...

on which the sandstone floors and walls could be built. Seams of old brown mortar were found throughout the rubble layer.

The walls of Lock 39 appear to be in contact with the bedrock although there is a layer of rubble up to 10 feet deep below the floor.

Layers of sand approximately 1 foot thick were found at the bedrock surface in Boreholes 18, 19 and 35. Deeper deposits of sand and silt, 4 feet, 7 feet and 8 feet thick were encountered in Boreholes 1, 3 and 13 respectively.

A pocket of cohesive clayey silt approximately 2 feet deep was encountered below the masonry in Borehole 1.

The downstream sills of Locks 39 and 42 were lined with timber. Timber was encountered immediately below the floor at Boreholes 3 and 41. Other wood fragments were encountered in Boreholes 3 and 28 within the rubble stratum closer to the bedrock surface.

Voids or pockets of very loose material were encountered within the rubble layer at Boreholes 3, 34 and 35. Washwater was lost while penetrating a sand seam at 30 feet

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in Borehole 18 and could be seen escaping from the base of the wall inside the lock and rising through Borehole 19 in the lock floor.

(c) Bedrock

All boreholes were taken into the bedrock which consists of granite, granitic gneiss and chlorite schist. The cores recovered from Boreholes 3, 8, 11, 15, 35, 41, 42 and 43 were examined and classified by a consulting geologist. The cores from the remaining boreholes were logged by comparison with this classification. The Geologist's Report on the regional and local geology is reproduced in Appendix 'A'. A zone of weathered or metamorphosed rock, possibly the result of shearing in a south-east direction was identified in Boreholes 8, 13 and 11 at Lock 42.

(d) Backfill

The backfill material sampled in Boreholes 13, 39 and 46 consists mainly of stiff clayey silt containing seams or pockets of fine sand and traces of organic material. Boreholes B1, B2, B3, B10, B11 and B13 on Drawing #2 also show mainly cohesive backfill materials mixed with some sand extending from the ground surface to the bedrock.

.../...

Below the fill at a depth of 17 feet in Borehole 46, a grey varved clayey silt of very stiff consistency, becoming sandy at 25 feet, extends to a depth of 30 feet and is underlain by a sandy till extending to the bedrock surface at 35.8 feet. Borehole B13 to the east of this hole shows similar conditions.

.../...

4.0 INFORMATION FROM OTHER SOURCES

4.1 Intrusion Prepakt Limited of Thornhill, Ontario carried out a remedial grouting programme at Lock 39 in 1971. Their engineering staff stated that the grouting consisted mostly of horizontal holes through the masonry walls. A few holes were drilled in the floor but grout pumped into these quickly reappeared elsewhere in the structure as leakage, indicating that the volume of grout retained was small.

The horizontal grouting was carried out in two stages. In the first, holes were drilled approximately 3 feet into the masonry. In the second stage the holes penetrated through the walls into the backfill. A total of 4600 cubic feet of grout was used, most of this being pumped into or through the walls.

A Montreal based contractor is understood to have carried out a similar grouting programme at Locks 40, 41 and 42, possibly in 1972.

Intrustion Prepakt supplied from their files a copy of a site investigation report of Lock 39 prepared in 1970 by Butts Ross Magwood & Hall Limited.

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4.2 Butts Ross Magwood & Hall in 1970 carried out a site investigation at Lock 39 consisting of 14 horizontal or inclined holes through the main walls and wing walls; 7 vertical holes through the backfill and 2 holes on the centre line of the structure upstream and downstreaum of the wing walls. The locations of the vertical holes are plotted on Drawing #2 and the information contained in the borehole logs has been used in preparing the inferred subsurface profile and cross-sections.

Two vertical holes through the east wall (V1 and V2) and one through the upper sill (B6) indicate that the masonry is in contact with the bedrock. Up to 12 feet of material classified as rubble is reported below the floor and lower sill (Boreholes B7, B8 and B15). The horizontal holes through the walls encountered 8 to 9.5 feet of sandstone masonry at the thinnest sections compared to the 3 to 4 feet thickness shown on Drawing RC7388. Four of the fourteen horizontal holes indicated the presence of voids several inches deep between the masonry and the clayey backfill.

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4.3 Department of Transport and Parks Canada personnel provided information on the effects of the earlier grouting programmes. Mr. V.J. Lortie, P. Eng., Deputy Superintending Engineer at the time, commented that prior to the grouting, leakage through the mortar joints was excessive to the point that small craft could be flooded and there was a noticable drop in water level in the locks while the gates were shut.

Pressure washing was used to clean out the deteriorated mortar and a foot or more of sand accumulated in the floor of the locks during this process. After the grouting, leakage from the joints was reduced to a negligible amount and the loss of water with the gates closed was considerably reduced.

Mr. Lortie believed there had been no change in the alignment of the gates since 1957 to earlier, indicating that the lock structures were not experiencing uneven settlement.

Mr. E. Moore noted that water in the parking area adjacent to Lock 40 had been a problem until the grade was raised recently and tile drains installed. Some recent leakage was observed through the sills, especially the upper sill of Lock 41 where minor remedial grouting was done.

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5.0 DISCUSSION

In general the boreholes have shown that the walls of the detached Lock 39 are bearing on rock at the points explored. The walls of the connected Locks 40 to 42 bear on rock at some points but elsewhere are supported on rubble including boulders and cobbles partly embedded in mortar and seams of uncemented sand and silt. The sills and inverts of both the detached and connected locks are underlain by rubble at a number of points.

In particular, the boreholes have revealed that the structures have several features which require either immediate remedial work or further investigation. These features are listed as follows:

a) Locks 39 and 42 have timber lower sills which should be replaced with concrete

b) The downstream end of Locks 39 and 42 could be subject to deterioration below the water line and this should be futher investigated when these locks are dewatered

c) The inverts of all of the locks should be re-lined or, where timber is found, completely replaced with concrete

d) The rubble present below the structures contains voids which may increase in size due to water movement. These voids should be grouted (if possible) and a cut-off is proposed at the downstream end of both structures to facilitate the grouting procedure.

.../...

e) The presence of deteriorated mortar throughout the masonry on both structures allows free movement of water. The joints should therefore be pressure washed and grouted

f) There is obvious surface deterioration of the masonry as reported in the "Assessment of Structures" report and this should be made good.

These features are discussed in further detail in the following sections.

5.1 Dewatering and Repair of Lower Sill (Lock 39)

To properly examine the condition of the structures at the downstream end of Lock 39, the lock should be dewatered. At the lower end of Lock 39 there is a substantial depth of coarse rubble overlying the bedrock. In these conditions the use of sheet piling or well point dewatering systems is not practical. Dewatering should be done by pumping from sumps dug into the rubble after the removal of the old timbers. Sand bag cofferdams can be used to reduce backflow into the excavation and to dewater one side of the structure at a time, if necessary.

When the structure has been adequately dewatered, the condition of the masonry below the normal low water level should be carefully examined and any deterioration made good by re-pointing or replacing the sandstone blocks as required. It is proposed that a downstream cut-off wall of reinforced concrete should be dowelled into the rock at approximately the locations shown

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on Drawing #1 to minimize the erosion of fines from beneath the lock invert and sill.

The old timber sill and any loose rubble immediately below it should be removed and replaced with reinforced concrete.

Drawing RC7388 indicates that the lock structures was rotated 2 to 3 degrees to the east and that settlement of the south-east wing wall has occurred. Borehole 45 drilled vertically through this wing wall shows it to be sitting directly on the bedrock at that point and gives no indication as to why the settlement has occurred. The rock surface slopes from west to east and possibly the entire structure has shifted in an easterly direction during construction or during its earlier life. As reported there has been no problem with the alignment of the gates, at least since 1957.

5.2 Dewatering and Repair of Lower Sill (Lock 42)

Boreholes 1, 3 and 8 indicate the presence of a substantial thickness of rubble including sand and silt below the masonry. The absence of drill head pressure while penetrating these fine strata indicates that they are loose and easily eroded and yet there is no sign of settlement of the structure Possibly it is sitting on timber cribs to spread the load which is estimated to be approximately 4000 p.s.f. at the base of the walls.

To properly examine and repair this lock it should be completely dewatered. To achieve this, it is proposed that a sheet pile cut-off be installed togehter with two well-point dewatering systems at the locations shown on Drawing #2. The cut-off may have to support as much as 20 feet of water if the enclosure is excavated to the bedrock surface. The piles should be taken down to the bedrock surface and provided with adequate horizontal bracing. It is proposed that two additional borings should be made on the line of the cut-off to provide data for the design of the sheet pile wall. It may be necessary to remove masonry rubble from the lake bottom before the commencement of pile driving. The purpose of the well point systems is to prevent any washing of fine material from below the walls into the lock during dewatering.

A thorough examination of the structure below the water line should be made after dewatering has been carried out. This should include an assessment of the bearing capacity of the supporting soil strata and the need, if any, for underpinning.

On conclusion of the remedial work, it is proposed that the sheet pile wall be cut off at the dredge level. The remainder of the wall should be left in place as a barrier to the erosion of fines from below the structure.

.../...

The timber sill and invert should be replaced with reinforced concrete after the removal of all undesirable material from the underlying rubble bed. (Timber was not encountered in Boreholes 8 and 11, although the "Assessment of Structures" report indicates that the invert of this lock is timber).

The space between the permanent cut-off and the edge of the new concrete sill should be filled with coarse rubble and capped with concrete.

5.3 Repair of Stone and Concrete Inverts

All loose and weathered material should be removed from the inverts of Locks 39, 40 and 41 and a new reinforced concrete lining provided. The lining should be dowelled to the old invert and the joint between the new and old materials prepared so as to ensure a good bond.

The repairs at Lock 39 should be carried out while the dewatering system at the lower end is still in operation.

The use of gunnite may be considered as a means of applying the new lining, especially if it is required to maintain the rounded contour of the invert.

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5.4 Grouting of Foundation

The presence of channels or watercourses in the rubble below the structures was clearly demonstrated by, for example, the movement of washwater down Borehole 18 and up through Borehole 19 and by the loss of washwater while drilling through the masonry. It is proposed that the rubble below the floors and sills be grouted with cement grout in a two-stage low/high pressure operation after the new concrete linings have been installed and hardened. The purpose of the grouting is to fill voids within the rubble and the weathered rock surface so as to minimize the possibility of future erosion. Grouting in the sand and silt strata below Lock 42 may not penetrate the fine material but should have the effect of compacting it. The grout will have an improved chance of penetrating the foundation material if the dewatering systems at the lower end of the locks are kept in operation until the grouting has been completed.

5.5 Grouting and Repair of Masonry

The boreholes which penetrated through the masonry walls and sills of both structures frequently encountered deteriorated mortar and voids. Notwithstanding the verbal reports that leakage problems were alleviated after the previous grouting operations, it is apparent that much of the mortar in the structures is in poor condition and may be expected to deteriorate further. It is proposed, therefore, that a two-stage programme of pressure grouting should be carried out throughout

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both structures after the foundation work has been completed. Patterns of vertical and horizontal holes are proposed to penetrate the main walls, wing walls, sills and around the sluice openings. The vertical holes through the walls should extend into the foundation material. The grouting should be preceded by thorough pressure washing and several of the horizontal holes through the masonry should extend into the backfill to fill any voids which may have been caused by erosion.

