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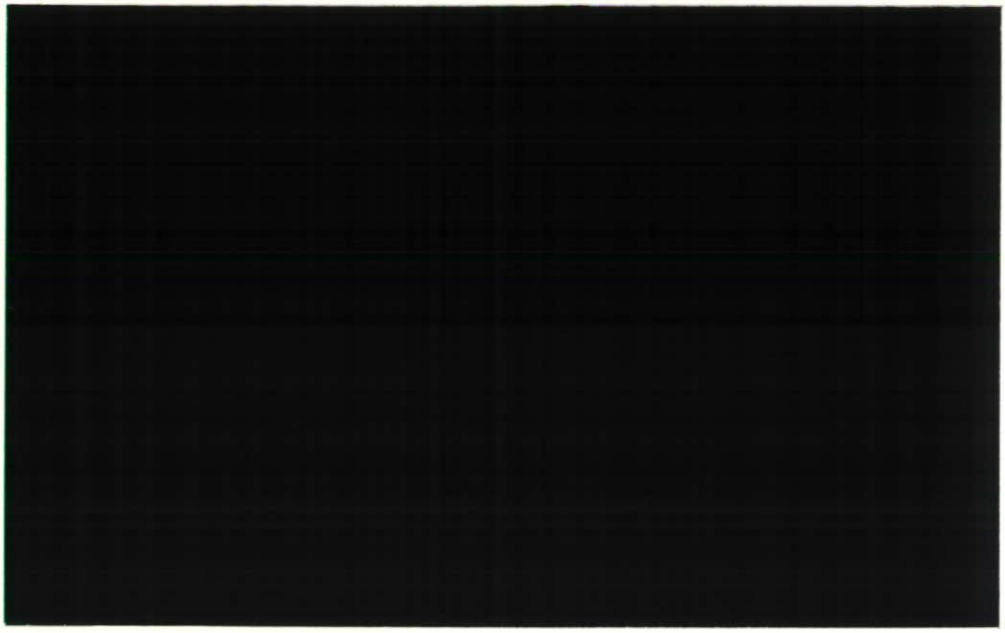

Natural Environment Research Council

RBS

Hydrological and Hydrogeological Assessment

Cransley Lodge, Kettering

for

Stock Land and Estates Ltd

Volume 2

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Appendix I

GEOLOGICAL LOGS - BOREHOLES

INSTITUTE OF HYDROLOGY BOREHOLE RECORD SHEET

IH Borehole No	: BH1	Project	:	Cransley Lodge
BGS Borehole No	:	Grid Ref	:	808765
Date Started	: 09/04/1991	Date Completed	:	09/04/1991
Surface Level	: 119.975 m.O.D.			
Water Struck	: 3.0 m BGL			
Rest Water Level	: m BGL			
Client	: Stock Land & Estates			
Driller	: W.Gee			
Logged	: N.Runnalls.			
Borehole Diam	: 200 mm			
Method of Drilling	: Power Auger			
Casing Diam/Type	: 60 mm UPVC			
	19 mm UPVC Piezometer Tubing			
Screen	: 1 m x Mesh			
Pack	: Gravel			
Comments	: Base of screen at 4.5 m BGL,			
	Gravel pack from 1.45 - 5.5 m BGL.			
	Bentonite seal from 0.90 m - 1.45 m BGL.			

GEOLOGICAL LOG

Depth	Description
0.0-0.5	Brown topsoil with organic material and ironstone fragments - possible made ground.
0.5-1.1 Gravel	Sandy gravel with abundant chips of platey and angular ironstone - Gravel.
1.1-1.5	Yellowish brown uniform grained fine sand, silt bands. Gradational towards the base into coarse sand and gravel with abundant ironstone fragments.
1.5-3.0	Brown gravel with clayey matrix. Abundant (40%) ironstone fragments.
3.0-4.1 Northampton Sand	Brown to slightly yellowish light brown clayey sand with 10% ironstone fragments (<10 mm diam).
4.1-4.5	Brown slightly clayey quartz sand with approximately 30% fragments of coarse ironstone.
4.5	Narrow band of hard ironstone(?)
4.5-9.0 Upper Lias Clay	Heavy black to dark bluish grey clay
	EOH

INSTITUTE OF HYDROLOGY BOREHOLE RECORD SHEET

IH Borehole No	:	BH2	Project	:	Cransley Lodge
BGS Borehole No	:		Grid Ref	:	807765
Date Started	:	09/04/1991	Date Complete	:	09/04/1991
Surface Level	:	121.33 m.O.D.			
Water Struck	:	1.6 3.0 m BGL			
Rest Water Level	:	1.75 m & 2.65 BGL			
Client	:	Stock Land & Estates			
Driller	:	W.Gee			
Logged	:	N.Runnalls.			
Borehole Diam	:	200 mm			
Method of Drilling	:	Power Auger			
Casing Diam/Type	:	60 mm UPVC			
		19 mm UPVC Piezometer Tubing			
Screen	:	1 m x Mesh			
Pack	:	Gravel			
Comments	:	Base of screen set at 9.8 m BGL,			
		Gravel pack from 2.9 - 10.8 m BGL.			
		Bentonite seal from 2.4 - 2.9 m BGL.			
		Base of ceramic piezometer tip set at 2.2 m BGL.			
		Gravel pack 1.0 - 2.2 BGL.			
		Bentonite seal 0.6 - 1.0 m BGL.			

GEOLOGICAL LOG

Depth		Description
0.0-0.4		Topsoil rich in organic material
0.4-1.3	Boulder Clay	Brown clay with rounded pebbles
1.3-1.6		Light Brown sandy clay with abundant rounded chert and limestone pebbles - gravel(?). Some rounded ironstone fragments to pebble size.
1.6-2.6		Light brown clay with abundant pebbles of broken angular (reworked?) ironstone. Wet from 1.6 m.
2.6-3.0	Lower Estuarine	Dark grey heavy clay
3.0-4.0	Northampton Sand	Pale grey to white fine grained silty quartz sand. Mottled yellow. Increased flow of water.
4.0-6.0		Black fine sand with orange oxidised iron staining towards the top of the section. Platey chips of hematitic vein material and cemented hematitic pebbly sandstone.
6.0-6.8		Black fine sand with progressively more clay towards the base. Cemented hematitic fragments up to 120 mm diam returned with the cuttings.
6.8-8.4		Dark grey to black fine grained hematitic clayey quartz sand. Marked increase in clay below 6.8 m with occasional pale grey bands.
8.4-8.7		Hard band of limestone(?).
8.7-10.0		Alternating dark silty clays and fine black and light grey quartz sands
10.0-12.0		Upper Lias ClayDark grey blue heavy clay. EOH

INSTITUTE OF HYDROLOGY BOREHOLE RECORD SHEET

IH Borehole No	: BH3	Grid Ref	: 812768
BGS Borehole No	:	Project	: Cransley Lodge
Date Started	: 09-04-1991	Date Completed	: 12/04/1991
Surface Level	: 118.095 m.O.D.		
Water Struck	: 1.7 m BGL		
Rest Water Level	: 1.7 m & 6.65 m BGL		
Client	: Stock Land & Estates Ltd		
Driller	: W. Gee.		
Logged	: N. Runnalls		
Borehole Diam	: 200 mm		
Method of Drilling	: Power Auger		
Casing Diam/Type	: 60 mm UPVC		
Screen	: 1 m x Mesh & Ceramic tip 19 mm UPVC Piezometer Tubing		
Pack	: Gravel		
Comments:	: Running sands with a high water inflow were encountered below approximately 3.5 m. The hole collapsed once drilling progressed below approximately 7.0 m. Hole was cased to 13.5 m and cleared by air. Tubing and screen were lowered inside the steel casing and the bas of the screen set at 12.2 m BGL. A gravel pack was installed as the casing was progressively withdrawn to 5.7 m where a bentonite seal was installed. A ceramic tipped piezometer was installed to 5.3 m and the sand allows to run in around the tubing. No gravel was used above 5.3 m. Base of screen set at 12.2 m BGL Gravel pack from 7.2 to 13.2 m BGL Bentonite seal 5.3-5.7 m BGL Base of ceramic tipped piezometer set at 5.3 m BGL Bentonite seal 0.9-1.2 m BGL		

GEOLOGICAL LOG

Depth		Description
0.0-0.5		Light brown sandy topsoil with very minor organic material and occasional rounded chert pebbles.
0.5-1.5	Gravel	Brown very sandy clay to clayey sand with 15% rounded flint pebbles.
1.5-3.0		Yellowish brown very uniform grained sand without any coarser pebbles. Occasional pale grey clay bands 10-20 mm thick towards the base of the section.
3.0-4.5	Lower Estuarine	Yellowish brown alternating clay and sand horizons. Clay bands up to 50 mm thick with the sands between 100-250 mm thick. Sand tending to be of variable grain size but generally medium to coarse grained. Clay horizons are grey to black in colour.
4.5-5.3		Wet running very fine sand and silt with clay bands.
5.3-5.7		Grey black dense clay
5.7-6.0	Northampton Sand	Orange brown coarse sand with minor grey to black clay layers. Minor cemented hard ferruginous bands and veins.
6.0-7.2		White to grey alternating fine sand and clay. Occasional sub-rounded

	pebbles of ferruginous cemented material - possibly slightly silicified. Minor white mica flakes. Mottling by orange yellow iron staining.
7.2-7.5	Narrow horizon of hard ferruginised sand. Mottled very light brown in colour - possible carbonate cement.
7.5-9.0	Light brown alternating fine sand and sandy silt with moderate to high clay content. Some darker grey bands to 40-50 mm thick.
9.0-10.3	Brown clayey unconsolidated sand. Occasional harder bands and veins of iron oxides and possible minor limestone horizons. Some silicified fragments.
10.3-10.5	Brown slightly clayey sand with abundant hematite (& goethite) veining. Occasional fragments of white limestone. Minor clay bands.
10.5-12.2	* Very poor sample recovery - contaminated sample*
	Wet fine to medium grained, brown to light brown running sands. Occasional patches of white sand.
12.2-13.5 Upper Lias Clay	Black to blue grey dense and uniform clay.
	EOH

INSTITUTE OF HYDROLOGY BOREHOLE RECORD SHEET

IH Borehole No	:	BH4	Grid Ref	: 811765
BGS Borehole No	:		Project	: Cransley Lodge
Date Started	:	10-04-1991	Date Completed	: 10-04-1991
Surface Level	:	126.442 m.O.D.		
Water Struck	:	7.9 & 13.0 m BGL		
Rest Water Level	:	13.2 m BGL		
Client	:	Stock Land & Estates Ltd		
Driller	:	W.Gee		
Logged	:	N. Runnalls		
Borehole Diam	:	200 mm		
Method of Drilling	:	Power Auger		
Casing Diam/Type	:	60 mm UPVC		
Screen	:	1 m x mesh 19 mm UPVC Piezometer Tubing		
Pack	:	Gravel		
Comments	:	Base of screen installed at 13.0 m BGL Gravel pack from 9.5 - 13.0 m BGL Backfilled from 8.6 - 9.5 m BGL Bentonite seal from 7.6 - 8.6 m BGL Backfilled with gravel to 7.1 m BGL Base of ceramic piezometer installed at 7.1 m BGL Gravel pack from 6.4 - 7.1 m BGL Bentonite seal from 2.0 - 2.3 m BGL The base of the Lower Estuarine Series was damp when drilled but due to error in backfilling the narrow diameter piezometer was installed 80 cm above this horizon. The base of the Northampton Sand was also damp when drilled and only by gradual seepage over more than a month did the sump fill with water and the levels equilibrate.		

GEOLOGICAL LOG

Depth	Description
0.0-0.5	Light brown topsoil with minor organic material. Minor chert and Chalk pebbles less than 10 mm in diameter.
0.5-1.6 Boulder Clay	Heavy grey mottled orange brown clay with approximately 10% rounded white Chalk chips - usually less than 3 mm in diameter.
1.6-3.3	Dark olive green to grey clay with minor fine (< 2 mm diameter) grains of chert. Larger pebbles of Chalk, chert and angular ironstone to 10 mm diameter.
3.3-4.2 Gravel	Light brown clayey fine grained quartz sand.
4.2-4.5	Light brown uniform medium grained quartz sand with occasional fragments of well rounded fossiliferous limestone.
4.5-6.0	Light brown sandy gravel with pebbles to 25 mm diameter but averaging 7-8 mm diameter. Pebbles of fossiliferous limestone, chert and minor more angular chips of ironstone. The limestone and chert pebbles tend to be very well rounded. Approximately 20% of sand grains are ironstone while the remainder are quartz.
6.0-6.7 Lower Estuarine	Light brown fine uniform grained sand to silty sand.

6.7-6.9		Light brown clay with minor thin (< 5 mm) sand layers. The clay in the lower half of the section are pale grey green in colour. The sample in slightly damp.
6.9-7.5		Light yellowish brown fine to medium grained quartz sand. Minor ironstone grains.
7.5-7.9		Light brown clayey fine sand and silt with occasional minor clay bands.
7.9-8.4		Dark grey to greenish clay alternating with orange brown clayey silt. The clay has a dense waxy texture and no mica.
8.4-9.0	Northampton Sand	Alternating bands of brown sandy clay with occasional pebbles of ironstone and very coarse sand. Approximately 50% of the sand in made up of angular limestone fragments up to 20 mm in diameter. The sample is relatively dry.
9.0-10.5		Brown ironstone gravel with predominantly very angular to platey ironstone fragments to 15 mm maximum dimension. The low portions of the section more orange black sand with a moderately clayey matrix. Sample is damp.
10.5-11.8		Orange brown finer grained sand than above with minor clay within the matrix (<15%) with variable very angular ferruginous vein material, average 10 mm maximum dimension. Size is probably only a function of fragmentation during drilling.
11.8-13.0		Yellow brown slightly clayey broken platey ironstone veins. Minor spongey ironstone.
13.0-14.0	Upper Lias Clay	Dark bluish grey dense uniform clay. Minor white mica flakes.
		EOH

INSTITUTE OF HYDROLOGY BOREHOLE RECORD SHEET

IH Borehole No	:	BH5	Grid Ref	: 808763
BGS Borehole No	:		Project	: Cransley Lodge
Date Started	:	10-04-1991	Date Completed	: 10-04-1991
Surface Level	:	127.063 m.O.D.		
Water Struck	:	Dry		
Rest Water Level	:	6.5 m BGL		
Client	:	Stock Land & Estates		
Driller	:	W.Gee.		
Logged	:	N. Runnalls		
Borehole Diam	:	200 mm		
Method of Drilling	:	Power Auger		
Casing Diam/Type	:	60 mm UPVC		
Screen	:	1 m x mesh 19 mm UPVC Piezometer Tubing		
Pack	:	Gravel		
Comments	:	Backfilled with Lias Clay to 6.5 m Base of screen installed at 6.5 m BGL Gravel pack from 5.3 to 6.5 m BGL Bentonite seal from 4.8 to 5.3 m BGL Base of ceramic piezometer installed at 4.8 m BGL Gravel pack from 4.0 to 4.8 m BGL Backfilled with Lias Clay from 2.0 to 4.0 m BGL Bentonite seal from 1.7 to 2.0 m BGL Backfilled to surface. The Northampton Sand is effectively dry in this hole. The sump took several months to fill.		

GEOLOGICAL LOG

Depth	Description
0.0-1.5 Boulder Clay	Brown dense clay with fine (<3 mm diam) pebbles of chert and limestone. Occasional larger pebbles to 10 mm diameter with a single cobble of Chalk to 50 mm diameter.
1.5-2.5 Gravel	Dense black to brown clay with approximately 20% well rounded pebbles of flint and limestone to 3 mm diameter and minor (<2%) pebbles to 10 mm diameter.
2.5-3.0	Sand to gravelly sand with black clay matrix and 15-10% pebbles of chert and limestone. Pebbles to 12 mm diameter. Occasional pale brown clay bands particularly towards the base of the section.
3.0-4.8	Very light brown uniform medium grained quartz sand. No pebbles.
4.8-5.3	Light brown sandy clay with minor (< 10%) interbedded medium grained quartz sand. Sample is wet.
5.3-5.7	Gravel with approximately 20% pebbles greater than 10 mm diameter and up to a maximum 25 mm diameter. Pebbles of well rounded chert in a relatively clean quartz sand matrix.
5.7-6.0	Brown clayey gravel consisting of approximately 20% fine pebbles of chert and limestone up to a maximum 5 mm diameter, but averaging 1-2 mm diameter. Occasional larger platey fragments of ironstone to 10 mm maximum dimension. Some ironstone with spongey texture.