It is anticipated that periodic grouting may be required as the old sand lime mortar deteriorates in order to keep the masonry in good repair.

DOMINION SOIL INVESTIGATION LIMITED

J. Park, P. Eng.
/jn

REGISTERED PROFESSIONAL ENGINEER
J. PARK
PROVINCE OF ONTARIO

APPENDIX

GEOLOGIST'S REPORT

FULOP J. & ASSOCIATES
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TEL.: (416) 483-3616

Dominion Soil Investigation Limited,
104 Crockford Blvd.,
Scarborough,Ontario,MlR 3C6,

Att:Mr.James Park,P.Eng.,Vice-President. March 16,1977

Bedrock geology from drill cores,Jones Falls,Ontario

Regionally the area is situated in the Grenville Geological Province where in addition to the Precambrian type of granits and gneisses sedimentary rocks of Paleozoic age also underlie the region.

Locally the bedrock was cored in most boreholes with size BX 1 and 5/8th inches and when cutting became harder in the deeper portions was the smaller size AX 1 and 3/16th inches corer used.

The cores show mainly granits,gneisses and chloritic schists with black and gray coloring due to the presence of more or less amount of biotite,hornblende,feldpar and quartz.The more or less continuous,dark and light bands in the gneisses(gneissocity) suggest a trend in the rocks to the south or east sloping 10-60 degrees.This is estimated from a few holes where a thin layer of feldspar rich crystal and the dark and light mineral bands show this trend.In other holes mainly to the south the cores show granits rich in quartz or bands of pure quartz ,most likely the result of shearing of granits under the effect of heat and pressure as part of the metamorphism.It also appears from the cores that the gneisses are more on top and the more granitic compositions tend to be in the lower sections.

In the vicinity of BH-11 and BH-8 a hornblende,biotite,chlorite-rich,weathered zone may possibly be a shear zone.

By inspecting the cores and taking into account the history of canal construction,there is no evidence that sedimentary rocks of sandstones or limestones would naturally overlie the older granit-gneiss type of rocks in the immediate project-site area.Cores showing sandstone slabs must have been man-placed.

Joints appear generally fairly tight and mainly of the shear types,dipping between 10-60 degrees and one can identify only a few extension joints of vertical dip angle and they mainly occur within the fine grained rocks.

Rock Quality Designation(RQD) factors range between 60-90% only a few sections showing lower values 30-50% where the rock for some reason was more brittle.When joints are plotted on frequency diagram or 'joint-rosette' it appears that a large percentage of the joints dip between 10-60 degrees.

Cores show only strings of mortar and there is no evidence of pressure-applied grouting.It appears that even in the weakest portion of sound rock level near BH-11 and BH-8 the joints warrant no requirements for possible grouting.

The unconsolidated sediments in the canal base appear to be sand,silt and clayey silt,the result of glacio-fluvial action in place or deposited by fast currents after the construction of canal base.

Respectfully submitted;J.Fulop,
P.Eng.,
Consultant.

ENGINEERING, GROUNDWATER, MINING, MARINE GEOPHYSICS

ENCLOSURES

SYMBOLS & NOMENCLATURE

	SAMPLE TYPE	CORE SIZE	DIA. (IN.)
RC	ROCK CORE	AX	1.25
SS	SPLIT SPOON	BXL	1.625
WS	WASH SAMPLE	NXL	2.125

OBSERVATIONS WHILE CORING

	Full Return of Wash Water	⌇
	Diminished Return of Wash Water	┆
(Void)	Nil Return of Wash Water	
	Steady Pressure on Drill Head	‖
	Intermittent Pressure on Drill Head	┆
	Nil Pressure on Drill Head	▯

RQD = Rock Quality Designation

REC. = Gross percent core recovery

SYMBOLS

MASONRY	⊣
MORTAR	▨
COBBLES OR BOULDERS	∘
SAND	⁘
SILT	‖‖
CLAY	⁄
BEDROCK	▩
FILL	■

LOG OF BOREHOLE 1

Our Reference No. 77-2-1

Enclosure No. 1

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION
LOCATION: SOUTH EAST WINGWALL, LOCK 42.
DATUM ELEVATION: GEODETIC

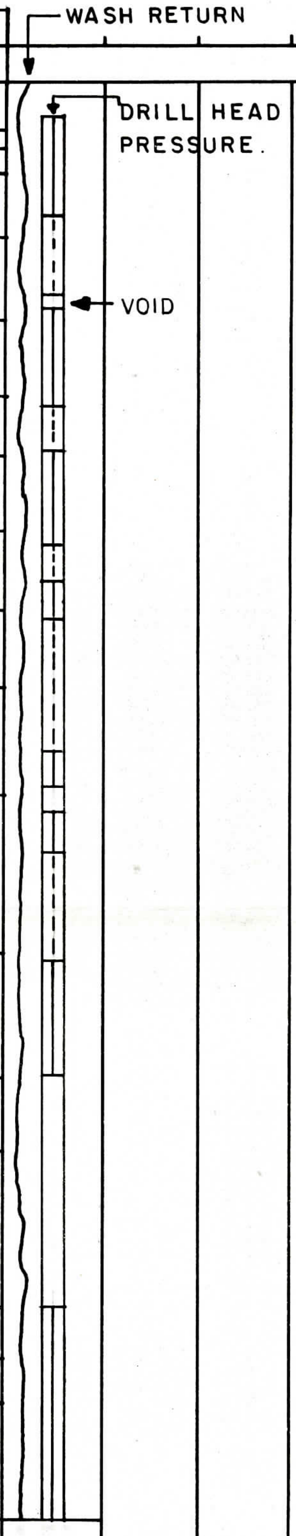
DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN.
Date: MAR. 18, 1977

ELEVATION Ft.	DEPTH Ft.	SUBSURFACE PROFILE – DESCRIPTION	GROUND WATER	SAMPLES – NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %	REMARKS
337.2	0	TOP OF WALL							
		White, grey & red SANDSTONE blocks with mortar joints (MASONRY)		1	NX		83	73	Mortar from: 1'8" - 1'10"
				2	RC		100	–	
				3			100	–	Mortar from: 3'3" - 3'4"
				4			92	85	
	5			5			98	58	Void from 5'5" - 5'10" (no pressure)
				6			92	80	
				7			100	55	
	10			8	BX RC		100	79	Mortar from: 10'7" - 10'9"
			⏚	9			96	69	12'0" - 12'2" 13'6" - 13'8"
	15			10			92	85	15'2" - 15'4" 16'10"- 16'11"
				11			98	96	18'8" - 19'2" (no pressure)
	20			12			93	73	Mortar from: 23.6" - 23.9"
	25			13			64	47	
311.2	26.0	Brown plastic Clayey SILT(pocket)							Bi-cone 26' to 32'
309.2	28.0	Very fine brown SAND or SILT			WS				
305.2	32.0	BEDROCK (grey, fine grained granitic quartz)		14			79	39	
				15			100	50	
	35			16	AX RC		62	31	
299.5	37.7	END OF BOREHOLE							
	40								
	45								

GROUND WATER: W.L. in Cataraqi River 324.5'

PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100
UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST

WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L



VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L. CHECKED:

LOG OF BOREHOLE 3

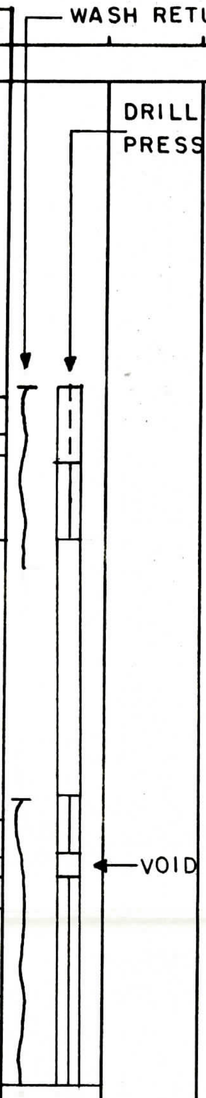
Our Reference No. 77-2-1

Enclosure No. 2

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION
LOCATION: FLOOR LOCK 42 (LOWER SILL)
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN.
Date: FEB. 22, 1977

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100 / UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST		WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %		
325.0	0	ICE SURFACE									
	0	WATER									
317.0	8.0	4" Concrete, White SANDSTONE Block			1	EX RC		100	–		
					2			100	–		
315.2	9.8	Granite cobbles & Grout Seams *			3			85	—		*Includes seam of grey cement grout 10" thick
313.0	12.0	wood Loose SAND or SILT 9" wood layer				WS					No pressure on drill head 13'0" - 18'7"; no wash return
305.7	19.3	Granite Cobbles			4	AX RC		100	-		10^0 to 45^0 joints @ 2" to 5" spacing
304.3	20.7	BEDROCK (Grey granite, green mottling due to chlorite & biotite schist			5			100	-		
					6			76	–		
					7			100	—		
					8			71	–		
298.7	26.3	END OF BOREHOLE									Note: BH. 3A drilled 12" east of BH. 3 encountered: 0 to 8.8' water 8.8 to 9.5' concrete 9.5 to 10.0' cavity 10.0 to 11.7' wood Hole abandoned



VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L. CHECKED:

LOG OF BOREHOLE 8

Our Reference No. 77-2-1

Enclosure No. 3

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION.
LOCATION: FLOOR LOCK 42
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN
Date: FEB. 19, 1977

SUBSURFACE PROFILE · SAMPLES · PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100 · UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST · WASH RETURN · DRILL HEAD PRESSURE. · WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	NUMBER	TYPE	REC. %	RQD %	REMARKS
325.0	0	ICE SURFACE					
		WATER					
317.7	7.3	8" Concrete Red & white SANDSTONE blocks, seams of mortar, sand and clayey silt (MASONRY)					
			1	BX RC	37	—	
	12.5	sand		WS			No pressure, washed out SAND from 12'5" to 15'0"
310.0	15	Grey & reddish garniferous granite; vuggs & solution cavities, possibly fractured bedrock - shear zone	2	BX RC	64	–	10^0 to 50^0 joints @ 2" to 3" spacing
			3	AX			
			4		42	–	
			5		100	–	
303.0	22.0		6		100	–	
		BEDROCK (Grey granite, some red & green mottling)	7	AX RC	100	–	
			8		100	–	
295.5	29.5	END OF BOREHOLE					

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L. CHECKED:

LOG OF BOREHOLE 11

Our Reference No. 77-2-1

Enclosure No. 4

CLIENT: ONTARIO REGION, PARKS CANADA.
PROJECT: JONES FALLS LOCK STATION.
LOCATION: FLOOR LOCK 42
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN.
Date: FEB. 21, 1977

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST			WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %	WASH RETURN. DRILL HEAD PRESSURE.		
325.0	0	ICE SURFACE										
	5	WATER										
317.8	7.2	2" MORTAR, White SANDSTONE block 2" mortar			1			97	–			
315.3	9.7 10	BEDROCK (chlorite schist, granite, gneiss rich in biolite, hornblende & pyroxene, reddish with green mottling) weathered, fractured, solution cavities-possible shear zone			2			100	–			10^0 to 70^0 joints @ 2" to 6" spacing
					3			96	33			
					4			100	60			
	15				5	BX RC		100	22			
305.8	19.2 20	END OF BOREHOLE										

VERTICAL SCALE: 1inch to 5 feet

DRAWN: F. L.