6.0-6.5	Northampton Sand	Yellow brown clayey quartz sand with angular fragments of ironstone vein material.
6.5-6.8		Weathered brown grey clay with minor ironstone fragments and medium grained sand.
6.8-9.5	Upper Lias Clay	Blue grey dense clay with minor white mica.
		EOH

INSTITUTE OF HYDROLOGY BOREHOLE RECORD SHEET

IH Borehole No	:	BH6	Grid Ref	: 808760
BGS Borehole No	:		Project	: Cransley Lodge
Date Started	:	10-04-1991	Date Completed	: 11-04-1991
Surface Level	:	133.540 m.O.D.		
Water Struck	:	3.2,4.7, 12.0 m BGL		
Rest Water Level	:	2.4, 10.5 m BGL		
Client	:	Stock Land & Estates Ltd		
Driller	:	W.Gee		
Logged	:	N. Runnalls.		
Borehole Diam	:	200 mm		
Method of Drilling	:	Power Auger		
Casing Diam/Type	:	60 mm UPVC		
Screen	:	1 m x Mesh 19 mm UPVC Piezometer Tubing		
Pack	:	Gravel		
Comments	:	There was a sudden inrush of water at 12.0 m BGL The hole was continued 2.5 m into the Lias because of the unexpected absence of the Jurassic sequence at this locality and the weathered nature of the Upper Lias Clay. Backfilled with Lias Clay to 13.5 m BGL Base of screen installed at 12.5 m BGL Gravel pack from 9.0 to 13.5 m BGL Bentonite seal from 8.0 to 9.0 m BGL Backfilled with Lias Clay from 5.18 to 8.0 m BGL Base of ceramic piezometer installed at 5.18 m BGL Gravel pack from 3.3 to 5.18 m BGL Bentonite seal from 3.0 to 3.3 m BGL Backfilled to surface		

GEOLOGICAL LOG

Depth	Description
0.0-0.6	Brown clayey topsoil with minor white Chalk and flint fragments to 15 mm diameter. Scattered quartz grains.
0.6-1.5 Boulder Clay	Brownish grey mottled dense clay with abundant Chalk fragments over 7 mm diameter with some clasts up to 35 mm diameter. Most pebbles and cobbles are well rounded.
1.5-3.2	Dark grey to olive green dense clay with occasional clasts of well rounded Chalk and flint. Matrix supported.
3.2-3.5	Brownish grey slightly sandy clay to silt with fine flint and Chalk fragments between 1 to 2 mm diameter. Very few pebbles present.
3.5-4.7	Dark grey heavy clay with scattered well rounded Chalk pebbles up to 12 mm diameter. Average size of clasts is approximately 1-2 mm diameter. Minor black lithic fragments (Lias?) averaging between 102 mm diameter and constituting less than 3% by volume. Scattered larger flint clasts up to 12 mm diameter.
4.7-5.1	Grey sandy clay with 30% by volume well rounded grains of Chalk to 1.5 mm diameter. The sample is wet.
5.1-6.0	Dark grey dense clay with 20% pebbles of Chalk, flint and lithic

	fragments. Several larger Chalk clasts to 30 mm diameter.
6.0-7.6	Dark grey to olive green slightly sandy dense clay with several large flint clasts up to 90 mm diameter. Abundant fine Chalk pebbles and grains to 1 mm diameter. Minor lithic clasts.
7.6-9.0	Dark grey dense clay with abundant lithic (possible Lias) clasts averaging approximately 3 mm diameter making up to 15% by volume of the section. Maximum clast size to 15 mm diameter. Minor ironstone clasts.
9.0-11.8	Dark grey dense clay with scattered white clasts of chalk, flint and limestone. Clasts up to 10 mm diameter. Matrix supported.
11.8-12.0	Thin pale brown well sorted quartz sand. In-rush of water.
12.0-15.5	Pale grey to grey slightly mottled clay, Occasional clasts of flint and Chalk (probable contaminated sample). Becoming darker grey down the section.
15.5-16.5	Grey slightly silty dense clay.
	EOH

INSTITUTE OF HYDROLOGY BOREHOLE RECORD SHEET

IH Borehole No	: BH7	Grid Ref	: 808760	
BGS Borehole No	:	Project	: Cransley Lodge	
Date Started	: 11-04-1991	Date Completed	: 11-04-1991	
Surface Level	: 133.595 m.O.D.			
Water Struck	: 3.5 m BGL			
Rest Water Level	: 1.75 m BGL			
Client	: Stock Land & Estates Ltd			
Driller	: W.Gee			
Logged	: N. Runnalls			
Borehole Diam	: 200 mm			
Method of Drilling	: Power Auger			
Casing Diam/Type	: 60 mm UPVC			
Screen	: 1 m x Mesh			
	19 mm UPVC Piezometer Tubing			
Pack	: Gravel			
Comments	: Backfilled with gravel to 5.8 m BGL			
	Base of screen installed at 4.8 m BGL			
	Gravel pack from 2.5 to 5.8 m BGL			
	Bentonite seal 2.2 tp 2.5 m BGL			
	Backfilled with Boulder Clay to surface			

GEOLOGICAL LOG

Depth	Description
0.0-1.0	Brown clayey topsoil with abundant Chalk and flint pebbles to 20 mm diameter and minor fine ironstone pebbles. The upper portions of the section are probably spoil material from the ditch immediately to the north of this borehole.
1.0-1.5	Brown heavy clay with abundant matrix supported Chalk and flint pebbles with clasts of grey mafic clay. Chalk fragments up to 25% by volume, up to 20 mm diameter and average 7 mm diameter. Clay clasts up to 15% by volume and up to 5 mm diameter.
1.5-3.0	Grey brown dense clay with Chalk and ironstone clasts. Ironstone and ferruginous sand to 15% by volume and maximum size of 15 mm diameter but averaging 7 mm diameter. Chalk less than 10% by volume with clasts to 20 mm diameter.
3.0-3.5	Dark grey to olive green fine grained sandy clay with Chalk, ironstone and clay clasts. Chalk less than 5% by volume with clasts up to 10 mm diameter, but averaging 2-3 mm diameter. Ferruginous staining from weathered ironstone fragments.
3.5-4.5	Grey clayey sand with very few chalk clasts with bands of uniform fine to medium grained quartz sand and clay bands.
4.5-4.8	Grey sandy clay with scattered larger Chalk clasts to 10 mm diameter. Minor (Lias?) clay clasts. Wet sample.
4.8-6.0	Dark grey dense clay with abundant fine Chalk clasts from 5-7% by volume of average 2 mm diameter. Occasional Chalk clasts to 25 mm diameter, and rare ironstone and clay clasts (<2% by volume).
6.0-7.5	Grey dense clay with abundant Chalk clasts up to 15% by volume with

most of the Chalk clasts less than 1 mm diameter. Occasional well rounded pebbles to 10 mm diameter and rare cobbles to 25 mm diameter. Rare ironstone clasts.

EOH

Appendix II

GEOLOGICAL LOGS - PIEZOMETERS & AUGER HOLES

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	: P1	Grid Ref	: 804764
Date Completed	: -04-1991	Project	: Cransley Lodge
Surface Level	: 121.035 m.O.D.		
Water Struck	: 0.4 BGL		
Rest Water Level	: m BGL		
Client	: Stock Land & Estates Ltd		
Logged	: N. Runnalls		

GEOLOGICAL LOG

Depth	Description
0.0-0.3	Alluvial sands and clays, minor root material.
0.3-0.75	Coarse gravel with rounded flint, limestone and ironstone clasts to 12 mm diameter set in a sandy matrix. Difficulty in penetration parts of the section due to larger clasts. Hole abandoned due to running sands collapsing the hole and flowing up the guide tube.
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P2	Grid Ref	:	808765
Date Completed	:	-04-1991	Project	:	Cransley Lodge
Surface Level	:	115.505 m.O.D.			
Water Struck	:	0.5 m BGL			
Rest Water Level	:	m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth	Description
0.0-0.35	Organic rich material - peat with intercalated flood wash silts and clay.
0.35-1.0	Brown to light brown intermixed clays, silts and sands - probably alluvial in origin. Unlikely to be Northampton Sand.
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P3	Grid Ref	:	809767
Date Completed	:	-04-1991	Project	:	Cransley Lodge
Surface Level	:	113.345 m.O.D.			
Water Struck	:	DRY			
Rest Water Level	:	m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth	Description
0.0-0.3	Organic rich material with intercalated alluvial silts and clays.
0.3-0.65	Light brown clays, silt and minor quartz sand - probably alluvial material.
0.65-0.72	Dense grey clay - Upper Lias
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P4	Grid Ref	:	810767
Date Completed	:	-04-1991	Project	:	Cransley Lodge
Surface Level	:	112.22 m.O.D.			
Water Struck	:	DRY			
Rest Water Level	:	m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth	Description
0.0-0.25	Organic rich sand, silt and clay - Recent alluvial material
0.25-0.55	Light brown silts and quartz sands with minor pebbles towards the base - Recent alluvial material.
0.55-1.10	Grey dense clay, weathered and mottled towards the top, becoming darker grey and more uniform in texture with depth -Upper Lias
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P5	Grid Ref	:	811768
Date Completed	:	-04-1991	Project	:	Cransley Lodge
Surface Level	:	115.165 m.O.D.			
Water Struck	:	0.5 m BGL			
Rest Water Level	:	m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth	Description
0.0-0.3	Organic rich topsoil with intercalated silts and clay - alluvial material
0.3-0.55	Intercalated silts and fine quartz sands - probably Recent alluvial material.
0.55-1.05	Grey dense clay, weathered and mottled towards the top of the section , becoming darker in colour and less mottled lower in the hole.
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P6	Grid Ref	: 813769
Date Completed	:	-04-1991	Project	: Cransley Lodge
Surface Level	:	106.8 m.O.D.		
Water Struck	:	0.6 m BGL		
Rest Water Level	:	m BGL		
Client	:	Stock Land & Estates Ltd		
Logged	:	N. Runnalls		

GEOLOGICAL LOG

Depth	Description
0.0-0.25	Organic rich silt and clay - Recent alluvial material.
0.25-0.75	Light brown uniform fine sand and clay - possible Lower Estuarine Series.
0.75-0.95	Dense grey to greenish clay with minor thin silt bands.
0.95-1.05	Dark brown to black gravel. Ironstone fragments - possible Northampton Sand.

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P7	Grid Ref	: 809768
Date Completed	:	11-04-1991	Project	: Cransley Lodge
Surface Level	:	115.165 m.O.D.		
Water Struck	:	0.5 m BGL		
Rest Water Level	:	m BGL		
Client	:	Stock Land & Estates Ltd		
Logged	:	N. Runnalls		

GEOLOGICAL LOG

Depth	Description
0.0-0.4	Spoil material from filling of railway bank
0.4-0.9	Light brown silts and clay - ? Recent alluvium ?
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P8	Grid Ref	:	807761
Date Completed	:	22-04-1991	Project	:	Cransley Lodge
Surface Level	:	125.92 m.O.D.			
Water Struck	:	DRY			
Rest Water Level	:	1.25 m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth	Description
0.0-0.25	Clay rich topsoil with root material, flint pebbles, quartz sand grains.
0.25-1.0 Boulder Clay	Dense grey clay with pale greenish mottled patches. Angular chips as well as rounded pebbles of flint.
1.0-1.75 Upper Lias	Dense grey clay with minor mottling to light grey (paleosol?). Occasional chips of flint but probably contamination along the outside of the auger hole.
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P9	Grid Ref	:	804761
Date Completed	:	22-04-1991	Project	:	Cransley Lodge
Surface Level	:	126.78 m.O.D.			
Water Struck	:	DRY			
Rest Water Level	:	0.55 m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth		Description
0.0-0.3		Sandy clay rich topsoil with decaying root material, flint pebbles, quartz sand grains.
0.3-0.8	Boulder Clay	Dense grey clay with pale greenish mottled patches. Angular chips as well as rounded pebbles of flint Chalk and ironstone.
0.8-1.4	Upper Lias	Dense grey clay with mottling to light grey (paleosol?). Occasional chips of flint but probably contamination along the outside of the auger hole. Contact between Boulder Clay the Upper Lias is difficult to pick because of the weathered nature of the Upper Lias. There is no evidence of a distinctive "gravel" or sand unit at the base of the Pleistocene at this location.
		EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P10	Grid Ref	:	807763
Date Completed	:	16-05-1991	Project	:	Cransley Lodge
Surface Level	:	120.31 m.O.D.			
Water Struck	:	1.0 m BGL			
Rest Water Level	:	0.64 m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth		Description
0.0-0.8	Peat	Black spongy organic rich material - Peat
0.8-1.8	Northampton Sand	Yellow to orange brown ferruginous silty sand. Rare ferruginous vein material. Occasional chert fragments. This unit is possibly remnant basal Pleistocene sand-gravel or more probably the base of the Jurassic.
1.8-2.0	Upper Lias	Blue grey dense uniform clay.
		EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P11	Grid Ref	: 811767
Date Completed	:	20-06-1991	Project	: Cransley Lodge
Surface Level	:	116.05 m.O.D.		
Water Struck	:	DRY		
Rest Water Level	:	DRY BGL		
Client	:	Stock Land & Estates Ltd		
Logged	:	N. Runnalls		

GEOLOGICAL LOG

Depth	Description
0.0-0.3	Sandy clay soil with some root material
0.3-0.8	Sandy brown clay with chips of flint. Either Boulder Clay or material derived from Boulder Clay. sample damp above underlying clay horizon.
0.8-1.0	Greenish grey clay with minor silty bands. Initially this horizon was interpreted to be the unit at the base of the Lower Estuarine Series. However it is more likely that this is merely a clay within the basal Pleistocene "Gravel".
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P12	Grid Ref	:	810767
Date Completed	:	20-06-1991	Project	:	Cransley Lodge
Surface Level	:	118.66 m.O.D.			
Water Struck	:	DRY			
Rest Water Level	:	DRY m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth	Description
0.0-0.4	Sandy clay soil with some root material, occasional larger chips of flint and Chalk.
0.4-0.8 Boulder Clay	Sandy brown clay with chips of flint. Variable amount of larger clasts. This hole was abandoned and redrilled several times in attempts to penetrate past large hard boulders.
0.8-1.0	Greenish grey clay with minor silty bands. Initially this horizon was interpreted to be the unit at the base of the Lower Estuarine Series. However it is more likely that this is merely a clay within the basal Pleistocene "Gravel".
	EOH

* P18 drilled 7 m northeast of this site penetrated to the Lower Estuarine Series.

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P13	Grid Ref	: 813767
Date Completed	:	20-06-1991	Project	: Cransley Lodge
Surface Level	:	119.51 m.O.D.		
Water Struck	:	3.0 m BGL		
Rest Water Level	:	3.39 m BGL		
Client	:	Stock Land & Estates Ltd		
Logged	:	N. Runnalls		

GEOLOGICAL LOG

Depth	Description
0.0-0.3	Sandy clay with minor organic material, rare chips of flint.
0.3-0.6	Light brown clayey silt, rare fine chips of flint and Chalk.
0.6-4.6 Lower Estuarine	Light brown uniform fine silty sand. Occasional thin clay bands with damp sands above the main aquifer. Drilling was abandoned due to collapse of the lower parts of the hole with running wet sands.
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P14	Grid Ref	:	813765
Date Completed	:	20-06-1991	Project	:	Cransley Lodge
Surface Level	:	119.01 m.O.D.			
Water Struck	:	0.6 m BGL			
Rest Water Level	:	1.0 m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth	Description
0.0-0.4	Dark brown organic rich material with minor silt and clay. Occasional chips of flint.
0.4-0.8	Dark brown dense silty clay. Possible Recent alluvial material.
0.8-1.2 Upper Lias ?	Dark grey to grey dense clay.
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P15	Grid Ref	:	812768
Date Completed	:	20-04-1991	Project	:	Cransley Lodge
Surface Level	:	116.3 m.O.D.			
Water Struck	:	0.3 m BGL			
Rest Water Level	:	- m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth	Description
0.0-0.4	Organic rich topsoil with intercalated clayey material, some flint chips
0.4-1.0	Grey to dark grey dense clay with sandy bands and pebbles of Chalk and flint. Variable amount of organic material towards the top of the section - Boulder Clay or Gravel.
	EOH

Note: This piezometer was damaged soon after installation by agricultural machinery.

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P16	Grid Ref	:	808763
Date Completed	:	21-08-1991	Project	:	Cransley Lodge
Surface Level	:	124 m.O.D.(approx)			
Water Struck	:	5.8 m BGL			
Rest Water Level	:	5.9 m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	N. Runnalls			

GEOLOGICAL LOG

Depth	Description
0.0-0.25	Sandy clay topsoil with minor organic material.
0.25-0.9	Brown sandy clay with occasional chips of flint, ironstone and Chalk. Several large diameter clasts difficult to drill past.
0.9-2.0 Boulder Clay	Grey dense clay with chips of flint, Chalk and ironstone.
2.0-4.0 Gravel	Alternating sandy silt, sands and occasional coarser beds with rounded flint pebbles to 10 mm diameter. Angular ironstone clasts. Clay band from 3.4-3.9 m BGL.
4.0-5.3	Very clayey sand with occasional sandier bands.
5.3-6.5 Northampton Sand	Brown more uniform medium to fine grained quartz sand with angular ironstone chips to 12 mm maximum dimension. Occasional clay bands. Wet sample.
6.5-6.7 Upper Lias	Dense steel blue grey clay.
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P17	Grid Ref	:	807763
Date Completed	:	22-10-1991	Project	:	Cransley Lodge
Surface Level	:	124.8 m.O.D.			
Water Struck	:	DRY			
Rest Water Level	:	1.51 m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	D. Aberg			

GEOLOGICAL LOG

Depth	Description
0.0-0.2	Topsoil. Probably including spoil from the drainage ditch.
0.2-1.45 Boulder Clay	Dense dark grey clay with chips of ironstone, ferruginised sand, flint, Chalk and limestone.
1.45-1.9 Upper Lias	Variably mottled dark blue grey clay with minor sand and white mica.
1.9-2.4	Harder dense uniform blue grey clay.
	EOH

INSTITUTE OF HYDROLOGY PIEZOMETER RECORD SHEET

IH Piezometer No.	:	P18	Grid Ref	:	810767
Date Completed	:	22-01-1991	Project	:	Cransley Lodge
Surface Level	:	118.66 m.O.D.			
Water Struck	:	1.3 m BGL			
Rest Water Level	:	m BGL			
Client	:	Stock Land & Estates Ltd			
Logged	:	D. Aberg			

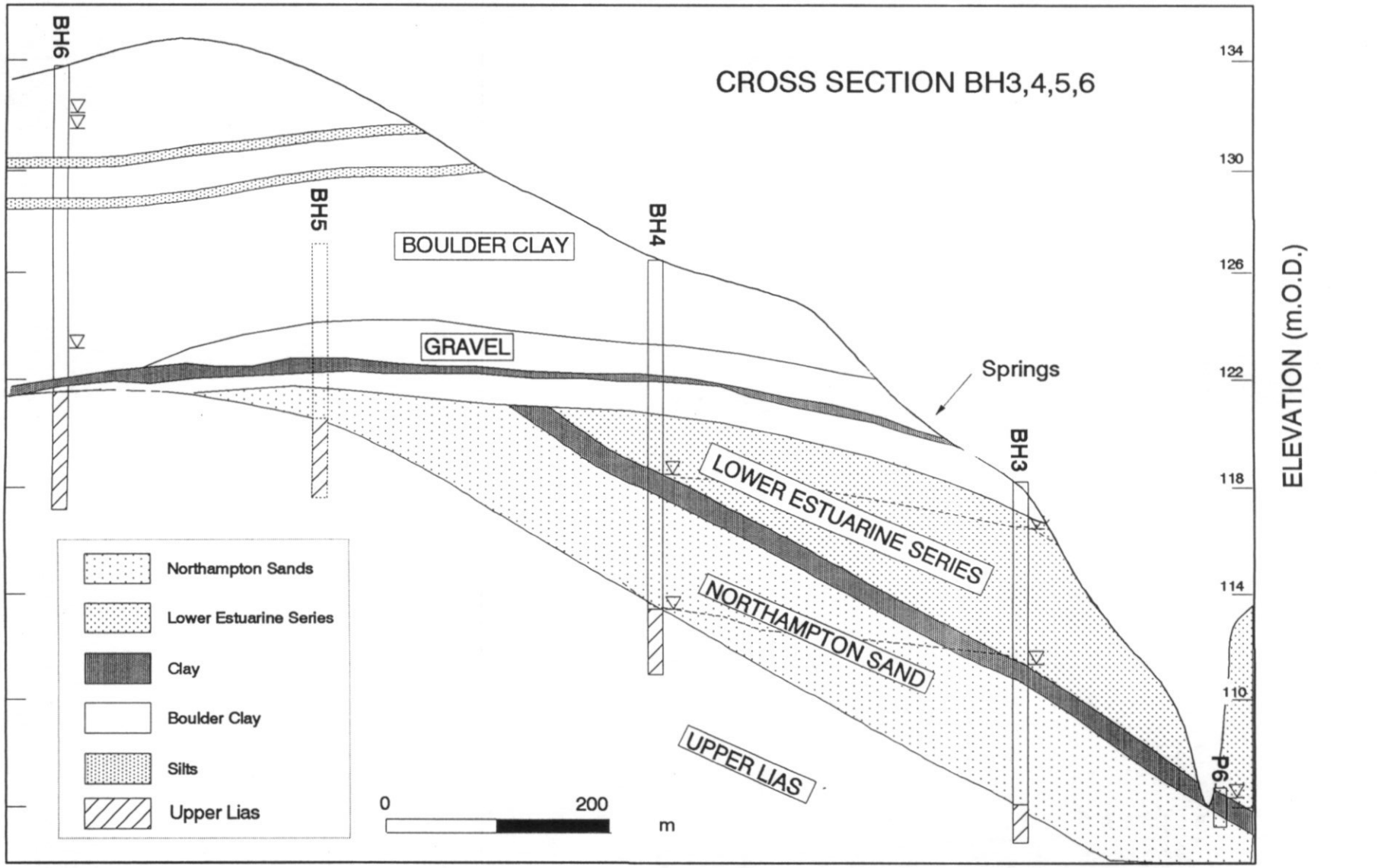
GEOLOGICAL LOG

Depth	Description
0.0-0.3	Sandy clay with minor organic material, mostly roots. Occasional chips of flint.
0.3-1.3 Boulder Clay	Brown dense silty clay with flint, Chalk and ironstone clasts. Small lenses of sand.
1.3-1.87	Brown dense clay with flint, Chalk and ironstone pebbles.
1.87-1.95 Gravel	Brown clay with coarser material, patches of yellow sand and gravel size clasts.
1.95-2.54 Lower Estuarine	Brown uniform medium grained quartz sand without any clasts. Water logged with the hole collapsing due to running sands.
	EOH

Appendix III

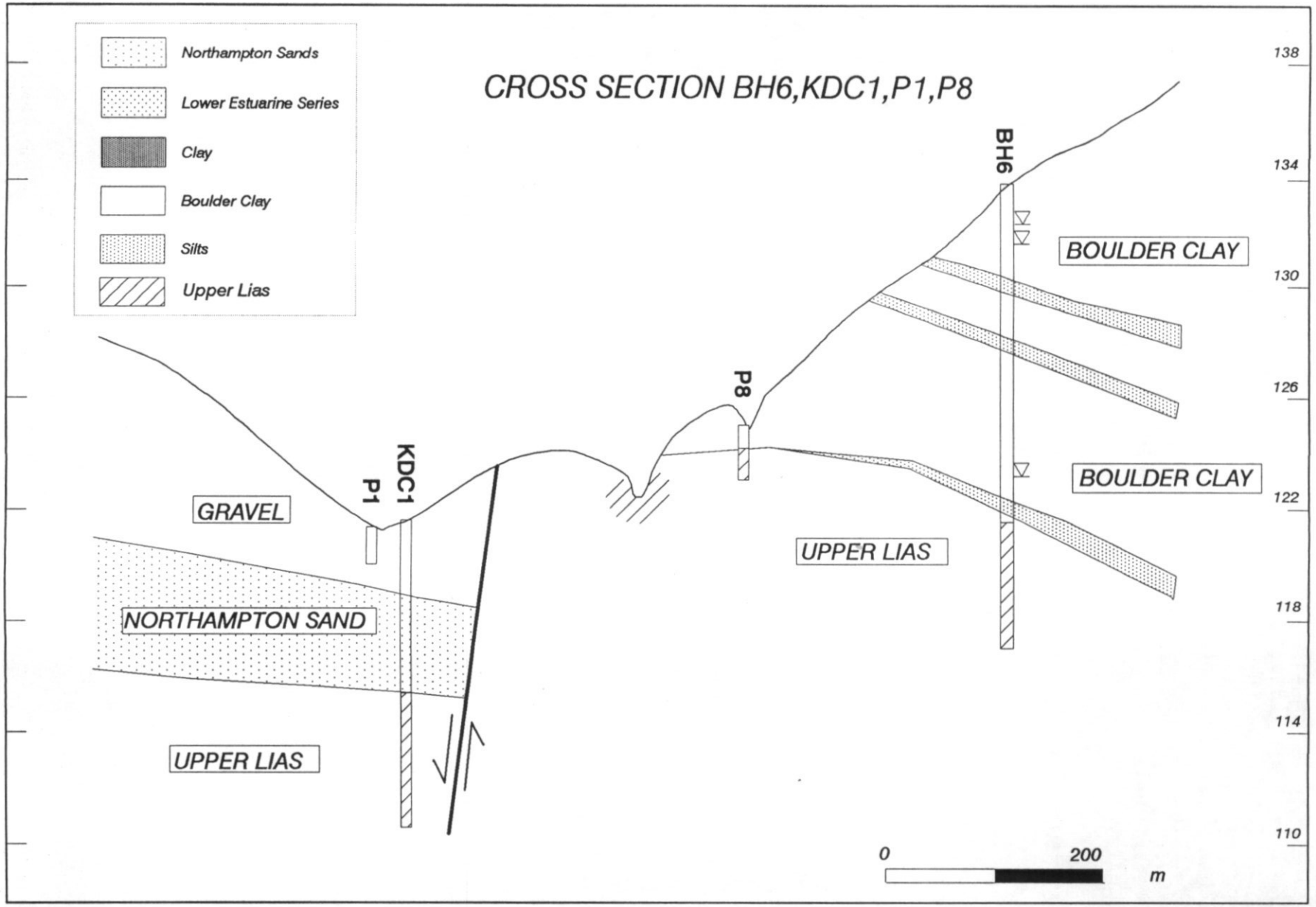
GEOLOGICAL CROSS SECTIONS

CRANSLEY LODGE



SECTION 1

CRANSLEY LODGE



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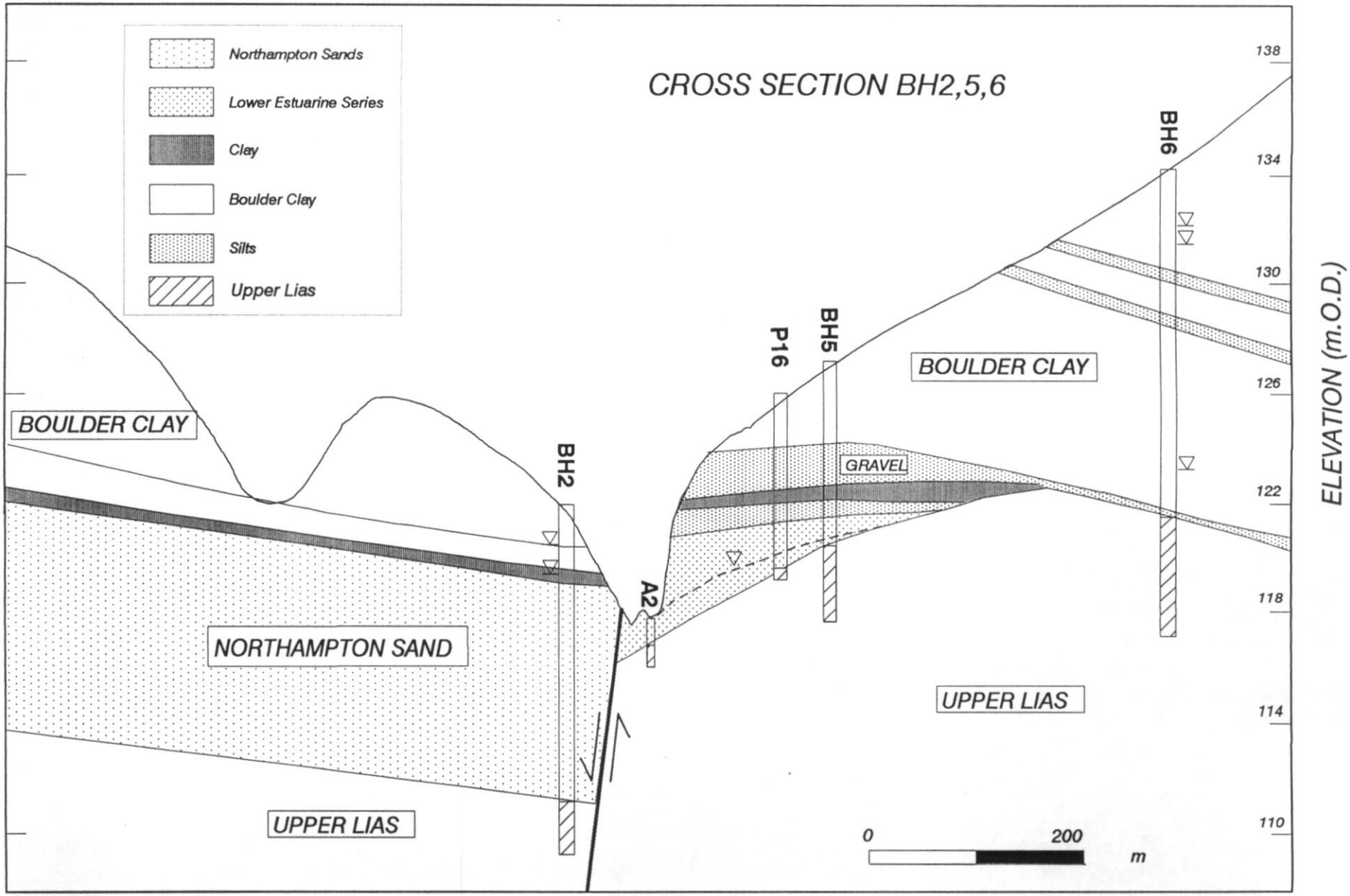
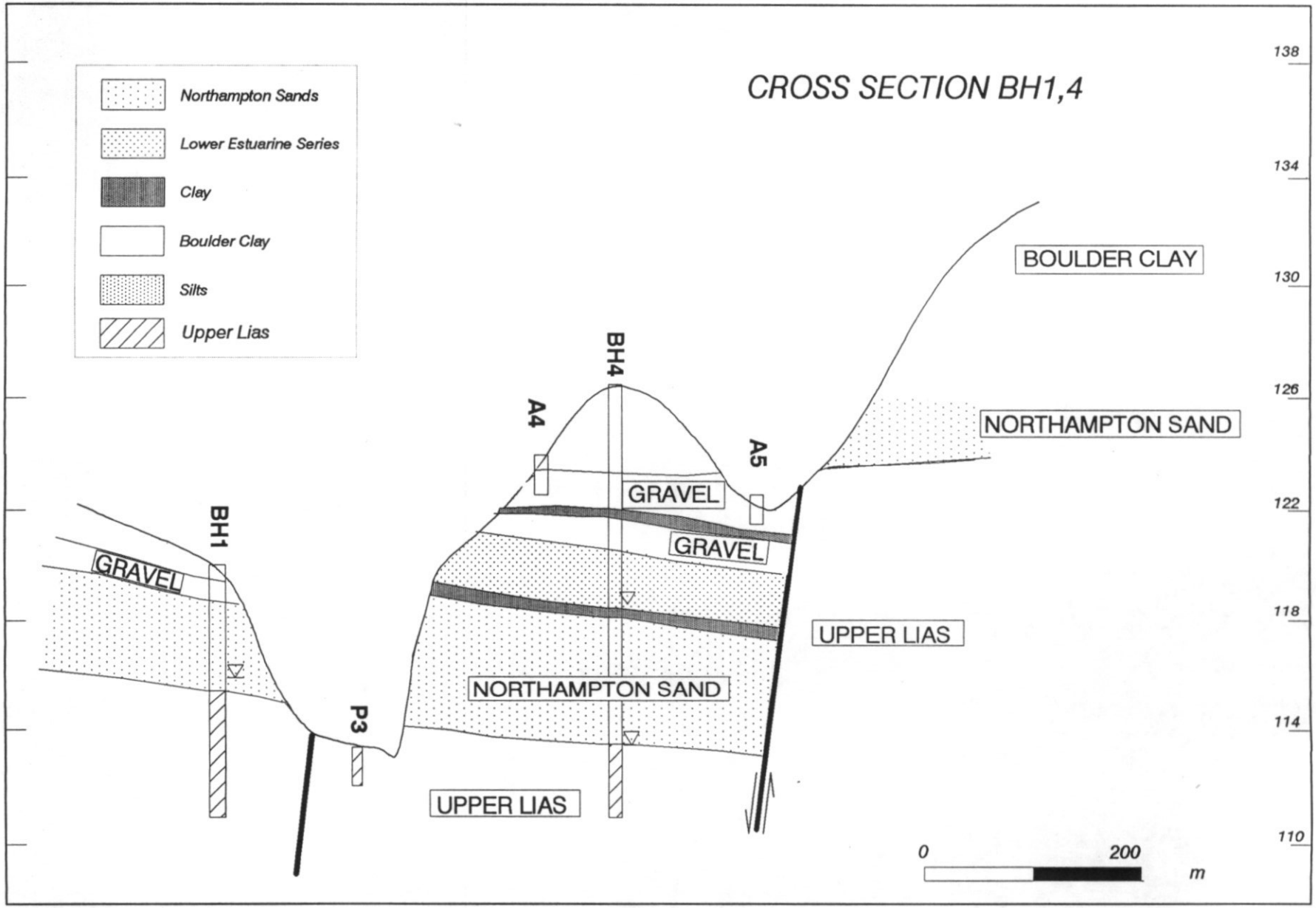
CRANSLEY LODGE