CHECKED:

DOMINION SOIL INVESTIGATION LIMITED

LOG OF BOREHOLE 13

Our Reference No. 77-2-1

Enclosure No. 5

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION
LOCATION: BACKFILL LOCK 42
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (BBS No.1)
Diameter: AS SHOWN
Date: MAR. 10, 1977

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %	REMARKS
337·2	0	GROUND SURFACE						
		5" Organic Topsoil						
		SDST cobble 1.0' to 1.3'	1	SS	42*			*Effect of frost
		Firm to stiff grey - brown clayey silt FILL, few sand pockets	2	SS	12			
			3	SS	7			
			4	SS	7			
	14·0	greenish, organic traces	5	SS	5			
318·2	19·0	LST and SDST fragments in cemented GROUT, some honeycombing	6	AX		100	–	No pressure from 19'6" to 19'10"
			7	AX		100	–	
			8	AX		21	–	No pressure from 21'0" to 30'4"
314·8	22·4	Grey SILT with fine sand and some clay		WS				
306·9	30·3	BEDROCK (granite) Fractured grey, red & green layer, possible shear zone	9	AX		28	–	
			10	AX		48	29	
	39·0	2" sand seam	10A.	AX		83	–	
		Speckled orange and grey with quartz seams	11	AX		71	30	
	43·8	grey	12	AX		60	30	
289·4	47·8	END OF BOREHOLE						

PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100
UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST
WASH RETURN
DRILL HEAD PRESSURE.
WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L. CHECKED:

LOG OF BOREHOLE 15

Our Reference No. 77-2-1

Enclosure No. 6

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION
LOCATION: UPPER SILL, LOCK 42
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN
Date: FEB. 24, 1977

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100 UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST		WASH RETURN	DRILL HEAD PRESSURE	WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %				
		TOP OF GATE SILL											
330.1	0	4" CONCRETE											
		White & red SANDSTONE blocks with mortar joints (MASONRY), occasional granite cobble			1			100	66				
					2			100	35				
	5				3			63	17				Mortar from 5' to 5'5" (no pressure)
					4			67	—				
					5			80	—				
	10				6	BX RC		78	60				
319.7	10.4	Grey, granite cobbles with 2" to 4" mortar seams			7			93	—				
	14.7 15	Red SDST			8			100	50				
314.4	15.7	Mortar seams			9			100	—				
	17.7	BEDROCK (Grey granite with speckles of pyrite, biotite & chlorite - rich gneiss)			10			100	90				Run 10: 10° to 30° joints @ 0'4", 0.6", 1'2", 1'4", 2'0", 2'2", 2'4", 2'6". And 90° extension joint 12" long from 0'4" to 1'4"
	20				11			100	—				
					12	AX RC		77	15				
					13			100	92				
307.3	22.8	END OF BOREHOLE											
	25												
	30												
	35												
	40												
	45												

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L.

CHECKED:

LOG OF BOREHOLE 18

Our Reference No. 77-2-1

Enclosure No. 7

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION.
LOCATION: MID NORTH WALL, LOCK 41.
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN
Date: MAR. 6, 1977

PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100
UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST
WASH RETURN
DRILL HEAD PRESSURE.

WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %	REMARKS
352.5	0	TOP OF WALL								
		White and red SANDSTONE blocks, seams of mortar (MASONRY), occasional limestone cobble			1			90	90	Brown crumbling mortar seam 6'2" to 7'5"
					2			100	31	
					3			100	56	
					4			66	38	
	5				5			100	100	Lost wash water in cavity @ 1'6", water discharging from mortar seam in wall 12" below coping level & 9' west of borehole.
					6			100	100	
					7			77	32	
	10				8			100	—	
					9			87	50	
					10	NX RC		75	75	Cavity 2'11" to 3'3½"
	15				11			80	—	
					12			94	47	Mortar seams generally friable, sometimes honeycombed.
332.3	20 / 20.2	Grey granite and some red sandstone COBBLES and BOULDERS with mortar seams			13			76	33	
					14			100	—	
					15			93	59	
	25				16			100	—	
					17			47	47	
					18			98	32	
	30	Black SAND Seam			19	AX RC		59	—	Lost water @ 30' Water & black sand escaping from base of wall & through Borehole 19 in centre of lock
321.5	31.0	BEDROCK (grey, pink & green) mottled granite)			20			50	—	
					21			100	43	
					22			83	—	
	35				23			97	68	
					24			75	32	
315.2	37.3	END OF BOREHOLE								
	40									
	45									

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L. CHECKED:

Our Reference No. 77-2-1

LOG OF BOREHOLE 19

Enclosure No. 8

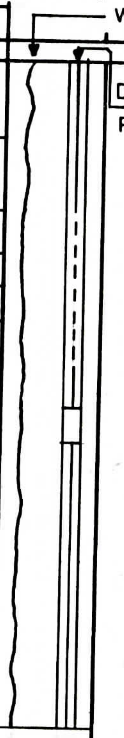
CLIENT: ONTARIO REGION, PARKS CANADA.
PROJECT: JONES FALLS LOCK STATION
LOCATION: FLOOR, LOCK 41
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN
Date: MAR. 2, 1977

PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100
UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST

WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L

SUBSURFACE PROFILE					SAMPLES					REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %	
332.8	0	FLOOR SURFACE								
		CONCRETE			1			79	42	
330.8	2.0	6" SDST & Mortar								
		Grey granite COBBLES with mortar seams			2	BX RC		61	–	
	5				3			85	–	
					4			40	–	
					5			100	–	
					6			37	–	
		black sand								
322.8	10									No pressure from 9 to 10' 10^0 to 50^0 joints @ 2" to 3" spacing.
		quartz seam			7	AX RC		81	–	
		BEDROCK (Grey granite with red & green mottling)			8			93	38	
	15				9			91	55	
					10			87	42	
315.5	17.3	END OF BOREHOLE								
	20									



VERTICAL SCALE: 1 inch to 5 feet

DRAWN: F. L

CHECKED:

DOMINION SOIL INVESTIGATION LIMITED

LOG OF BOREHOLE 25

Our Reference No. 77-2-1

Enclosure No. 9

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION
LOCATION: UPPER SILL, LOCK 41.
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN
Date: MAR. 5, 1977

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100 / UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST		WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %		
347.6	0	TOP OF SILL									
		White, olive and red SANDSTONE blocks, occasional granite cobble and mortar seams 2" to 3" thick.			1	BX		98	98		
					2			100	50		
					3			96	52		
					4			96	68		
					5			84	58		
					6	AX		66	23		
					7			82	43		
331.3	16.3	mortar trace BEDROCK (Grey granite, some red & green mottling)			8			86	43		10° to 50° joints @ 1" to 10" spacing,
					9			81	45		70° extension joint 7" long in run 10
					10			90	90		
323.2	24.4	END OF BOREHOLE									

WASH RETURN

DRILL HEAD PRESSURE.

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L. CHECKED:

LOG OF BOREHOLE 28

Our Reference No. 77-2-1

Enclosure No. 10

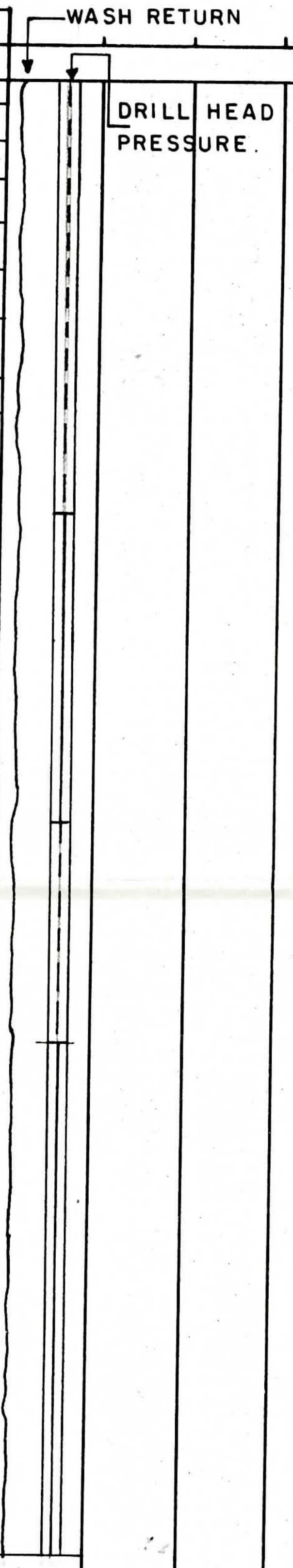
CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION
LOCATION: SOUTH WALL, LOCK 40
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (BBS No. 1)
Diameter: AS SHOWN
Date: MAR. 17, 1977

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SAMPLES NUMBER	SAMPLES TYPE	REC. %	RQD %	REMARKS
367·6	0	TOP OF WALL					
		Red, white & grey SANDSTONE blocks with mortar seams, (MASONRY)	1		100	—	Brown mortar, friable and crumbling, sand only in some seams.
			2		100	73	
			3		92	41	
			4		93	40	
	5		5	NX	93	52	
			6		87	—	
			7		100	31	
			8		100	—	
	10		9		100	63	
			10		74	—	
	15		11		90	78	
	20		12		72	54	
	25		13		80	—	
341·2	26·4	Granite COBBLES, traces of Sandstone and Mortar	14	BX	43	—	
	30		15		86	23	Wood from 31'11" to 32'4"
		wood	16		60	30	
			17		100	—	
	35		18		62	-	
332·3	35·3	BEDROCK (Grey granite, pink mottline)	19		71	-	
			20		100	50	
327·7	39·9	END OF BOREHOLE					
	40						
	45						

PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100
UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST

WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L



VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L. CHECKED:

Our Reference No. 77-2-1

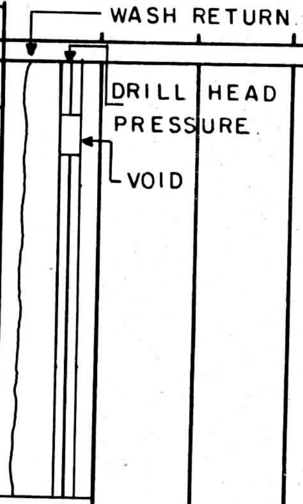
LOG OF BOREHOLE 29

Enclosure No. 11

CLIENT: ONTARIO REGION, PARKS CANADA.
PROJECT: JONES FALLS LOCK STATION
LOCATION: FLOOR LOCK 40
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN
Date: MAR. 7, 1977

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 / UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST		WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %		
347.6	0	TOP OF FLOOR									
		9" concrete 8" granite boulder 16" VOID 4" concrete			1			93	47		Wood encountered 2" below floor while trying to anchor drill 1 ft. east of borehole. Void from 1'5" to 2'9" (no pressure) 20° to 60° joints @ 1" to 6" spacing.
					2	NX		28	–		
344.5	3.1	Granite Cobbles, some Sandstone, trace mortar			3 4			100 100	– –		
	5				5			79	–		
342.0	5.6	2-inch seam of clayey silt BEDROCK (Grey granite, reddish mottling)			6			94	56		
					7	BX		100	79		
	10				8			100	84		
					9			100	31		
336.1	11.5	END OF BOREHOLE									
	15										
	20										



VERTICAL SCALE: 1 inch to 5 feet

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F. L.