SECTION 3

CRANSLEY LODGE



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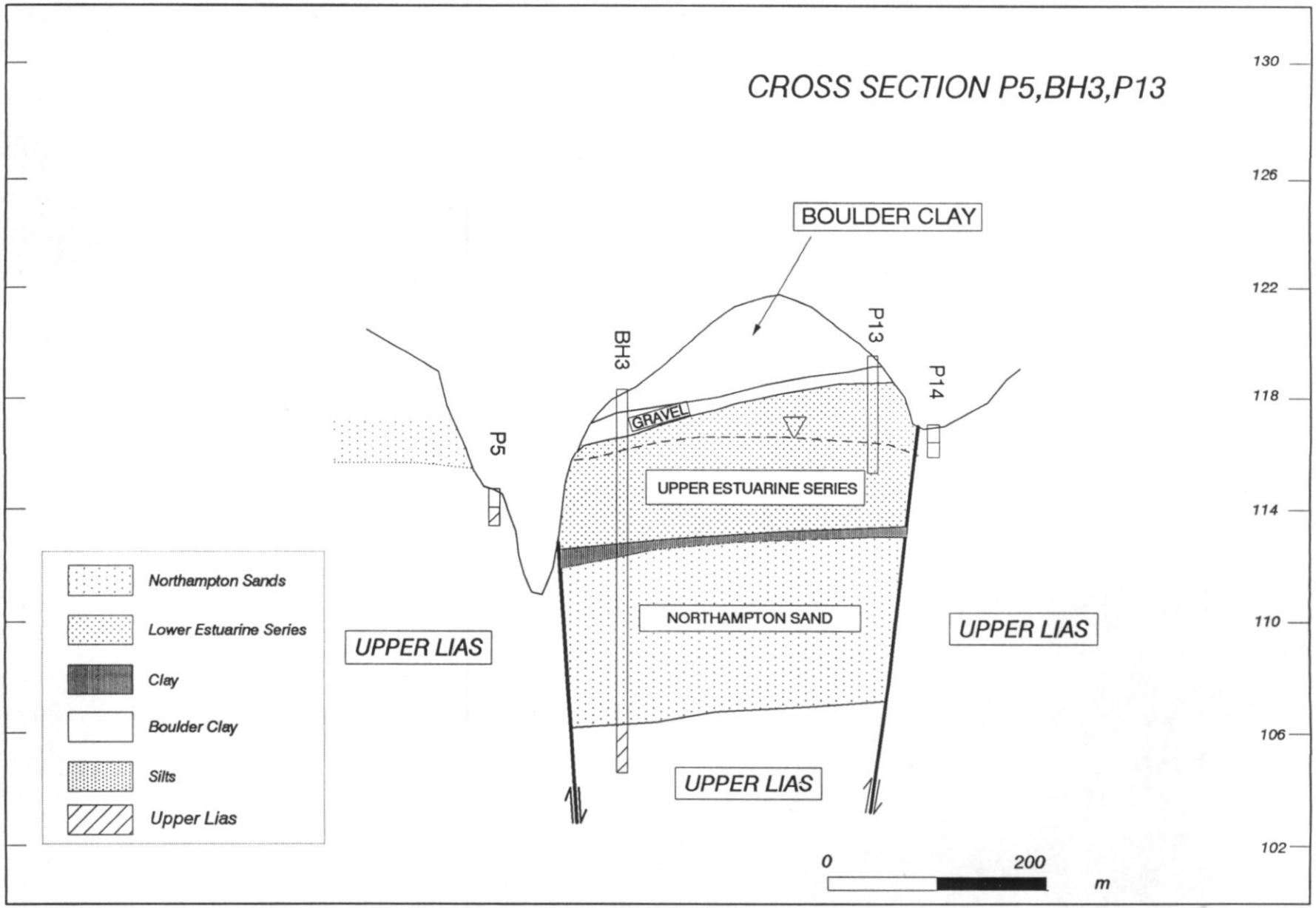
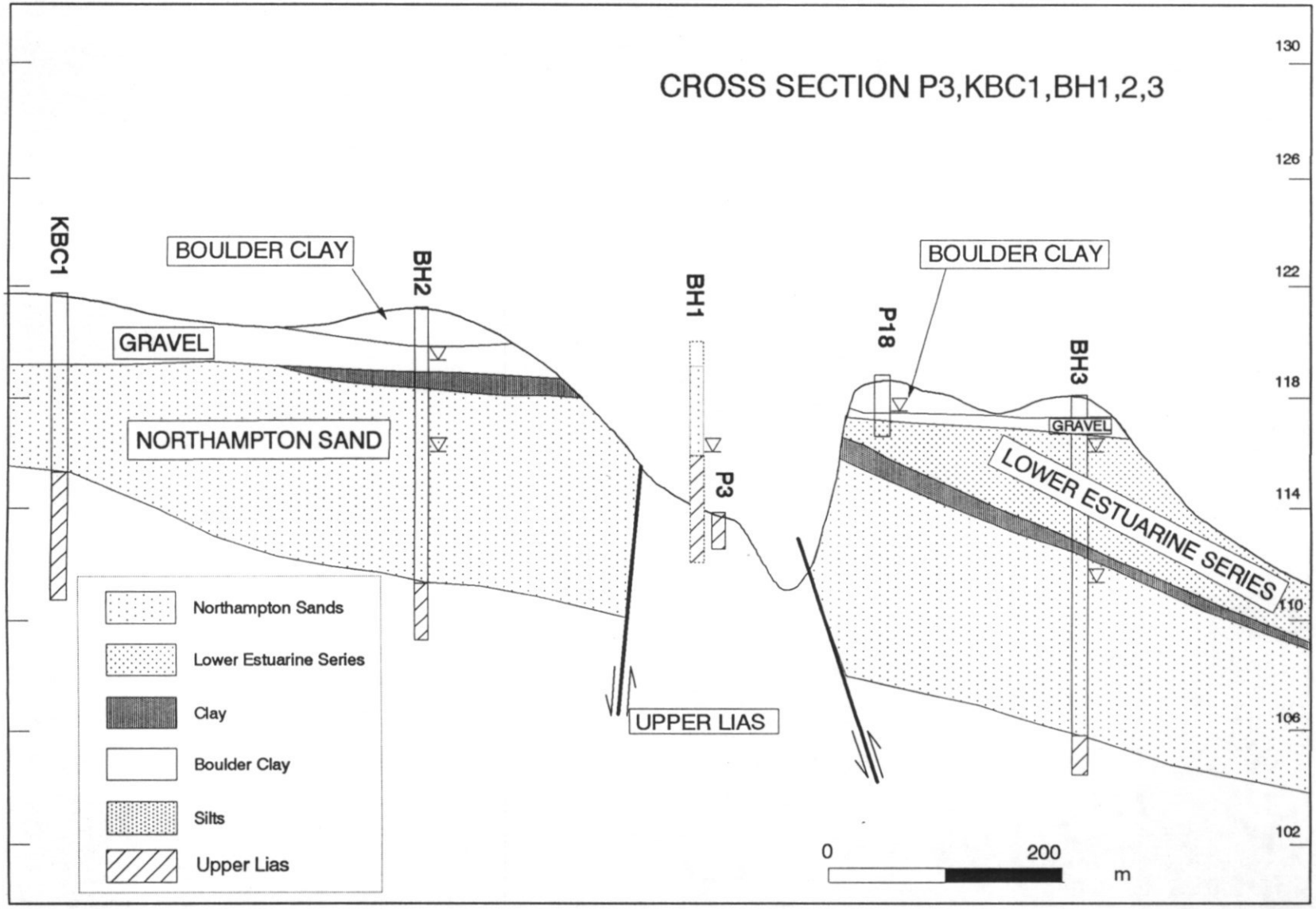


SECTION 5

CRANSLEY LODGE



SECTION 6

Appendix IV

AQUIFER PROPERTY TESTS

1. **Falling Head Tests**
2. **Grain Size Analyses**

AQUIFER PROPERTY TESTS

1. Falling Head Tests

(Tests Undertaken According to BS 5930)

Location: Cransley Lodge
Borehole No.: BH7
Date Completed:
Formation: Sandy silt with Boulder Clay

	T (Mins)	Ho (cm)	H @ 0.37 (cm)	K (m/d)
Falling Head Test	18.52	20	7.40	0.037
Rising Head Test	18.99	19	7.02	0.036
	Shape Factor: c.4.2		Average:	0.0365

Location: Cransley Lodge
Borehole No.: BH2
Date Completed:
Formation: Northampton Sand

	T (Mins)	Ho (cm)	H @ 0.37 (cm)	K (m/d)
Falling Head Test	15.70	25?	9.25	0.017
	15.66	23.2	8.58	0.017
Rising Head Test	19.70	27	9.99	0.014
	19.66	23.2	8.58	0.014
	Shape Factor: c.10.4		Average:	0.0155

2. Grain Size Analyses

CRANSLEY LODGE

Grain size analysis

Station No PS

Sample No 1

Mean	0.85 phi	(1.430 mm)
Standard deviation	1.67	(2.738)
Skewness	-1.3481	(2.787)
Kurtosis	1.0724	(7.169)

Well screen slot size 0.405 mm
(retains 40% of formation)
Gravel pack mean size 1.25 mm
(70% grain size multiplied by 5)

Specific surface U 28.06
Permeability estimate 63.49 m/day

CRANSLEY LODGE Grain size analysis

Station No NS

Sample No 1

Mean	-0.54 phi	(5.057 mm)
Standard deviation	2.77	(5.311)
Skewness	0.0995	(0.5046)
Kurtosis	-1.7757	(-1.379)

Well screen slot size 4.91 mm
(retains 40% of formation)
Gravel pack mean size 1.01 mm
(70% grain size multiplied by 5)

Specific surface U 27.06
Permeability estimate 68.28 m/day

CRANSLEY LODGE

Grain size analysis

Station No LES

Sample No 1

Mean	-0.97 phi	(5.316 mm)
Standard deviation	2.63	(4.770)
Skewness	0.5061	(0.3772)
Kurtosis	-1.5044	(-1.207)

Well screen slot size 5.32 mm
(retains 40% of formation)
Gravel pack mean size 1.05 mm
(70% grain size multiplied by 5)

Specific surface U 22.44
Permeability estimate 99.20 m/day

CRANSLEY LODGE

Grain size analysis

Station No PG

Sample No 1

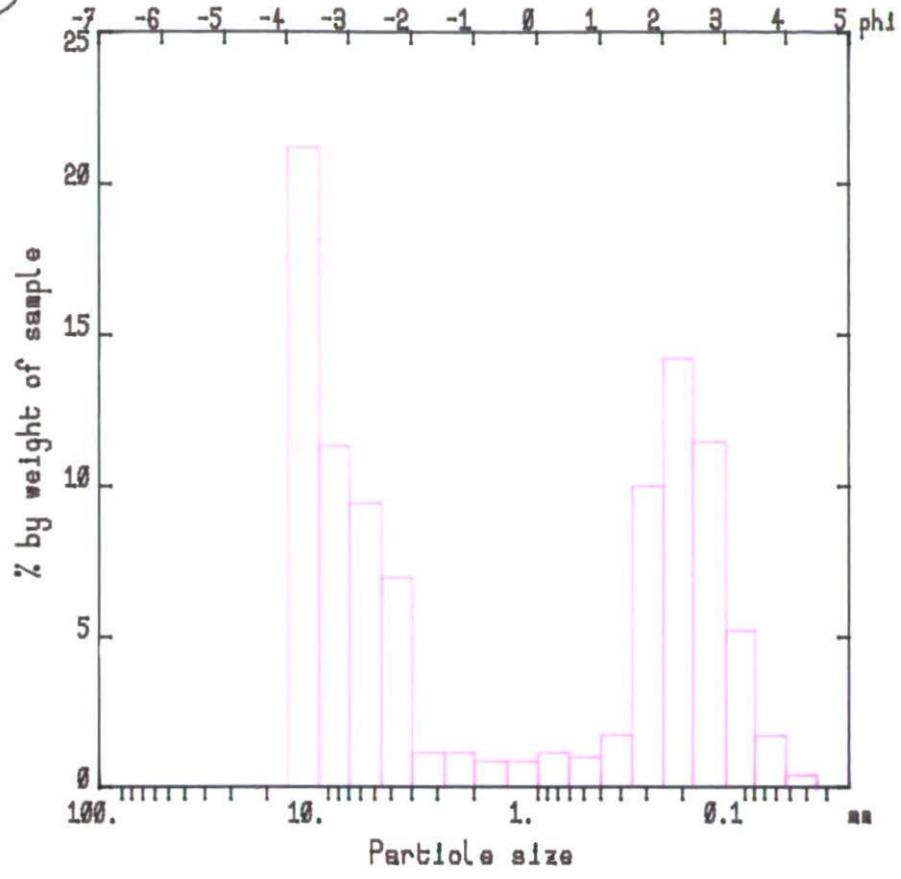
Mean	-1.02 phi	(5.038 mm)
Standard deviation	2.29	(5.122)
Skewness	0.2805	(0.6297)
Kurtosis	-1.3308	(-1.218)

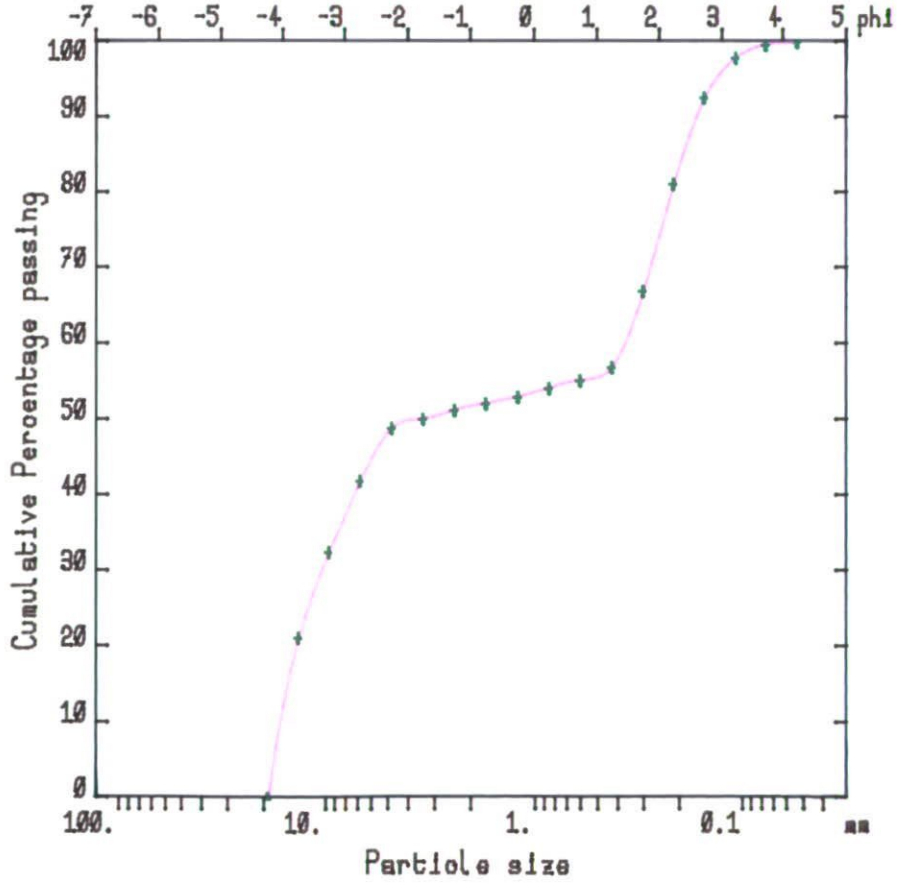
Well screen slot size 4.47 mm
(retains 40% of formation)
Gravel pack mean size 2.55 mm
(70% grain size multiplied by 5)

Specific surface U 15.73
Permeability estimate 201.9 m/day

CRANSLEY LODGE

Station NS

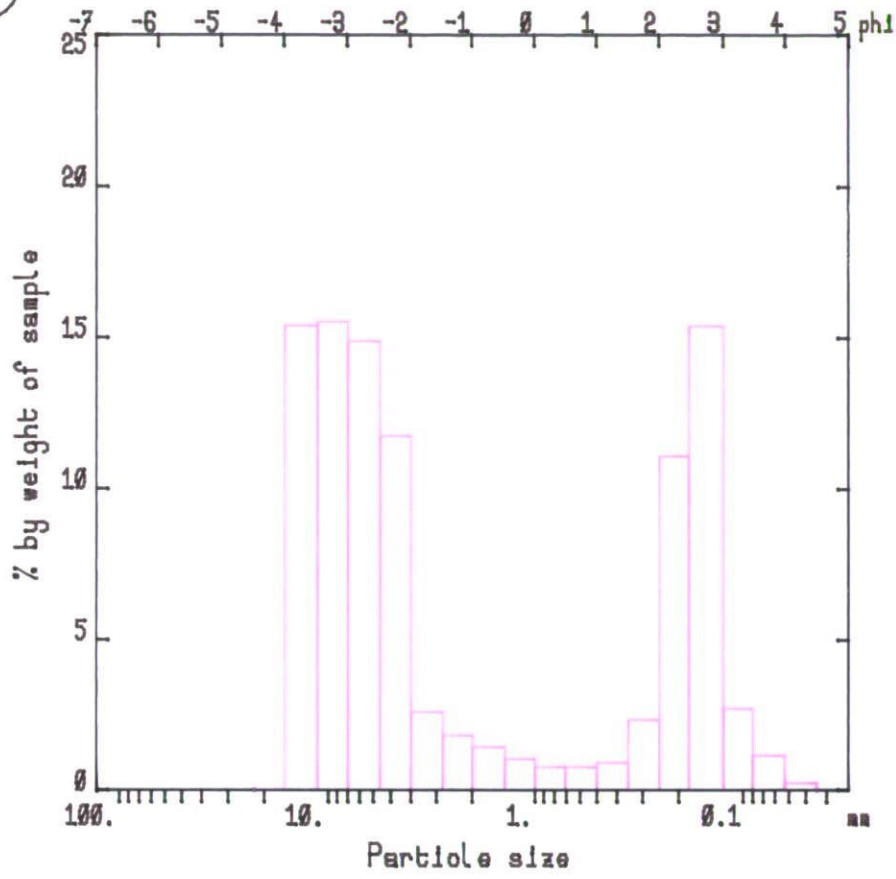


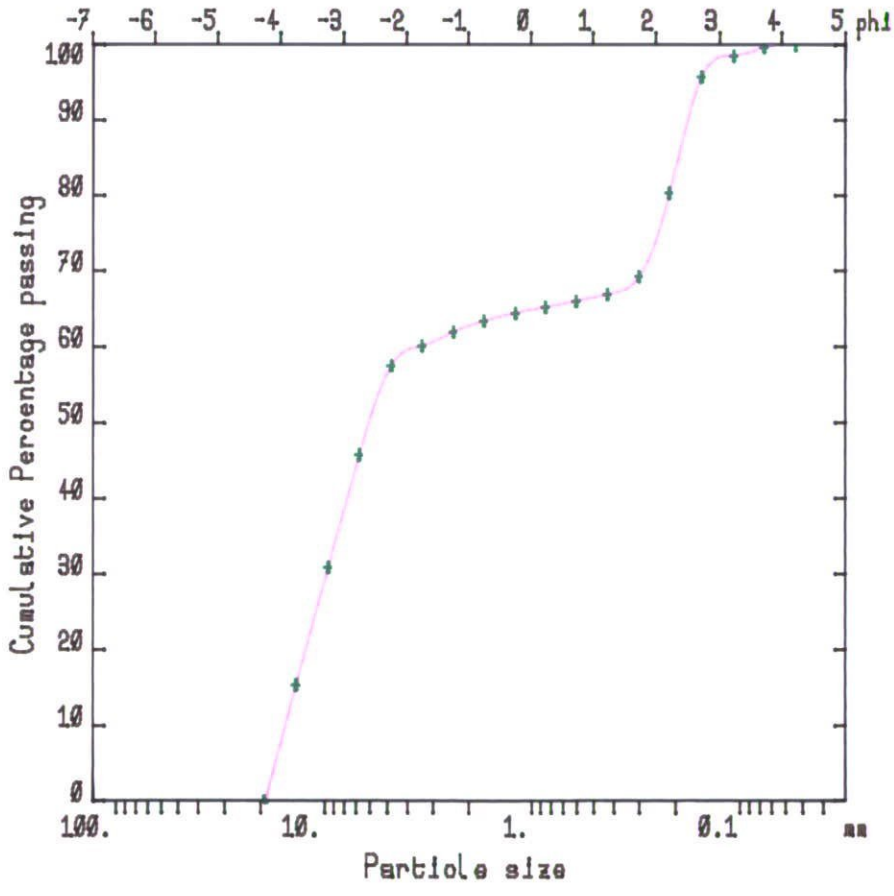


Grain Size Analysis - Northampton Sand

CRANSLEY LODGE

Station LES

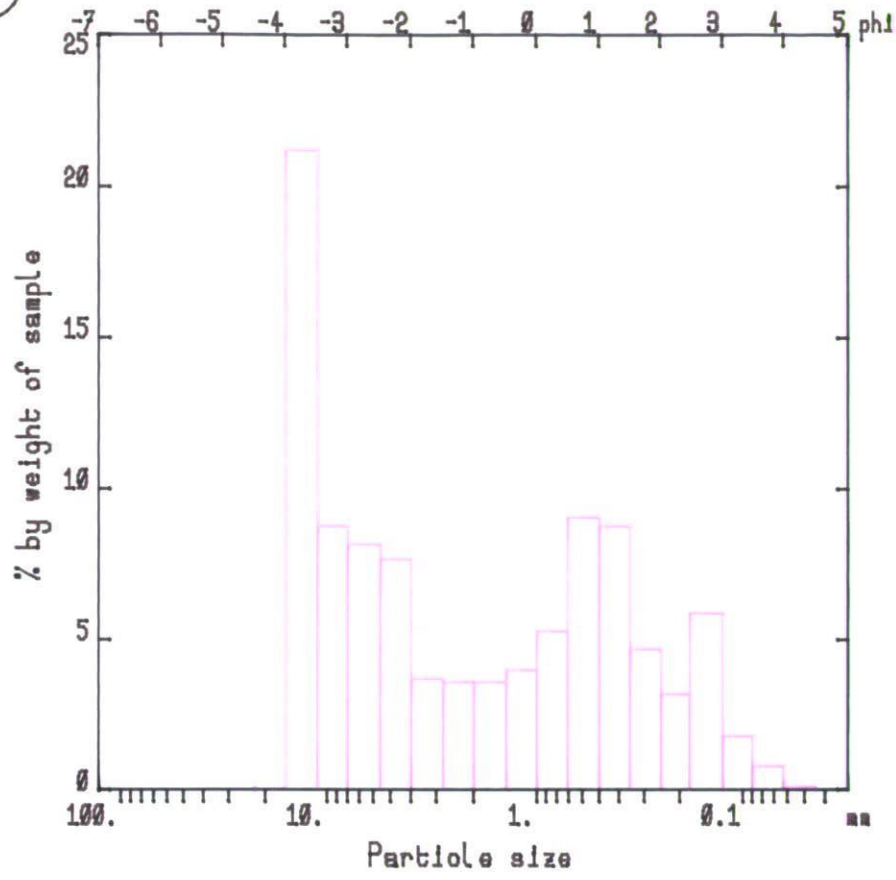


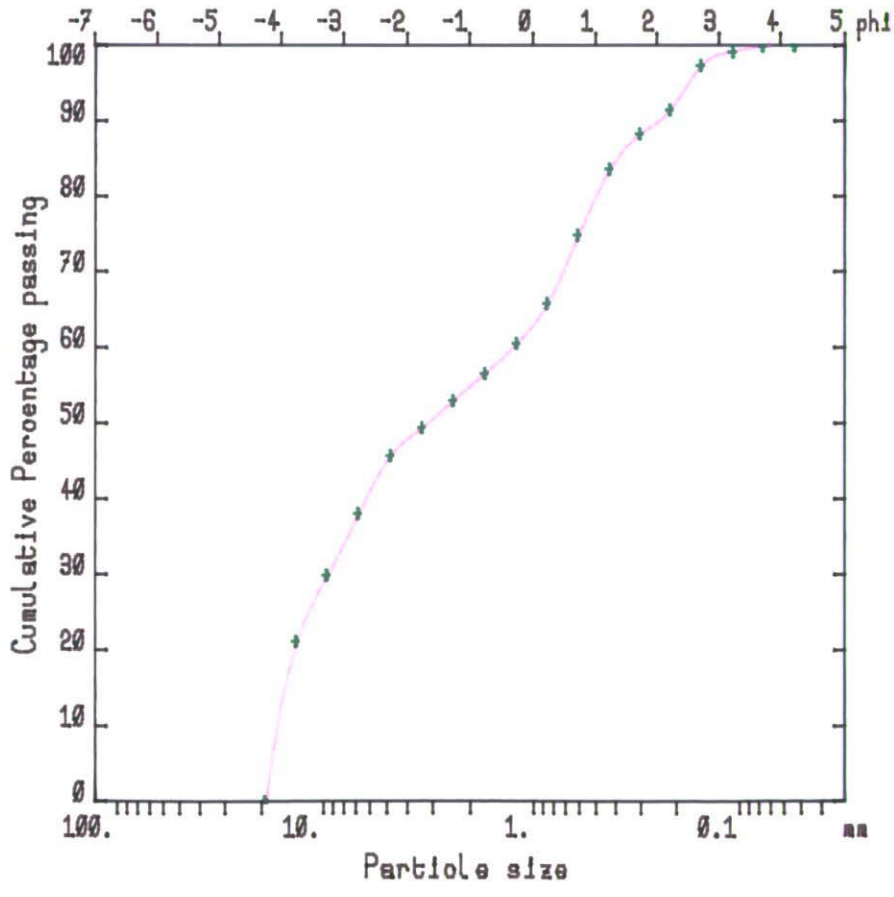


Grain Size Analysis - Lower Estuarine Series

CRANSLEY LODGE

Station PG

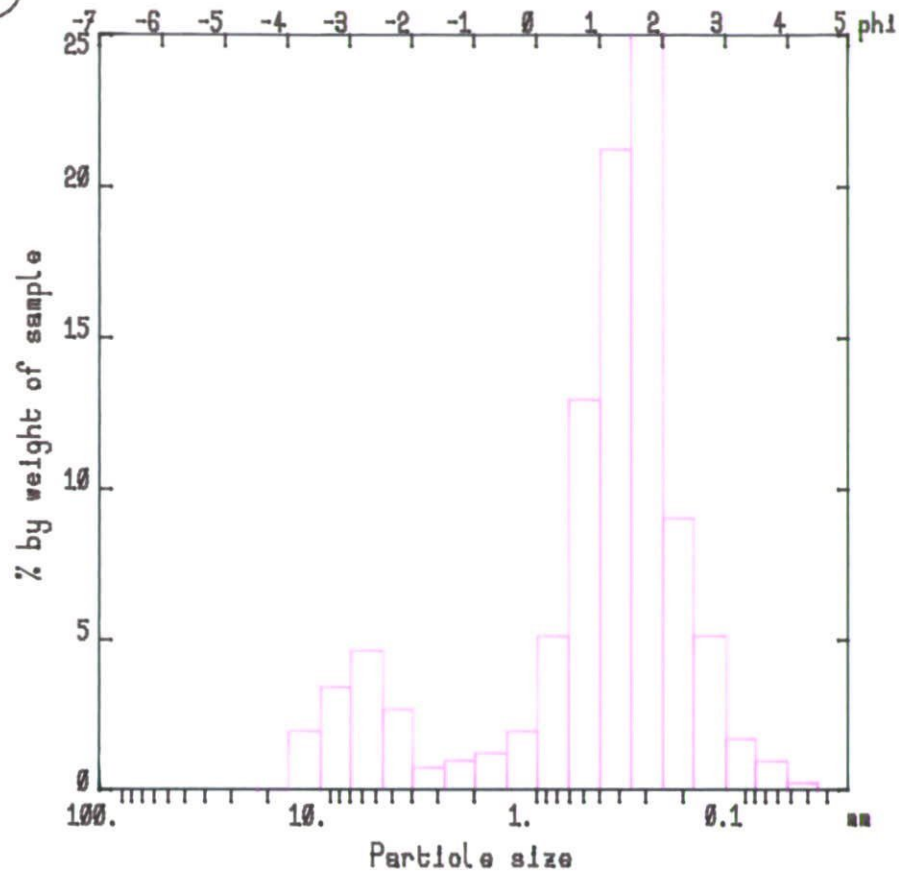


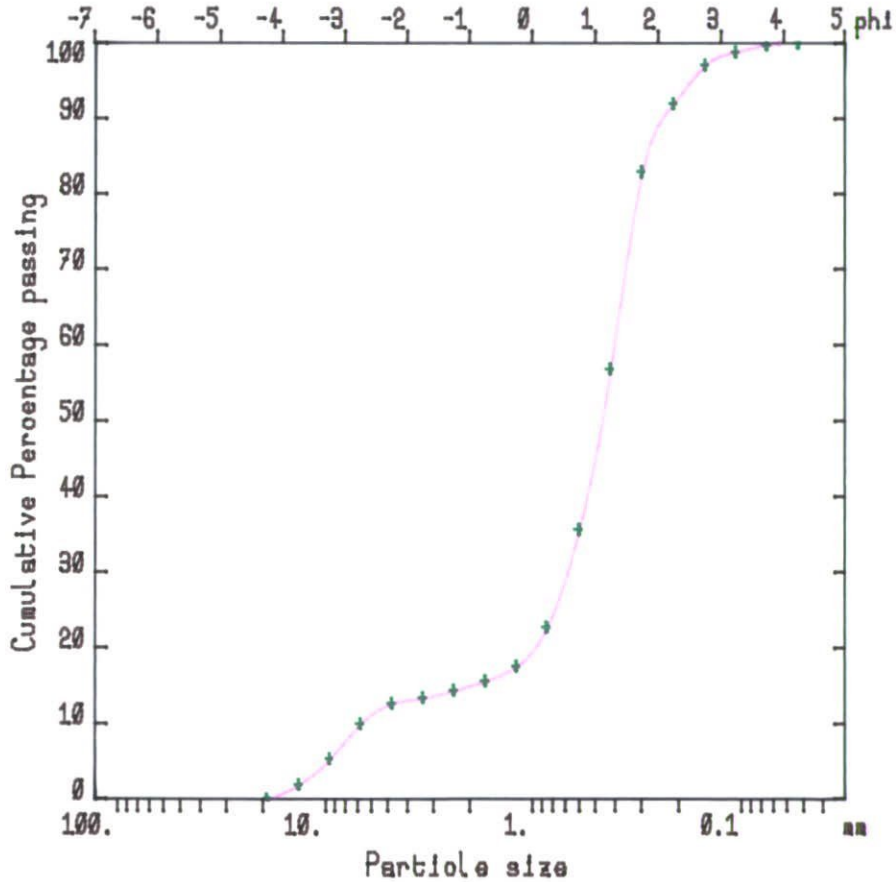


Grain Size Analysis - Pleistocene Gravel

CRANSLEY LODGE

Station PS





Grain Size Analysis - Pleistocene Sand

Appendix V

HYDROGRAPHS AND WATER LEVEL DATA

WATER LEVEL DATA - CRANSLEY LODGE

Depth Below Datum in metres

-999.000 Indicates DRY hole

BH1	8085	7674	119.910	12	2
910411	-999	3.930			
910422	-999	3.993			
910516	-999	4.070			
910612	-999	4.123			
910717	-999	4.156			
910821	-999	4.174			
910919	-999	4.172			
911022	-999	4.186			
911217	-999	4.145			
920116	-999	3.684			
920218	-999	3.978			
920218	-999	3.978			
BH2	8069	7649	121.300	12	2
910422	-999	2.695			
910516	-999	2.687			
910612	-999	2.821			
910620	-999	2.804			
910717	-999	2.869			
910821	-999	2.901			
910919	-999	2.920			
911022	-999	2.903			
911121	-999	2.632			
920116	-999	2.518			
920218	-999	2.622			
920218	-999	2.622			
BH2A	8069	7649	121.300	12	2
910422	-999	1.740			
910516	1509	1.818			
910612	-999	1.959			
910620	-999	1.990			
910717	-999	2.040			
910821	-999	2.010			
910919	-999	-999.000			
911022	-999	-999.000			
911121	-999	1.715			
920116	-999	1.680			
920218	-999	1.871			
920218	-999	1.871			
BH3	8120	7678	118.059	14	2
910411	-999	6.610			
910422	-999	6.665			
910516	-999	6.650			
910612	-999	6.748			

910620	-999	6.791			
910717	-999	6.860			
910821	-999	6.958			
910919	-999	7.024			
911022	-999	7.025			
911121	-999	6.818			
911217	-999	6.715			
920116	-999	6.524			
920218	-999	6.622			
920218	-999	6.622			
BH3A	8120	7678	118.059	16	2
910411	-999	2.405			
910422	-999	1.687			
910516	-999	1.715			
910612	-999	1.790			
910620	-999	1.786			
910717	-999	1.855			
910821	-999	1.938			
910919	-999	1.995			
910919	-999	1.995			
911022	-999	1.967			
911022	-999	1.967			
911121	-999	1.671			
911217	-999	1.881			
920116	-999	1.611			
920218	-999	1.779			
920218	-999	1.779			
BH4	8108	7647	126.440	15	2
910411	-999	14.000			
910422	-999	13.305			
910516	1413	13.322			
910612	-999	13.323			
910717	-999	13.330			
910821	-999	13.336			
910919	-999	13.321			
911022	-999	-999.000			
911022	-999	13.338			
911121	-999	13.332			
911217	-999	13.321			
920116	-999	-999.000			
920116	-999	13.332			
920218	-999	13.290			
920218	-999	13.290			
BH4A	8108	7647	126.440	13	2
910411	-999	7.260			
910422	-999	7.260			
910516	-999	7.260			
910612	-999	7.260			
910620	-999	7.260			
910717	-999	7.260			
910919	-999	-999.000			
911022	-999	-999.000			

911121	-999	-999.000
911217	-999	-999.000
920116	-999	-999.000
920218	-999	-999.000
920218	-999	-999.000

BH5	8083	7622	127.269	13	2

910411	-999	7.380
910422	-999	7.380
910612	-999	7.354
910620	-999	6.525
910717	-999	6.542
910821	-999	6.535
910919	-999	6.513
911022	-999	6.535
911121	-999	6.541
911217	-999	6.532
920116	-999	6.542
920218	-999	6.550
920218	-999	6.550