CHECKED:

LOG OF BOREHOLE 30

Our Reference No. 77-2-1

Enclosure No. 12

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION.
LOCATION: NORTH WALL, LOCK 40.
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (BBS No. 1)
Diameter: AS SHOWN.
Date: MAR. 6, 1977

SUBSURFACE PROFILE | SAMPLES | PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100 | UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST | WASH RETURN | DRILL HEAD PRESSURE. | WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %	REMARKS
367.6	0	TOP OF WALL								
		Red with some white SANDSTONE blocks and mortar seams (MASONRY), occasional limestone and granite cobbles and boulders			1			90	70	Crumbling mortar layers 1'6" to 2'2" & 3'0" to 4'0"
					2			55	92	
					3			86	79	
					4			68	68	Roots in mortar to 3'0"
	5				5			100	—	
					6			93	58	
					7	NX		75	51	No pressure from 7'10" - 8'1"
	10				8			71	38	No pressure from 14'2" to 14'4"
	15				9			83	55	
	20				10			80	49	Lost water 19'1"
					11			100	—	
344.3	23.3	mottled, fractured BEDROCK (Grey granite, red and green mottling)			12			77	48	Many vertical & horizontal joints 23.3' to 26.0'
	25				13	BX		100	—	
					14			92	53	10^0 to 30^0 joints @ 3" to 6" spacing.
	30				15			100	70	
335.0	32.6	END OF BOREHOLE								
	35									
	40									
	45									

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L. CHECKED:

LOG OF BOREHOLE 34

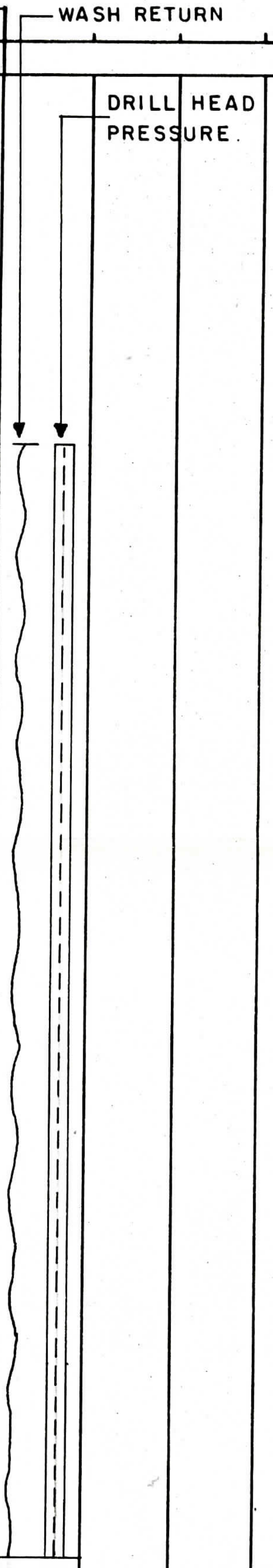
Our Reference No. 77-2-1

Enclosure No. 13

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION.
LOCATION: NORTH WEST AIRSHAFT, LOCK 40.
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (BBS No. 1)
Diameter: AS SHOWN.
Date: MAR. 7, 1977

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100 / UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST		WATER CONTENT % PLASTIC LIMIT WP NATURAL W LIQUID LIMIT WL	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %		
367·6	0	TOP OF COPING									
	0 – 5·2	AIR SHAFT									
	5·2 – 10·5	SLUICE OPENING									
357·1	10·5	1" Brown mortar 10" Hard Limestone Concrete*			1	NX		39	27		*Recent aggregate - grout pack
		Red SANDSTONE and mortar seams, many small voids			2			45	–		
350·6	17·0	Granite COBBLES and mortar seams			3			75	–		
					4			100	–		
					5	BX		90	–		
347·1	20·5	Red Sandstone and some grey granite blocks with mortar seams (MASONRY)			6			77	44		
341·1	26·5	Granite with some sandstone COBBLES			7			61	14		
					8	BX		69	–		
335·4	32·2	SAND & PEBBLES (possibly glacial till stratum)*			9			22	–		12" Granite boulder 34'-5 to 35'-5 *Intermittent pressure on drill head, 32.2' to 37.8'
					10			31	–		
329·8	37·8	BEDROCK (Black and red granite)			11	AX		67	12		
325·4	42·2	END OF BOREHOLE									



VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L.
CHECKED:

LOG OF BOREHOLE 35

Our Reference No. 77-2-1

Enclosure No. 14

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION.
LOCATION: UPPER SILL, LOCK 40.
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN
Date: FEB. 20, 1977

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SAMPLES NUMBER	SAMPLES TYPE	REC. %	RQD %	WASH RETURN / DRILL HEAD PRESSURE	REMARKS
357.7	0	TOP OF SILL						
		14" CONCRETE	1		86	–		Mortar seams, 7'6 to 8'1, 13'0 to 13'9
		Grey Granite and red Sandstone Blocks with mortar seams (MASONRY)	2		75	50		
			3		25	–		
	5		4		68	33		
	10		5		80	30	VOID	Void 8'5 to 9'3 14'7 " 15'6 (no pressure)
			6		100	72		
343.9	13.8	Grey granite COBBLES with mortar seams						
	15		7	BX	22	–	VOID	
			8		63	–		
	20		9		17	–		
			10		50	–		
		sand	11		27	46		
333.7	24.0	BEDROCK (Black & grey granite with red mottling)						
	25		12		78	56		10^0 to 20^0 joints at 3" to 9" spacing
			13		92	21		
	30		14		100	100		
327.2	30.5	END OF BOREHOLE						

PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100
UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST
WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L.
CHECKED:

LOG OF BOREHOLE 37

Our Reference No. 77-2-1

Enclosure No. 15

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION
LOCATION: SOUTHWEST WINGWALL, LOCK 40.
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (BBS No.1)
Diameter: AS SHOWN
Date: MAR. 15, 1977

SUBSURFACE PROFILE — SAMPLES — PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100 — UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST — WASH RETURN — DRILL HEAD PRESSURE — WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %	REMARKS
367·6	0	TOP OF WALL								
		Red and Grey SANDSTONE blocks with mortar seams (MASONRY)			1	NX		100	–	Void and no pressure 1'7" to 1'11"
					2			100	–	
					3			100	–	
					4			57	–	
						WS				
					5			61	18	Run 5: evidence of old (brown) and newer (grey) mortar Washed-out mortar from 2'2" to 4'6"
					6			100	41	Mortar from 5'1" to 5'3"
					7	BX		53	22	Run 6: contains seams of grey mortar 1", 4" and 5" thick.
					8			57	36	Run 8: 50% of core recovered is broken grey mortar.
		sand								Sand seam, 21'7 to 22'0
					9			45	20	
341·6	26·0	Granite COBBLES and mortar			10	AX		53	26	
339·2	28·4	Bedrock, (grey and black granite with red mottling)			11			82	41	
					12			97	43	
333·1	34·5	END OF BOREHOLE								

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L.

CHECKED:

LOG OF BOREHOLE 38

Our Reference No. 77-2-1

Enclosure No. 16

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION.
LOCATION: BACK FILL, SOUTHWEST WINGWALL, LOCK 40.
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (BBS No. 1)
Diameter: AS SHOWN.
Date: MAR. 14, 1977

SUBSURFACE PROFILE · SAMPLES · PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100 · UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST · WASH RETURN · DRILL HEAD PRESSURE · WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L · REMARKS

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %	REMARKS
367·6	0	GROUND SURFACE						
		5½" topsoil Dark brown stiff clayey SILT (FILL), sand seams, organic traces	1	SS	20			Wash boring to 15'
			2	SS	12			
			3	SS	12			
	14.5	gravel						
353·1	15	Red SANDSTONE block	4	SS	60/2"			
351·3	16·3	BEDROCK (Grey, black, some red granite)	5	BX		100	—	
			6	AX		88	47	
			7			79	48	
345·3	22·3	END OF BOREHOLE						

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L. CHECKED:

LOG OF BOREHOLE 39

Our Reference No. 77-2-1

Enclosure No. 17

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION
LOCATION: NORTHWEST WINGWALL, LOCK 40.
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (BBS No. 1)
Diameter: AS SHOWN
Date: MAR. 3, 1977

SUBSURFACE PROFILE				SAMPLES			PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100		WATER CONTENT %	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST REC. %	RQD %	PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L	
367.6	0	TOP OF WALL								
		Grey & red sandstone blocks with mortar seams (MASONRY)		1			100	86		
				2			100	68		
				3			100	93		
				4			100	64		
				5	NX		80	61		
358.9	8.7	Sand or decayed MORTAR		6	SS	40/2"				Lost water & drill head pressure @ 8.7', pressure return @ 12.5', water return @ 16'9"
355.6	12.0	Red or grey Sandstone with occasional granite blocks, traces of mortar (MASONRY)		7			79	34		
				8	BX		69	49		Low water return from 16'9" to 27'8"
				9			57	38		
		sand			WS					
				10			82	66		No water return from 27'8" to end.
				11			38	29		
				12	BX		48	16		
331.6	36.0	BEDROCK (Grey, black & mottled red Granite)		13			93	76		
325.0	42.6	END OF BOREHOLE								

WASH RETURN

DRILL HEAD PRESSURE.

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L.

CHECKED:

LOG OF BOREHOLE 41

Our Reference No. 77-2-1

Enclosure No. 18

CLIENT: ONTARIO REGION, PARKS CANADA.
PROJECT: JONES FALLS LOCK STATION.
LOCATION: LOWER SILL, LOCK 39.
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (BBS. No.1)
Diameter: AS SHOWN.
Date: FEB. 21, 1977

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100			WATER CONTENT %	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST REC. %	RQD. %	—WASH RETURN	PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L	
		TOP OF SILL										
359.9	0	CONCRETE with granite plumbs			1			100	–	DRILL HEAD PRESSURE.		
					2			100	55			
357.9	2.0	10" Timber										
357.1	2.8	Granite with mortar seams (boulders or broken rock)			3			53	22			
					4			83	–			
	5				5	RC BX		71	28			Mortar seam 5'3 to 5'7
353.4	6.5	BEDROCK (dark grey granite and gneiss with red mottling, some coarse, feldspar grains)			6			79	65			10^0 to 20^0 to 60^0 joints @ 3" to 10" spacing
	10				7			100	79			
347.3	12.6	END OF BOREHOLE										

VERTICAL SCALE: 1 inch to 5 feet

DRAWN: F. L. CHECKED:

DOMINION SOIL INVESTIGATION LIMITED

LOG OF BOREHOLE 42

Our Reference No. 77-2-1

Enclosure No. 19

CLIENT: ONTARIO REGION, PARKS CANADA.
PROJECT: JONES FALLS LOCK STATION
LOCATION: FLOOR LOCK 39
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (BBS No.1)
Diameter: AS SHOWN
Date: FEB. 22, 1977.

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100 / UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST			WATER CONTENT % PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %	WASH RETURN		
362·1	0	TOP OF FLOOR 3" concrete								DRILL HEAD PRESSURE		
		Grey granite cobbles and mortar seams			1			77	27			Sandstone 1'10 to 2'0
					2			64	–			
	5				3			50	–			
					4	BX		65	11			
354·8	7·3	BEDROCK (Grey and pink granite with chlorite schist)			5	RC		56	32			10^0 to 30^0 joints @ 3" to 10" spacing
	10				6			83	48			
					7			94	71			
347·9	14·2	END OF BOREHOLE										
	15											
	20											

VERTICAL SCALE: 1 inch to 5 feet

DRAWN: F. L

CHECKED:

DOMINION SOIL INVESTIGATION LIMITED

Our Reference No. 77-2-1

LOG OF BOREHOLE 43

Enclosure No. 20

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION
LOCATION: FLOOR LOCK 39
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (BBS No. 1)
Diameter: AS SHOWN
Date: FEB. 21, 1977

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Foot 20 40 60 80 100			WATER CONTENT %	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST REC. %	RQD %	WASH RETURN	PLASTIC LIMIT W_p NATURAL W LIQUID LIMIT W_L	
362.1	0	TOP OF FLOOR										
		Grey SANDSTONE Block			1			67	22	DRILL HEAD PRESSURE		
360.4	1.7	BEDROCK (Black and grey granite, red and white mottling, coarse feldspar crystals) *			2			89	31			60^0 to 90^0 extension joints between 2.0' and 5.0'
	4.5				3			71	18			
	5				4	RC BX		89	53			10^0 to 20^0 joints below 5.0' @ 2" to 12" spacing
	10				5			85	61			
350.6	11.5	END OF BOREHOLE										
	15											* Mortar traces, could be boulders or broken grouted rock
	20											

VERTICAL SCALE: 1 inch to 5 feet

DRAWN: F. L.

CHECKED:

DOMINION SOIL INVESTIGATION LIMITED

LOG OF BOREHOLE 44

Our Reference No. 77-2-1

Enclosure No. 21

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION.
LOCATION: WEST WALL LOCK 39
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN
Date: MAR. 3, 1977

ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	REMARKS
385·4 117·47	0	TOP OF WALL	
	0 – 25·7	Red and white SANDSTONE and occasional grey GRANITE blocks with mortar seams (MASONRY)	No pressure 5'1" - 5'4"
	140	loose mortar	No head pressure 14' to 15'
	21·4 – 23·3	loose mortar seams	Low water return from 19' to 23.5
359·7	25·7 7·83	Bedrock (Grey granite with pink mottling)	
	26·5	*	*Grey & black gneiss layer or boulder
			20^0 to 40^0 joints @ 3" to 6" spacing
355·1	30·3 9·24	END OF BOREHOLE	

SAMPLES NUMBER	TYPE	REC. %	RQD %
1	NX	97	39
2		76	70
3		92	87
4		93	93
5		100	–
6		98	74
7		100	83
8		98	83
9		87	35
10		47	–
11	BX	87	54
12		93	43
13		100	64
14		100	69
15		76	53

PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100
UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST
WASH RETURN
DRILL HEAD PRESSURE.

WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L. CHECKED:

LOG OF BOREHOLE 45

Our Reference No. 77-2-1

Enclosure No. 22

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION.
LOCATION: SOUTH EAST WINGWALL, LOCK 39
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN.
Date: MAR. 15, 1977

SUBSURFACE PROFILE

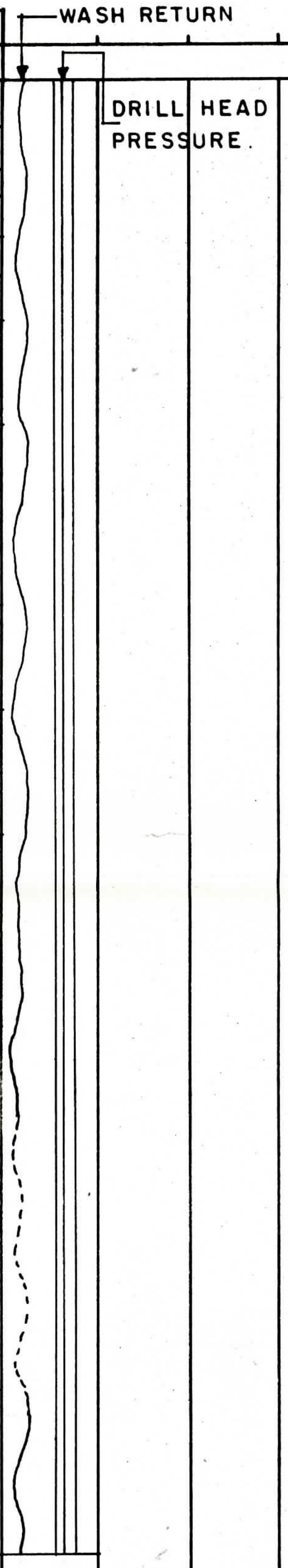
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION
		TOP OF WALL
385·4 117,45	0	Grey & mottled brown SANDSTONE blocks with mortar seams (MASONRY)
	5	
	10	
	15	
	20	
	25	
		red
	30	
	30·8	*
	31·5	
	35	
349·4	36·0 10,97	BEDROCK (Black, red & grey granite)
345·4	40 12,19	END OF BOREHOLE
	45	

SAMPLES

NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %
1			90	70
2			96	—
3			100	100
4			96	90
5			100	92
6			93	84
7			100	31
8			100	69
9			96	56
10			95	55
11			76	25
12			97	67
13			95	95
14			98	74
15			100	55

PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100

UNDRAINED SHEAR STRENGTH p.s.f.
+ FIELD VANE TEST ● COMPRESSION TEST



WATER CONTENT %
PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L

REMARKS

Low water return from 28' to 36'5

*Granite cobble 30'9" to 31'6"

VERTICAL SCALE: I inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L.

CHECKED:

LOG OF BOREHOLE 46

Our Reference No. 77-2-1

Enclosure No. 23

CLIENT: ONTARIO REGION, PARKS CANADA
PROJECT: JONES FALLS LOCK STATION
LOCATION: BACKFILL, NORTH EAST WINGWALL, LOCK 39.
DATUM ELEVATION: GEODETIC

DRILLING DATA
Method: DIAMOND DRILLING (WINKIE)
Diameter: AS SHOWN.
Date: MAR.16, 1977

SUBSURFACE PROFILE					SAMPLES			PENETRATION RESISTANCE Blows/Ft. 20 40 60 80 100 / UNDRAINED SHEAR STRENGTH p.s.f. + FIELD VANE TEST ● COMPRESSION TEST		WATER CONTENT % PLASTIC LIMIT W_P NATURAL W LIQUID LIMIT W_L	REMARKS
ELEVATION Ft.	DEPTH Ft.	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	'N' Blows/Ft.	REC. %	RQD %		
385·4 117.47	0	GROUND SURFACE									
		FILL clayey silt			1	SS	7				Wash boring to 11"
					2	SS	9				
	5·5 (1,65)	fine to medium sand			3	SS	23				
	10				4	SS	1/6"				
	11·0 (3.35)										
	12·2 (3.71)	cobbles clayey SILT, some Sand									Running casing & bi-cone to rock.
					5	SS	3				Void from 16'5" to 17'0"
368·4	17·0 (5,18)	Grey, varved clayey SILT (very stiff)			6	SS	16				
		very sandy			7	SS	12				
355·4	30 (9,14)	Grey fine to coarse SAND, embedded gravel (Sand till) Very Dense			8	SS	31/9"				
349·6	35·8 (10.87)	BEDROCK (Red & grey granite)			9	AX		94	39		
					10	AX		100	67		
345·1	40·3 (12.27)	END OF BOREHOLE									

WASH RETURN

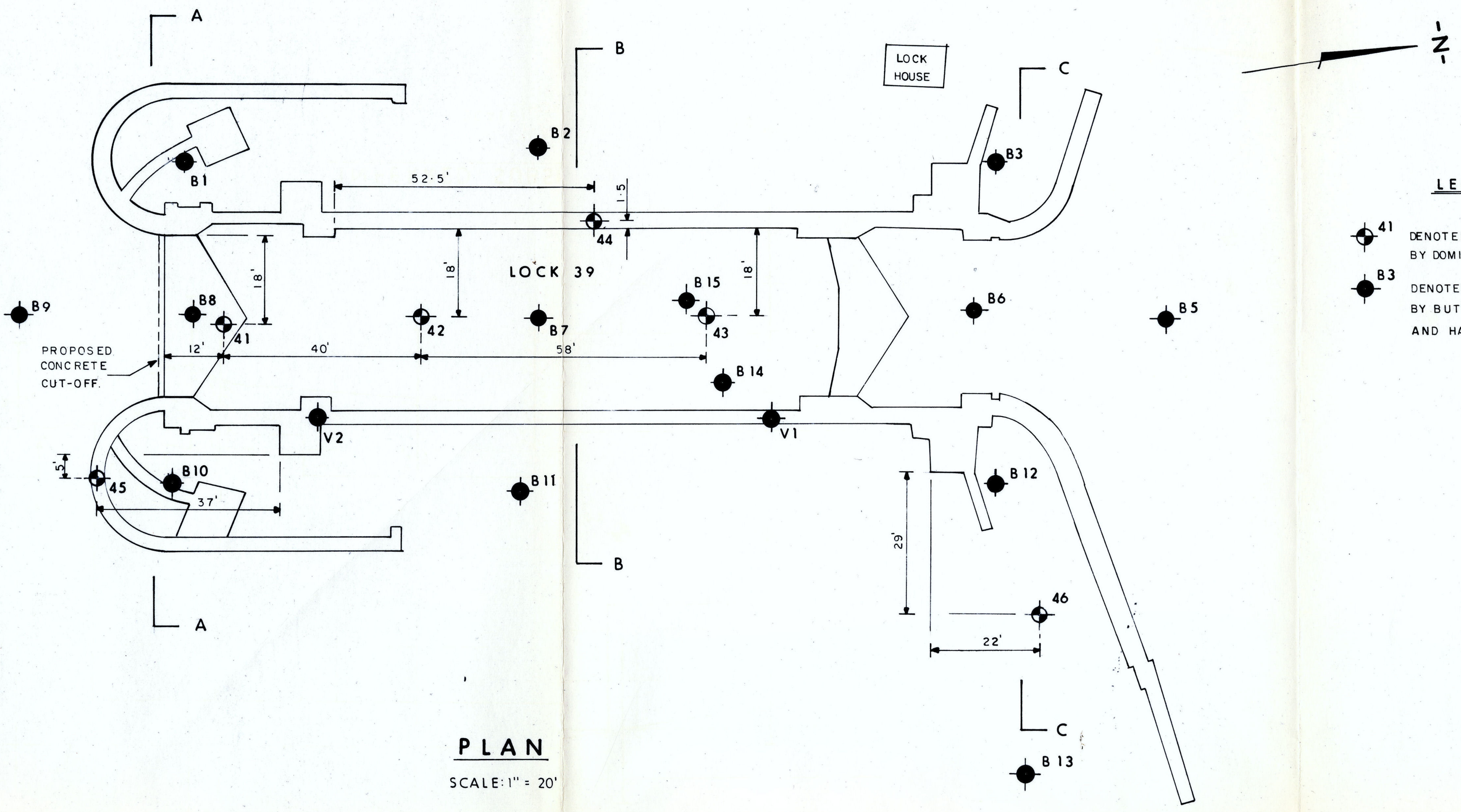
DRILL HEAD PRESSURE.