BH5A	8083	7622	127.269	15	2

910411	-999	4.335
910411	-999	4.330
910422	-999	4.335
910422	-999	4.330
910516	-999	4.330
910612	-999	4.330
910620	-999	4.330
910717	-999	4.330
910919	-999	-999.000
911022	-999	-999.000
911121	-999	-999.000
911217	-999	-999.000
920116	-999	-999.000
920218	-999	-999.000
920218	-999	-999.000

BH6A	8084	7598	133.759	10	2

910411	-999	4.000
910422	-999	3.513
910516	-999	2.402
910612	-999	2.252
910717	-999	2.346
910919	-999	2.428
911022	-999	2.491
920116	-999	1.976
920116	-999	1.976
920218	-999	1.780

P1	8043	7636	121.529	17	2

910319	-999	0.713
910411	-999	0.728
910422	-999	0.733

910516	-999	0.737			
910612	-999	0.781			
910620	-999	0.715			
910717	-999	0.803			
910821	-999	0.838			
910919	-999	0.845			
910919	-999	0.845			
911022	-999	0.826			
911022	-999	0.826			
911121	-999	0.691			
911217	-999	0.684			
920116	-999	0.664			
920218	-999	0.681			
920218	-999	0.681			
P2	8082	7650	115.760	17	2
910319	-999	0.308			
910411	-999	0.533			
910422	-999	0.451			
910516	-999	0.588			
910612	-999	0.602			
910620	-999	0.368			
910717	-999	0.785			
910821	-999	0.807			
910919	-999	0.768			
910919	-999	0.768			
911022	-999	0.601			
911022	-999	0.601			
911121	-999	0.228			
911217	-999	0.371			
920116	-999	0.246			
920218	-999	0.261			
920218	-999	0.261			
P3	8091	7662	113.750	17	2
910319	-999	1.400			
910411	-999	1.270			
910422	-999	1.260			
910516	-999	1.195			
910612	-999	1.195			
910620	-999	0.375			
910717	-999	1.195			
910821	-999	1.257			
910919	-999	1.075			
910919	-999	1.075			
911022	-999	0.855			
911022	-999	0.855			
911121	-999	0.895			
911217	-999	1.098			
920116	-999	0.973			
920218	-999	1.103			
920218	-999	1.103			

P4	8097	7674	112.459	16	2
910319	-999	1.400			
910411	-999	0.985			
910422	-999	0.869			
910516	-999	0.715			
910612	-999	0.836			
910717	-999	0.912			
910821	-999	1.031			
910919	-999	1.145			
910919	-999	1.145			
911022	-999	1.017			
911022	-999	1.017			
911121	-999	0.510			
911217	-999	0.802			
920116	-999	0.531			
920218	-999	0.523			
920218	-999	0.523			
P5	8110	7686	111.180	16	2
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910516	-999	0.940			
910612	-999	0.968			
910717	-999	0.962			
910821	-999	1.012			
910919	-999	0.999			
910919	-999	0.999			
911022	-999	0.962			
911022	-999	0.962			
911121	-999	0.809			
911217	-999	0.902			
920116	-999	0.915			
920218	-999	0.951			
920218	-999	0.951			
P6	8131	7693	107.029	16	2
910319	-999	0.566			
910411	-999	0.859			
910422	-999	0.864			
910516	-999	0.689			
910612	-999	0.775			
910717	-999	1.024			
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910919	-999	1.156			
910919	-999	1.156			
911022	-999	1.254			
911022	-999	1.254			
911121	-999	0.574			
911217	-999	0.629			
920116	-999	0.613			
920218	-999	0.651			
920218	-999	0.651			
P7	8092	7679	115.139	15	2

910411	-999	0.620			
910422	-999	0.541			
910516	-999	0.551			
910612	-999	0.553			
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910919	-999	0.710			
910919	-999	0.710			
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911022	-999	-999.000			
911121	-999	0.544			
911217	-999	0.551			
920119	-999	0.519			
920218	-999	0.512			
920218	-999	0.512			
P8	8063	7606	126.220	13	2
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910612	-999	1.251			
910620	-999	0.900			
910717	-999	-999.000			
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910919	-999	-999.000			
911022	-999	1.250			
911121	-999	1.068			
911217	-999	1.175			
920116	-999	1.054			
920218	-999	1.071			
920218	-999	1.071			
P9	8041	7611	127.169	12	2
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910516	-999	0.547			
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911022	-999	-999.000			
911121	-999	0.529			
911217	-999	0.542			
920116	-999	0.459			
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920218	-999	0.500			
P10	8066	7629	120.540	13	2
910612	-999	0.635			
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910717	-999	0.512			
910821	-999	0.675			
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911022	-999	0.557			
911121	-999	0.410			

911217	-999	0.497			
920116	-999	0.499			
920218	-999	0.509			
920218	-999	0.509			
P11	8104	7674	116.190	11	2
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910919	-999	-999.000			
910919	-999	-999.000			
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911121	-999	-999.000			
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920218	-999	-999.000			
920218	-999	-999.000			
P12	8102	7667	118.889	11	2
910717	-999	0.850			
910821	-999	0.850			
910919	-999	-999.000			
910919	-999	-999.000			
911022	-999	-999.000			
911022	-999	-999.000			
911121	-999	-999.000			
911217	-999	-999.000			
920116	-999	-999.000			
920218	-999	-999.000			
920218	-999	-999.000			
P13	8135	7665	119.660	12	2
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910717	-999	3.890			
910821	-999	3.360			
910919	-999	3.405			
910919	-999	3.405			
911022	-999	3.409			
911022	-999	3.409			
911121	-999	3.404			
911217	-999	3.510			
920116	-999	3.383			
920218	-999	3.378			
920218	-999	3.378			
P14	8131	7653	119.160	11	2
910717	-999	1.158			
910821	-999	1.158			
910919	-999	-999.000			
910919	-999	-999.000			
911022	-999	-999.000			
911022	-999	-999.000			
911121	-999	0.645			

911217	-999	0.989			
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920218	-999	0.765			
920218	-999	0.765			
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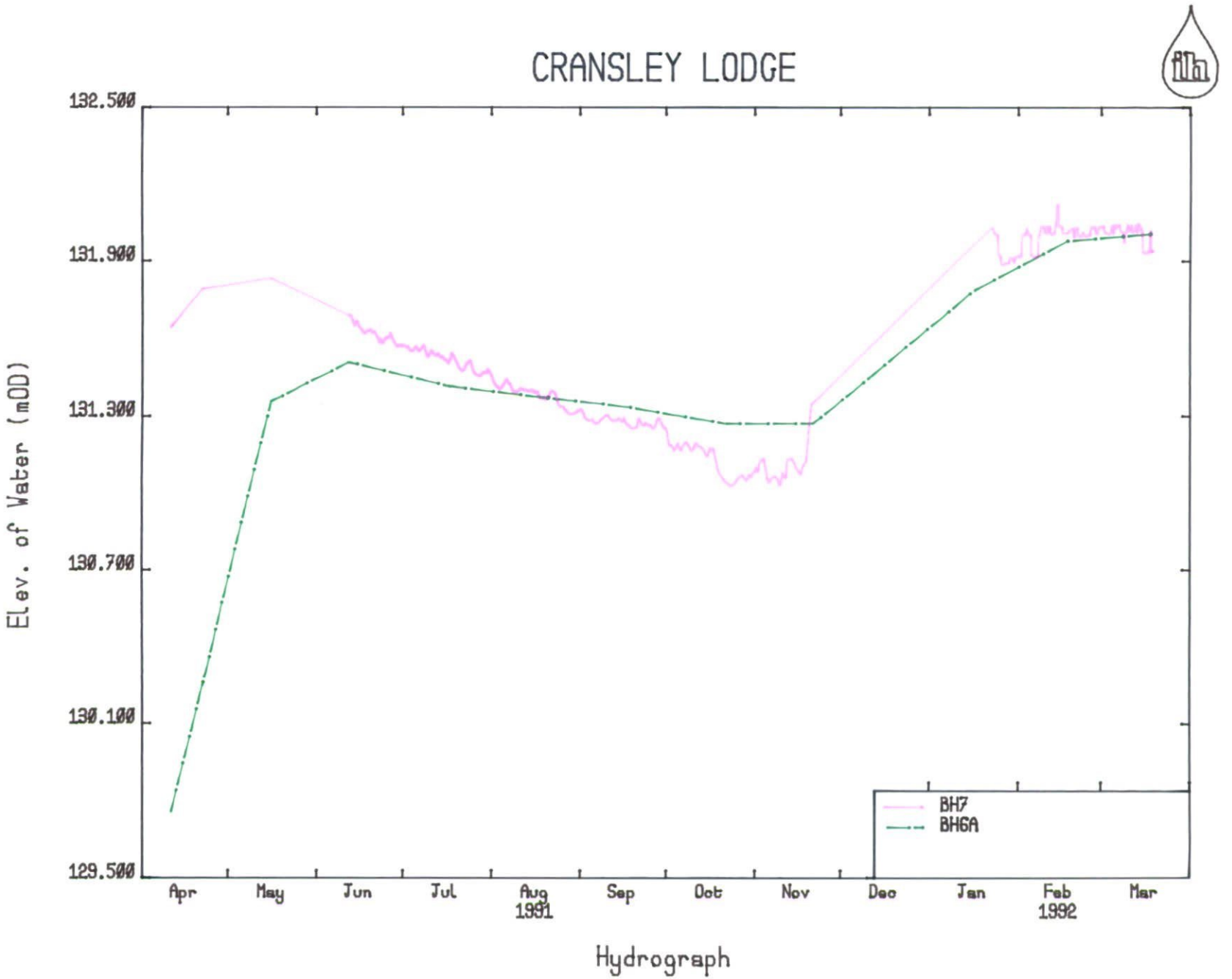
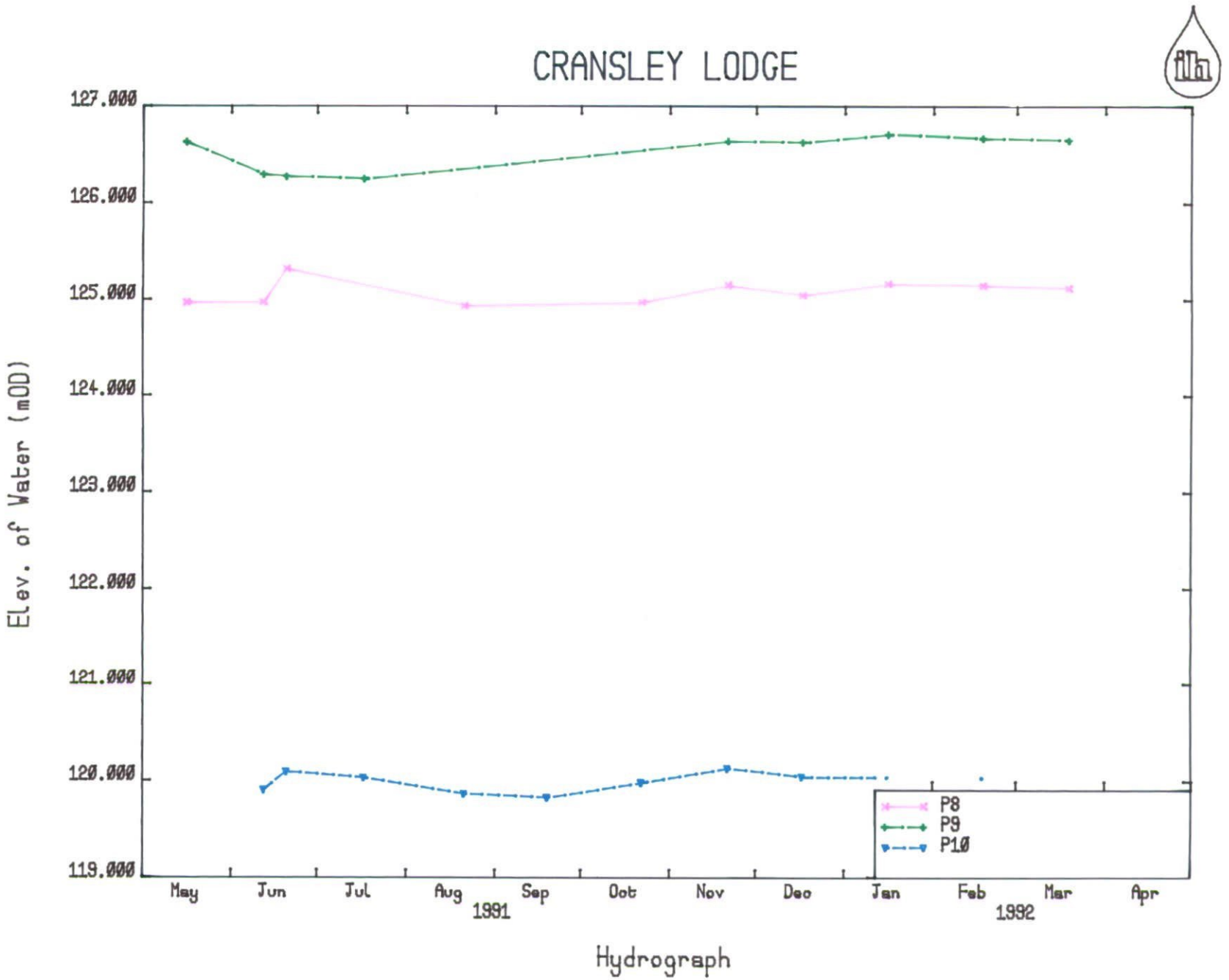
910919	-999	5.842			
911022	-999	5.883			
911022	-999	5.883			
911121	-999	5.885			
911217	-999	5.899			
920116	-999	5.239			
920218	-999	5.643			
920218	-999	5.643			
P17	0	0	0.000	4	2
911121	-999	1.509			
911217	-999	1.071			
920218	-999	0.753			
920218	-999	0.753			
P18	0	0	0.000	2	2
920218	-999	-999.000			
920218	-999	-999.000			


CRANSLEY LODGE
132.500
131.900
131.300
130.700
130.100
129.500
Elev. of Water (mOD)
Apr
May
Jun
Jul
Aug
1991
Sep
Oct
Nov
Dec
Jan
Feb
1992
Mar
BH7
BH6A
Hydrograph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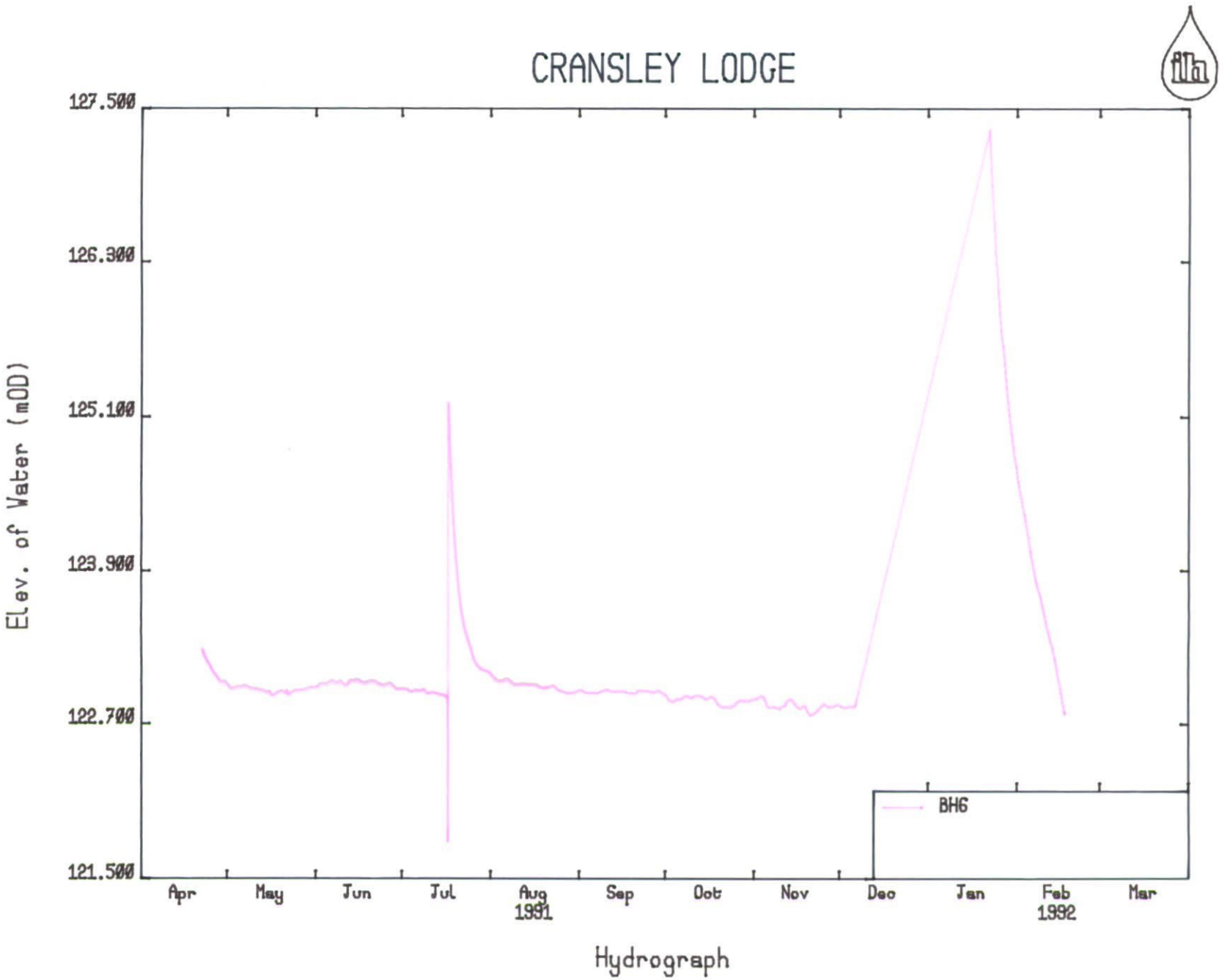
127.000
126.000
125.000
124.000
123.000
122.000
121.000
120.000
119.000
Elev. of Water (mOD)
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
1991
1992
P8
P9
P10