VERTICAL SCALE: 1 inch to 5 ft.

DOMINION SOIL INVESTIGATION LIMITED

DRAWN: F.L.

CHECKED:



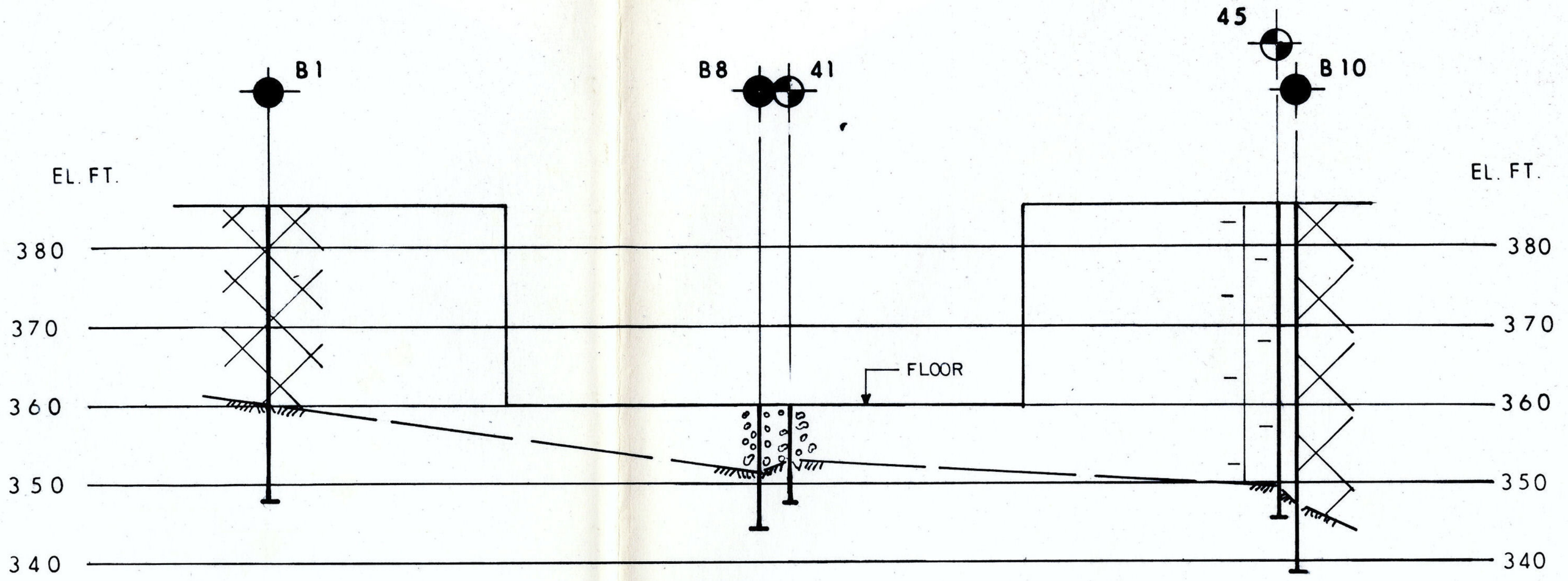
PLAN

SCALE: 1" = 20'

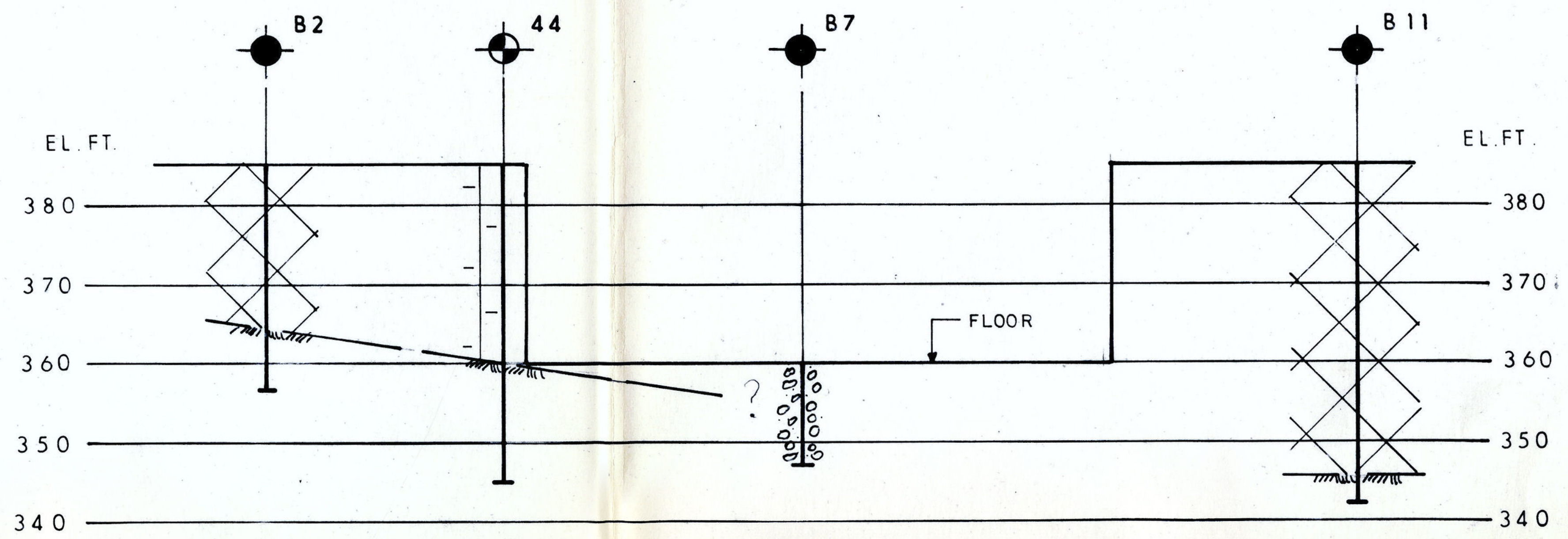
LEGEND

⊕ 41 DENOTES BOREHOLE BY DOMINION SOIL.

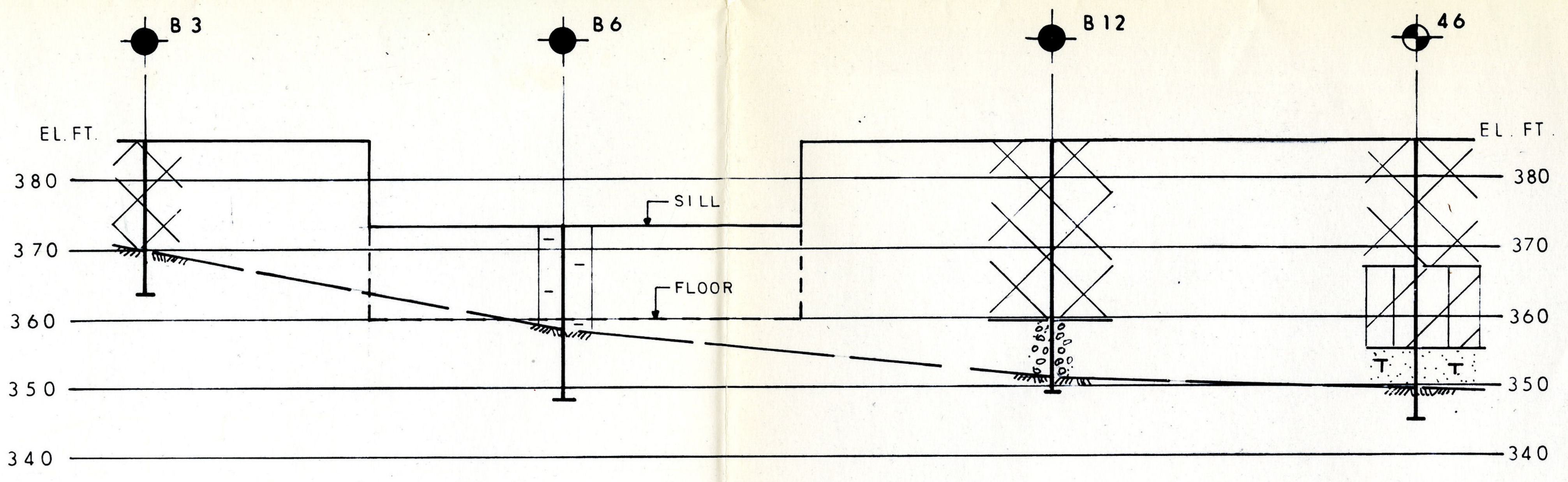
● B3 DENOTES BOREHOLE BY BUTTS, ROSS, MAGWOOD AND HALL LTD. (REF. 10-259-L)



SECTION A-A

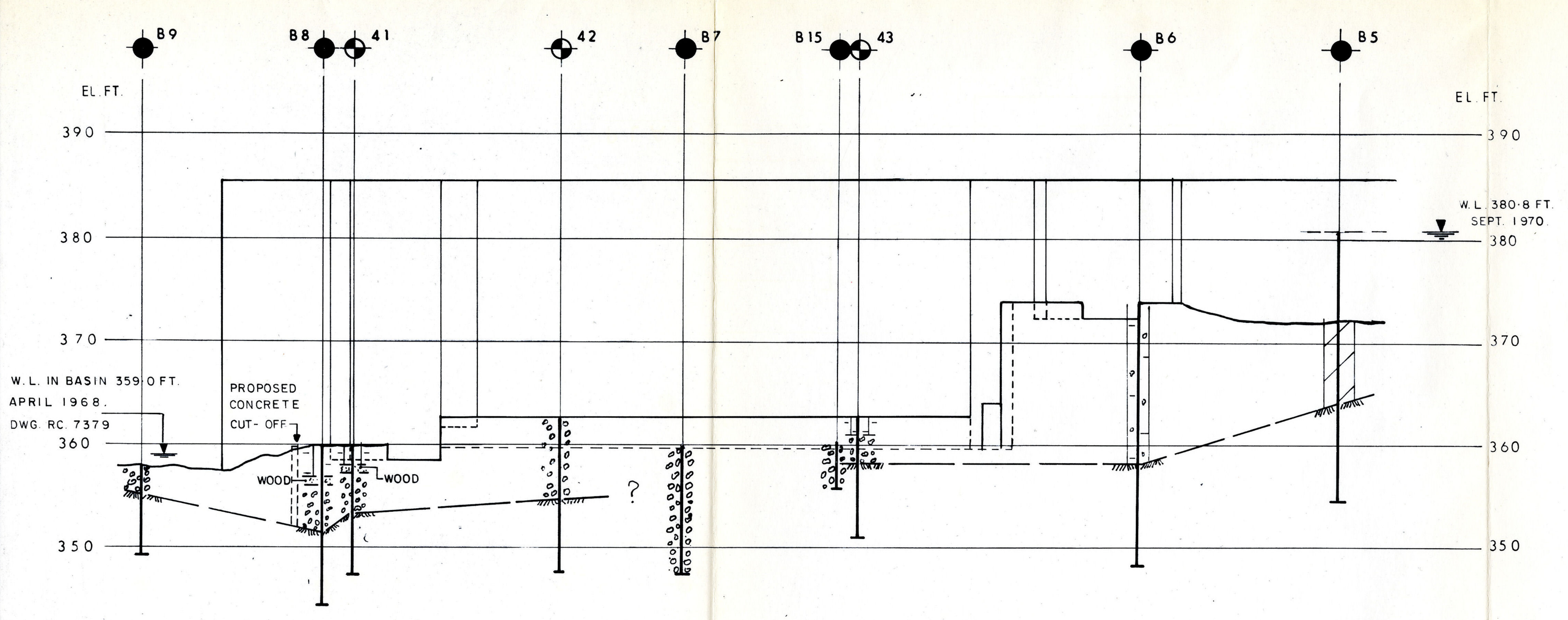


SECTION B-B



SECTION C-C

SCALE VER. 1" = 20' HOR. 1" = 10'



INFERRED SUBSURFACE PROFILE

SCALE VER. 1" = 10' HOR. 1" = 20'

LEGEND

▥ MASONRY

⁘ RUBBLE

▤ BEDROCK

⊠ CLAY, SILT AND SAND **FILL**

▧ CLAY AND SILT

▦ SANDY TILL

(NANOS) GLACIJALNI (RAZNI MAT.)

ONTARIO REGION, PARKS CANADA.

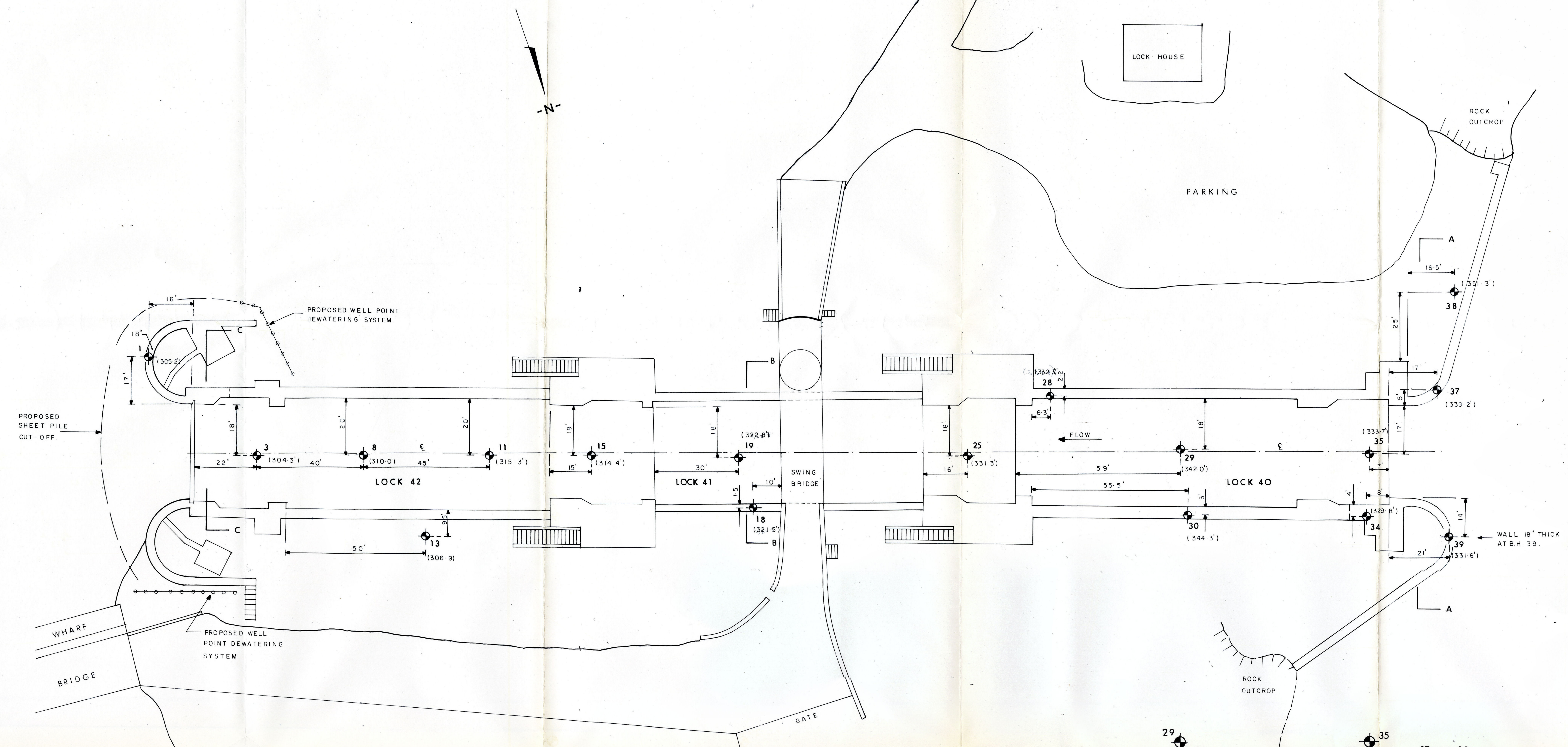
JONES FALLS, LOCK STATION

JONES FALLS, ONT.