Hydrograph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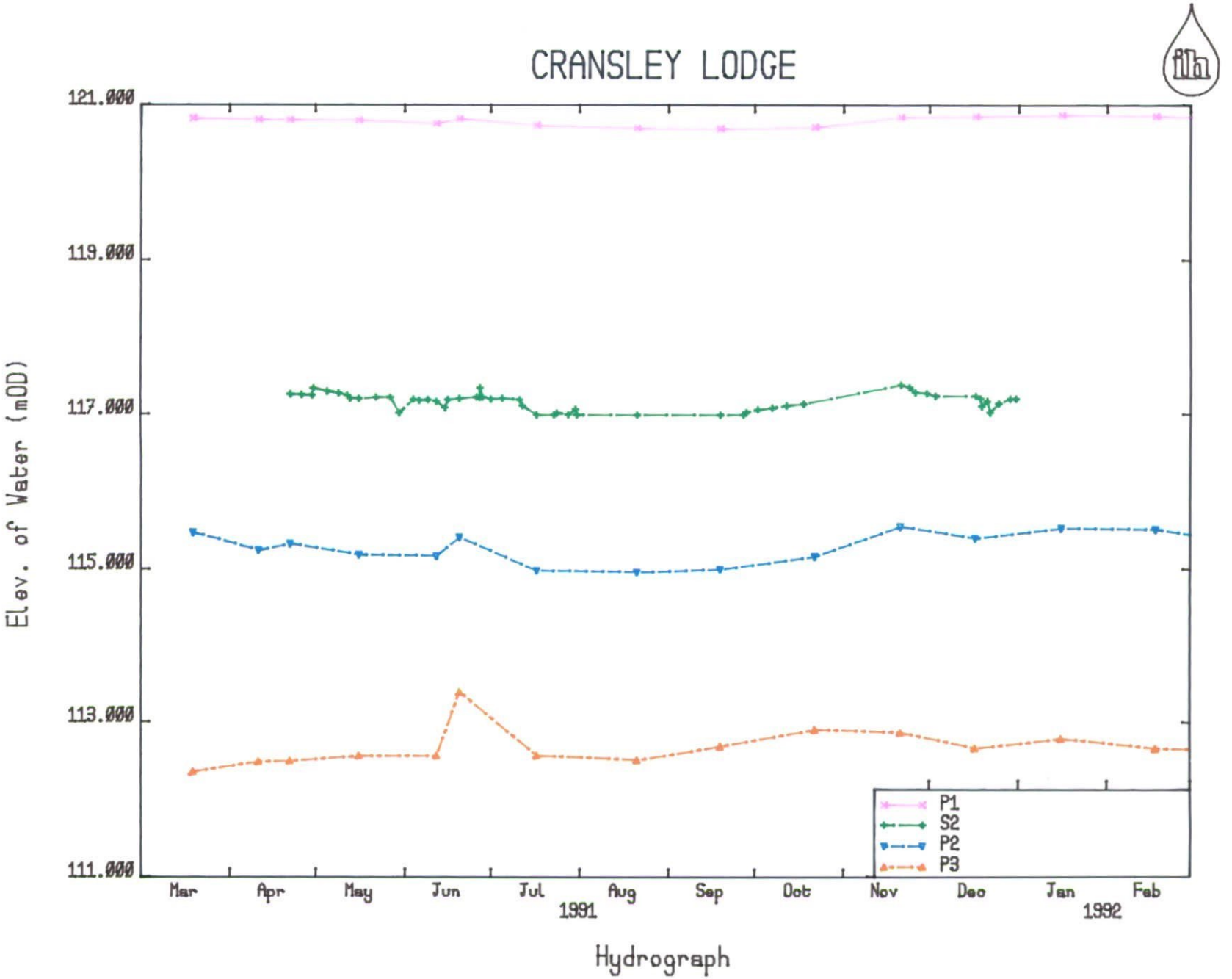
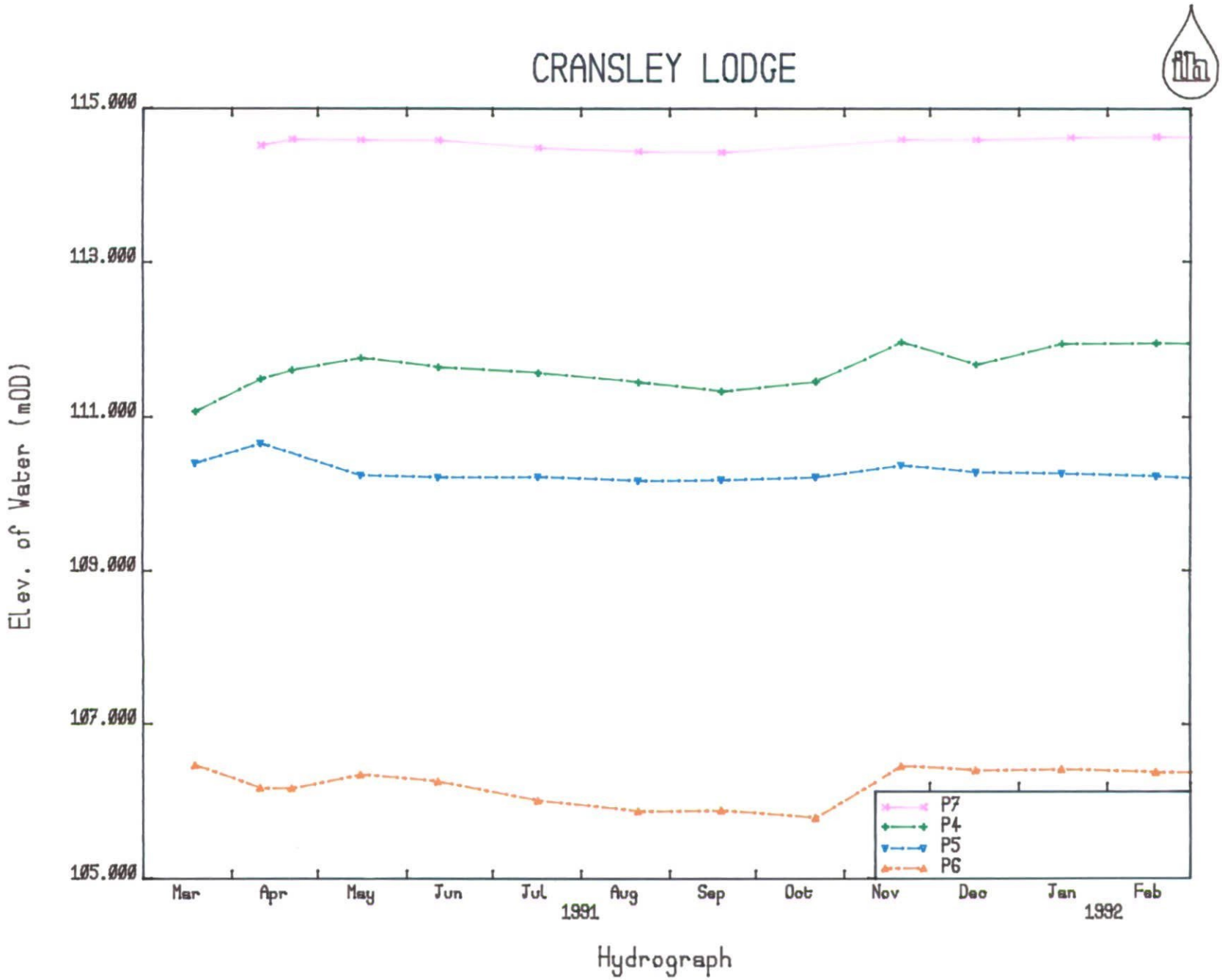
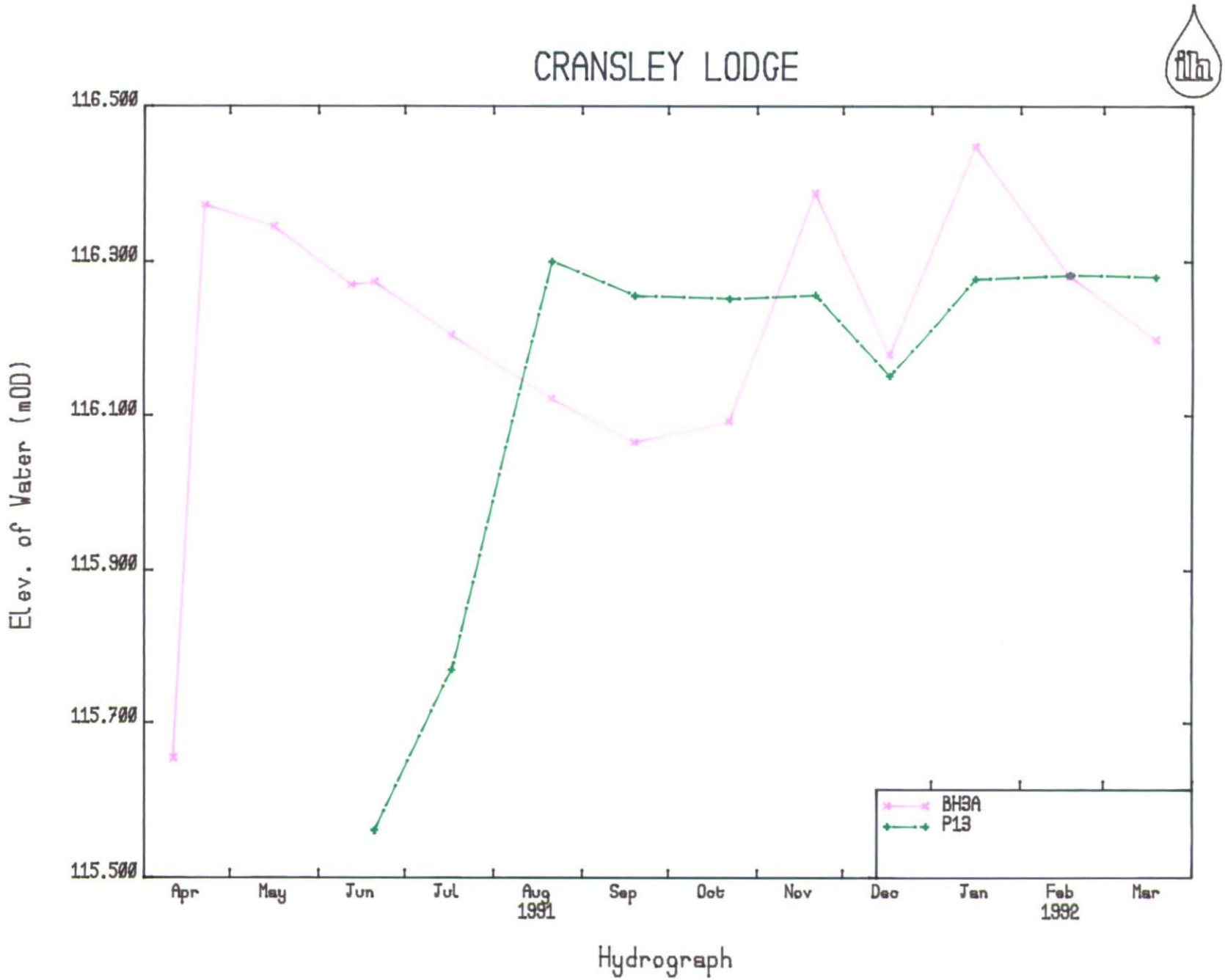
126.300
125.100
123.900
122.700
121.500
Elev. of Water (mOD)
Apr
May
Jun
Jul
Aug
1991
Sep
Oct
Nov
Dec
Jan
Feb
1992
Mar
BH6
Hydrograph


CRANSLEY LODGE
121.000
119.000
117.000
115.000
113.000
111.000
Elev. of Water (mOD)
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
1991
1992
P1
S2
P2
P3
Hydrograph


CRANSLEY LODGE
Elev. of Water (mOD)
115.000
113.000
111.000
109.000
107.000
105.000
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
1991
1992
P7
P4
P5
P6
Hydrograph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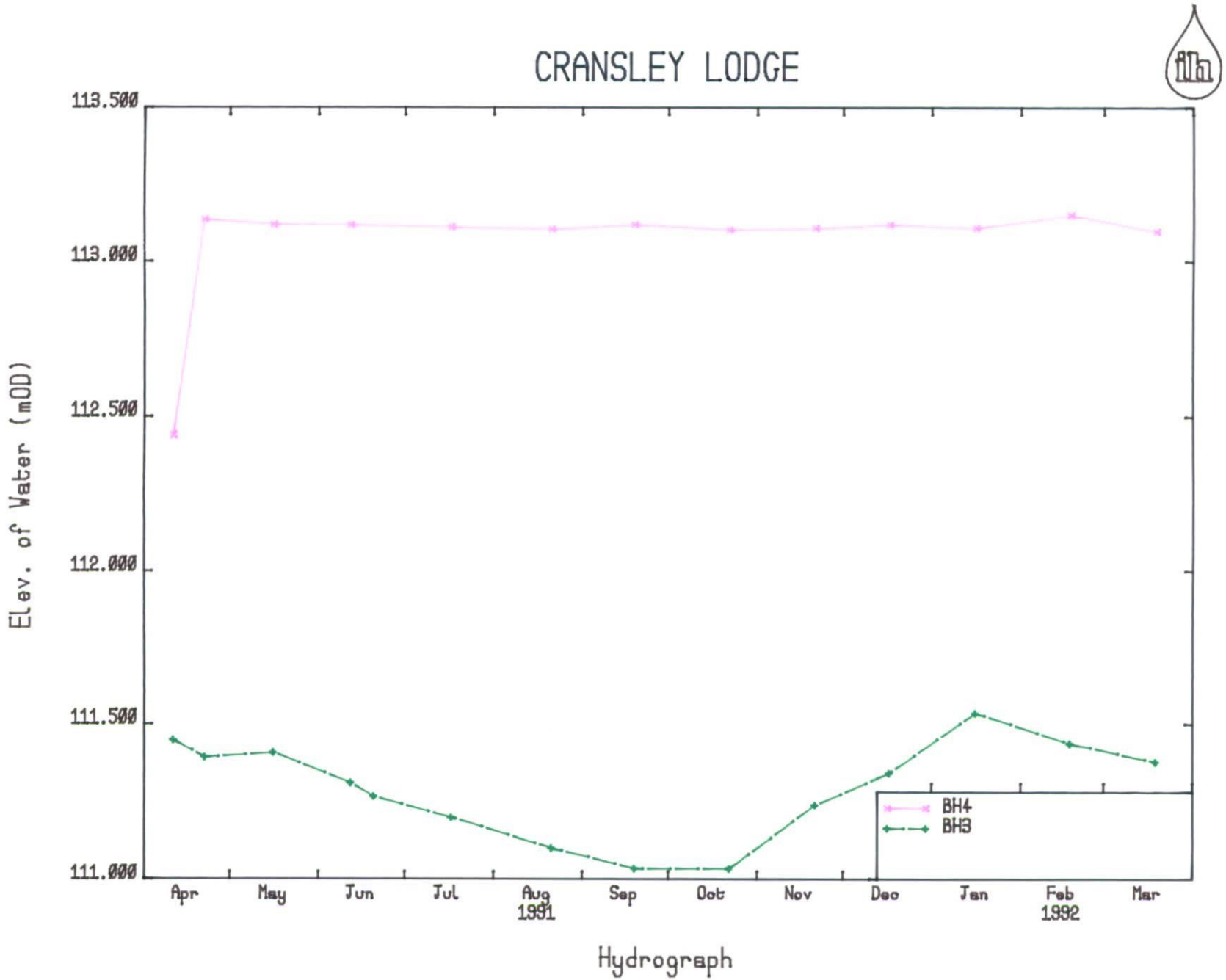
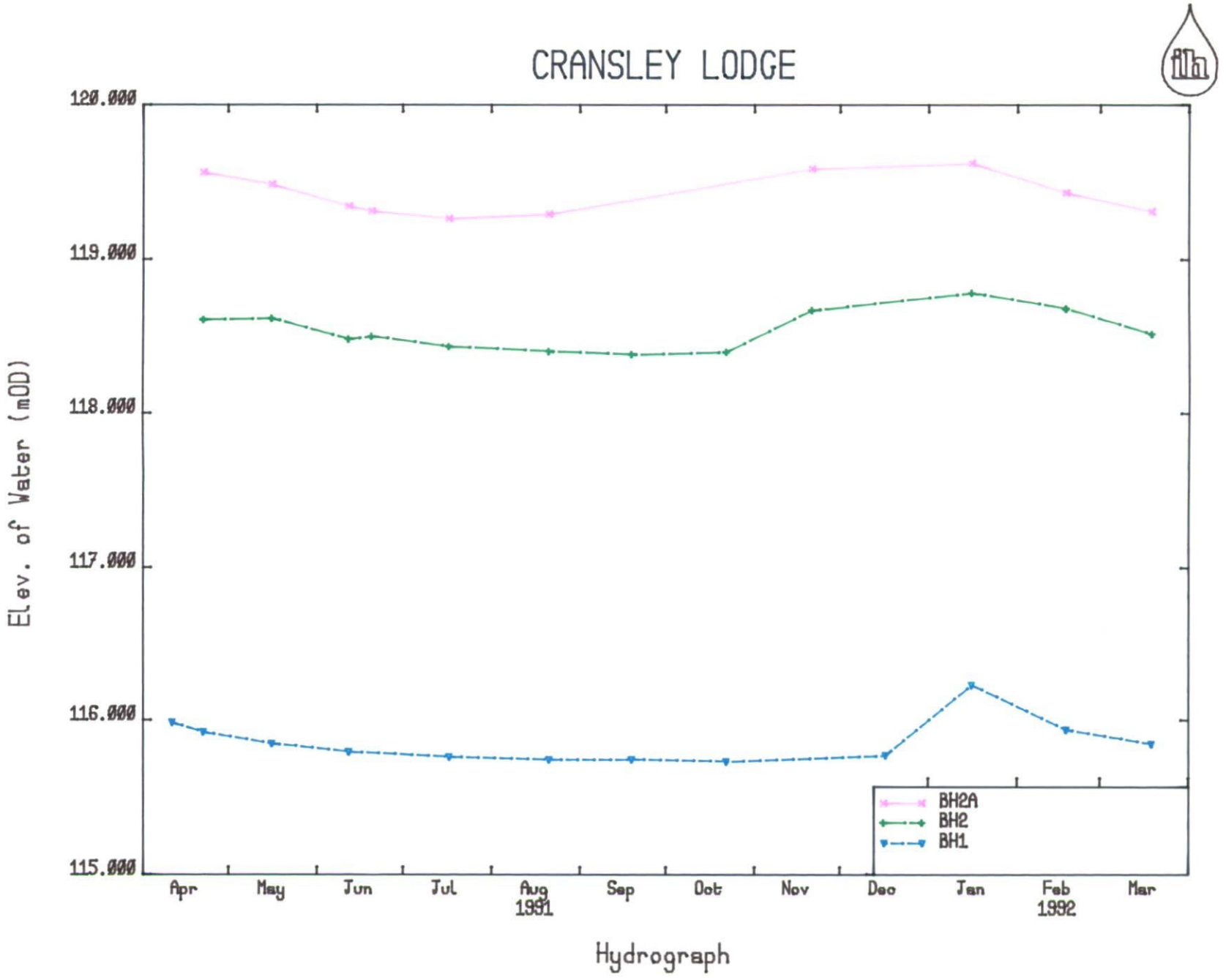
116.500
116.300
116.100
115.900
115.700
115.500
Elev. of Water (mOD)
Apr
May
Jun
Jul
Aug
1991
Sep
Oct
Nov
Dec
Jan
Feb
1992
Mar
BH3A
P13
Hydrograph