BOREHOLE LOCATION PLAN, PROFILE & SECTIONS

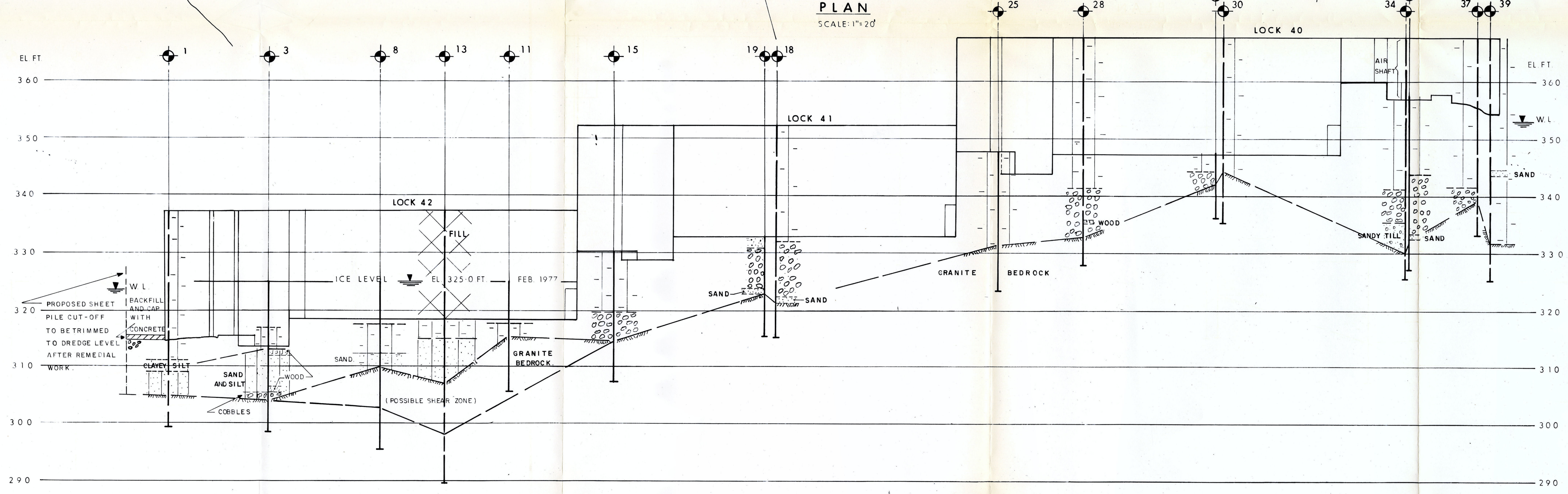
DOMINION SOIL INVESTIGATION LIMITED
CONSULTING SOIL & FOUNDATION ENGINEERS

SCALE	DATE	DRAWN BY	APPROVED BY	REF. No.	DWG. No.
AS SHOWN	MAR. 1977	F.L.		77-2-1	1



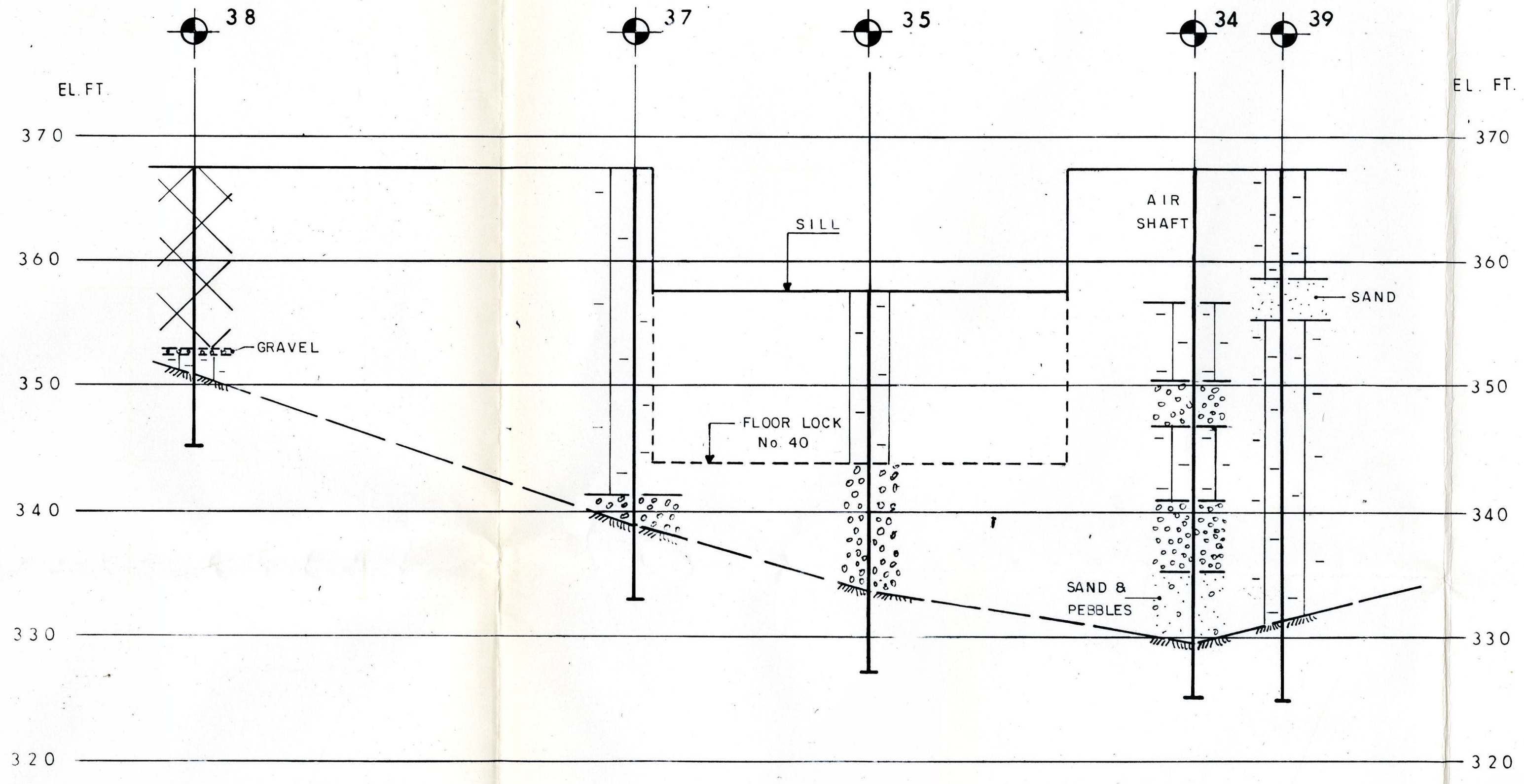
PLAN

SCALE: 1" = 20'



INFERRED SUBSURFACE PROFILE

SCALE VER. 1" = 10'
HOR. 1" = 20'

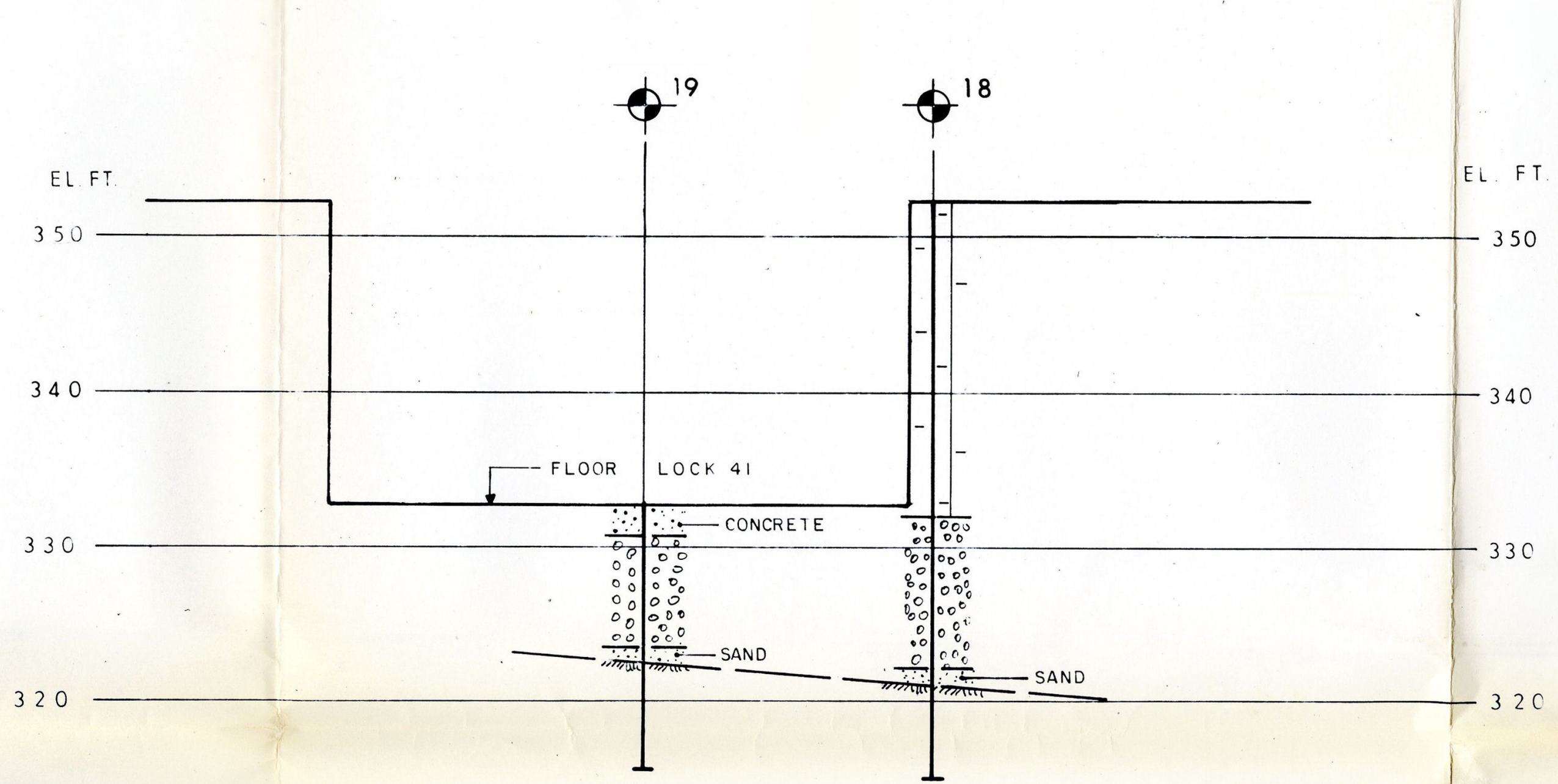


SECTION A-A

SCALE: 1" = 10'

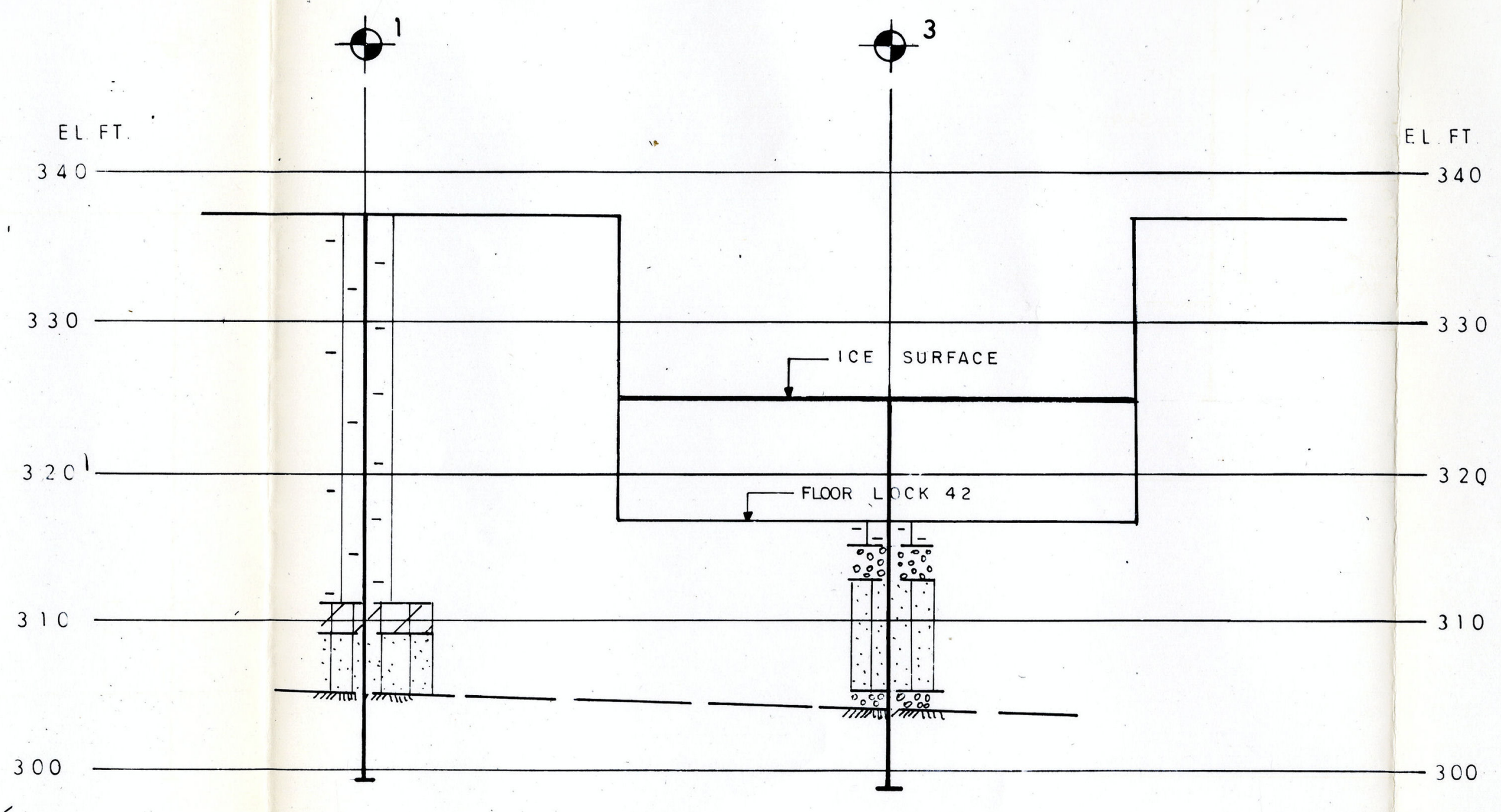
LEGEND

▥	MASONRY
⁘	RUBBLE
▭	BEDROCK
☒	CLAYEY SILT **FILL**
▨	SAND OR SILT
⊕ 38 (351·3')	FIGURES IN BRACKETS DENOTE BEDROCK ELEVATION AT BOREHOLE.



SECTION B-B

SCALE: 1" = 10'



SECTION C-C

SCALE: 1" = 10'

ONTARIO REGION, PARKS CANADA

JONES FALLS, LOCK STATION

JONES FALLS, ONT.

BOREHOLE LOCATION PLAN, PROFILE & SECTIONS

DOMINION SOIL INVESTIGATION LIMITED
CONSULTING SOIL & FOUNDATION ENGINEERS

SCALE	DATE	DRAWN BY	APPROVED BY	REF. No.	DWG. NO.
AS SHOWN	MAR. 1977	F.L.		77-2-1	2