CRANSLEY LODGE
113.500
113.000
112.500
112.000
111.500
111.000
Elev. of Water (mOD)
Apr
May
Jun
Jul
Aug
1991
Sep
Oct
Nov
Dec
Jan
Feb
1992
Mar
BH4
BH3
Hydrograph


CRANSLEY LODGE
120.000
119.000
118.000
117.000
116.000
115.000
Elev. of Water (mOD)
Apr
May
Jun
Jul
Aug
1991
Sep
Oct
Nov
Dec
Jan
Feb
1992
Mar
BH2A
BH2
BH1
Hydrograph

Appendix VI

SOIL MOISTURE DATA

NEUTRON PROBE SOIL MOISTURE DATA OBS. 1

single TUBE NO. 0001 DATE 19/ 3/91

PROBE NO. 164 WATER COUNT 945.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM
cm			cm	mm	mm
20	499	.494	0 - 20	90.8	90.8
40	436	.430	20 - 40	92.4	191.2
60	415	.409	40 - 60	83.9	275.0
80	363	.356	60 - 80	76.5	351.5
100	359	.352	80 - 100	70.8	422.3
120	365	.358	100 - 120	71.0	493.3
140	358	.351	120 - 140	70.9	564.2
160	349	.342	140 - 160	69.3	633.5
175	356	.343	160 - 175	51.3	684.8

Printed on 10-01-92 at 10:52:58 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 0

single TUBE NO. 0001 DATE 16/ 5/91

PROBE No. 194 WATER COUNT 945.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 16/ 5/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	480	.475	0 - 20	94.9	94.9	-3.9	-3.9
40	438	.432	20 - 40	90.7	185.6	-1.7	-5.6
60	423	.417	40 - 60	84.9	270.5	1.8	-4.6
80	378	.368	60 - 80	76.0	346.5	1.5	-3.0
100	374	.363	80 - 100	75.0	421.5	2.2	-.8
120	369	.362	100 - 120	72.9	494.4	1.9	1.1
140	360	.361	120 - 140	72.4	566.8	1.5	2.6
160	384	.377	140 - 160	73.9	640.8	4.7	7.3
175	379	.372	160 - 175	56.8	697.6	4.9	12.2

Printed on 16-01-92 at 11:08:24 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 5

single TUBE NO. 0001 DATE 12/ 6/91

PROBE NO. 164 WATER COUNT 945.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 10/ 5/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	395	.388	0 - 20	77.7	77.7	-17.2	-17.2
40	402	.396	20 - 40	78.4	156.1	-12.3	-29.5
60	400	.394	40 - 60	78.9	235.0	-6.0	-35.5
80	364	.357	60 - 80	75.1	310.0	-2.5	-38.4
100	375	.368	80 - 100	72.5	382.6	-.5	-38.9
120	369	.362	100 - 120	73.0	455.6	.1	-38.8
140	368	.361	120 - 140	72.3	527.9	-.1	-38.9
160	398	.391	140 - 160	75.3	603.1	1.3	-37.6
175	430	.424	160 - 175	61.2	664.3	4.9	-32.7

Printed on 10-01-92 at 11:10:03 hrs .

single TUBE NO. 0001 DATE 17/ 7/91

PROBE NO. 165 WATER COUNT 890.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 12/ 6/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	407	.426	0 - 20	85.2	85.2	7.5	7.5
40	381	.398	20 - 40	82.4	167.6	4.0	11.6
60	363	.379	40 - 60	77.7	245.3	-1.2	10.3
80	340	.354	60 - 80	73.3	318.6	-1.8	8.6
100	349	.364	80 - 100	71.8	390.4	-.8	7.8
120	343	.357	100 - 120	72.1	462.4	-.9	6.9
140	341	.355	120 - 140	71.2	533.7	-1.1	5.8
160	369	.385	140 - 160	74.0	607.7	-1.2	4.6
175	411	.430	160 - 175	61.2	668.9	.9	4.6

Printed on 05-02-92 at 02:26 pm

NEUTRON PROBE SOIL MOISTURE DATA OBS. 5

single TUBE NO. 0001 DATE 21/ 8/91

PROBE NO. 164 WATER COUNT 939.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 17/ 7/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	352	.347	0 - 20	69.4	69.4	-15.8	-15.8
40	404	.400	20 - 40	74.2	144.2	-7.7	-23.5
60	392	.394	40 - 60	79.4	223.6	1.7	-21.7
80	371	.367	60 - 80	76.1	299.6	2.8	-19.0
100	378	.374	80 - 100	74.0	373.6	2.3	-16.7
120	380	.376	100 - 120	74.9	448.6	2.8	-13.9
140	384	.380	120 - 140	75.5	524.1	4.3	-9.5
160	400	.398	140 - 160	77.6	601.7	3.6	-6.0
175	461	.458	160 - 175	64.1	665.8	0.9	-5.1

Printed on 05-02-92 at 14:06:40 hrs .

single TUBE NO. 0001 DATE 19/ 9/91

PROBE NO. 184 WATER COUNT 983.9 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 21/ 8/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	251	.324	0 - 20	44.8	44.8	-24.6	-24.6
40	331	.326	20 - 40	55.0	99.8	-19.7	-44.4
60	350	.355	40 - 60	68.1	167.9	-11.4	-55.7
80	347	.342	60 - 80	69.7	237.6	-6.4	-62.1
100	359	.345	80 - 100	68.8	306.3	-5.2	-67.3
120	378	.374	100 - 120	72.0	378.3	-3.0	-70.3
140	386	.382	120 - 140	75.6	453.9	.1	-70.2
160	400	.397	140 - 160	77.9	531.8	.3	-69.9
175	464	.462	160 - 175	64.4	596.2	.3	-69.6

Printed on 10-01-92 at 11:14:04 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 7

single TUBE NO. 0001 DATE 28/10/91

PROBE NO. 164 WATER COUNT 944.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 19/ 9/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	330	.323	0 - 20	64.6	64.6	19.5	19.5
40	405	.399	20 - 40	72.2	136.8	17.2	37.0
60	404	.398	40 - 60	79.7	216.5	11.6	48.6
80	344	.337	60 - 80	73.5	290.0	3.8	52.4
100	337	.330	80 - 100	66.7	356.7	-2.1	50.3
120	376	.370	100 - 120	70.0	426.6	-2.0	48.3
140	382	.379	120 - 140	74.5	501.2	-1.1	47.2
160	397	.391	140 - 160	76.7	577.8	-1.2	46.0
175	422	.416	160 - 175	60.5	638.4	-3.8	42.2

Printed on 10-01-92 at 11:15:06 hrs .

single TUBE NO. 0001 DATE 21/11/91

PROBE NO. 164 WATER COUNT 944.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 28/10/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	477	.472	0 - 20	94.4	94.4	22.8	29.6
40	464	.459	20 - 40	93.1	187.5	20.9	50.7
60	433	.427	40 - 60	88.6	276.1	8.9	59.7
80	401	.395	60 - 80	82.2	358.4	8.7	68.4
100	359	.352	80 - 100	74.7	433.1	8.0	76.4
120	384	.378	100 - 120	73.0	506.1	3.0	79.5
140	375	.367	120 - 140	74.4	580.5	-.1	79.4
160	397	.391	140 - 160	75.7	656.3	-.9	78.4
175	408	.402	160 - 175	59.5	715.7	-1.1	77.4

Printed on 10-01-92 at 11:16:12 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 9

single TUBE NO. 0001 DATE 17/12/91

PROBE NO. 164 WATER COUNT 935.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 21/11/91 1500 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	467	.466	0 - 20	93.3	93.3	-1.1	-1.1
40	440	.439	20 - 40	90.5	183.8	-2.6	-3.7
60	420	.418	40 - 60	85.7	269.5	-2.9	-6.6
80	372	.369	60 - 80	78.7	348.3	-3.5	-10.1
100	375	.369	80 - 100	73.8	422.1	-.9	-11.0
120	373	.370	100 - 120	73.9	496.1	.9	-10.1
140	370	.367	120 - 140	73.7	569.8	-.7	-10.7
160	391	.389	140 - 160	75.6	645.4	-.2	-10.9
175	415	.414	160 - 175	60.2	705.6	.7	-10.2

Printed on 10-01-92 at 11:17:53 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 10

single TUBE NO. 0001 DATE 16/ 1/92

PROBE NO. 164 WATER COUNT 532.3 COUNT TIME 16 SEC READING TIME 1045

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 17/12/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	510	.512	0 - 20	102.4	102.4	9.1	9.1
40	464	.465	20 - 40	97.7	200.1	7.2	16.3
60	444	.444	40 - 60	90.9	291.0	5.2	21.5
80	396	.395	60 - 80	83.9	374.9	5.2	26.6
100	372	.370	80 - 100	76.5	451.4	2.7	29.3
120	371	.369	100 - 120	73.9	525.4	.0	29.3
140	365	.363	120 - 140	73.2	598.6	-.5	28.8
160	369	.368	140 - 160	75.1	673.7	-.5	28.3
175	455	.456	160 - 175	63.2	736.9	3.0	31.4

Printed on 28-01-92 at 11:35:42 hrs .

NEUTRON PROBE SOIL MOISTURE DATA 089. 11

single TUBE NO. 0001 DATE 18/ 2/92

PROBE NO. 164 WATER COUNT 934.5 COUNT TIME 16 SEC READING TIME 1044

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 16/ 1/92 1045 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	510	.511	0 - 20	102.2	102.2	.2	-.2
40	463	.463	20 - 40	97.3	199.5	-.3	-.5
60	443	.442	40 - 60	90.5	290.0	-.4	-1.0
80	386	.386	60 - 80	82.8	372.8	-1.1	-2.1
100	377	.374	80 - 100	76.0	448.8	-.5	-2.6
120	383	.381	100 - 120	75.5	524.3	1.6	-1.1
140	365	.362	120 - 140	74.3	598.6	1.1	.0
160	393	.391	140 - 160	75.3	673.9	.2	.2
175	456	.458	160 - 175	63.6	737.5	.4	.6

Printed on 05-03-92 at 15:43:42 hrs .

SOIL MOISTURE SUMMARY FOR SINGLE TUBE NO. : 0001

VOLUMETRIC AND TOTAL PROFILE WATER CONTENTS

DEPTH cm.	20	40	60	80	100	120	140	160	175	TOTAL mm.
19/ 3/91 1200	.494	.430	.403	.366	.352	.358	.351	.342	.340	684.8
16/ 6/91 1200	.475	.432	.417	.383	.367	.362	.362	.377	.372	697.6
12/ 6/91 1200	.388	.396	.394	.357	.368	.362	.361	.391	.424	664.3
17/ 7/91 1200	.426	.398	.378	.364	.364	.357	.355	.395	.430	669.3
21/ 8/91 1200	.347	.400	.394	.367	.374	.375	.380	.396	.458	665.8
13/ 9/91 1200	.224	.326	.355	.342	.345	.374	.382	.397	.462	595.2
28/10/91 1200	.323	.393	.398	.337	.330	.370	.376	.391	.419	628.4
21/11/91 1200	.472	.459	.427	.395	.352	.378	.367	.391	.402	715.7
17/12/91 1200	.465	.439	.418	.369	.369	.370	.367	.389	.414	705.6
16/ 1/92 1045	.513	.465	.444	.395	.370	.369	.363	.399	.450	736.9
MEAN VALUE	.413	.414	.402	.364	.359	.368	.366	.385	.418	677.4

Printed on 05-02-92 at 14:06:50 hrs .

SOIL MOISTURE SUMMARY FOR SINGLE TUBE NO. : 0001

VOLUMETRIC AND TOTAL PROFILE WATER CONTENTS

DEPTH cm.	20	40	60	80	100	120	140	160	175	TOTAL cm.
19/ 3/91 1200	.496	.430	.409	.356	.352	.358	.351	.342	.343	684.8
16/ 5/91 1200	.475	.432	.417	.353	.367	.352	.362	.377	.372	697.0
12/ 6/91 1200	.388	.395	.394	.357	.368	.352	.351	.351	.429	664.3
17/ 7/91 1200	.496	.398	.379	.354	.364	.357	.355	.389	.430	668.9
21/ 8/91 1200	.347	.400	.394	.367	.379	.376	.380	.396	.458	665.8
19/ 9/91 1200	.224	.325	.355	.342	.345	.374	.382	.397	.462	596.2
28/10/91 1200	.323	.389	.398	.337	.330	.370	.376	.391	.416	638.4
21/11/91 1200	.472	.459	.427	.395	.352	.378	.387	.391	.402	715.7
17/12/91 1200	.466	.439	.418	.366	.369	.370	.357	.389	.414	705.6
16/ 1/92 1045	.512	.465	.449	.395	.370	.369	.363	.388	.455	736.9
18/ 2/92 1044	.511	.463	.442	.386	.374	.381	.362	.391	.458	737.5
MEAN VALUE	.422	.419	.407	.366	.361	.369	.366	.385	.421	682.8

Printed on 09-03-92 at 10:10:46 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 1

single TUBE NO. 0002 DATE 21/ 8/91

PROBE NO. 164 WATER COUNT 945.9 COUNT TIME 16 SEC READING TIME 1200

DEPTH cm	READING	MVF	LAYER cm	WATER IN LAYER mm	CUM mm
20	295	.296	0 - 20	45.2	45.2
40	300	.292	20 - 40	51.8	97.1
60	329	.322	40 - 60	61.4	158.4
80	335	.328	60 - 80	64.9	223.4
100	315	.307	80 - 100	63.5	286.9
120	387	.380	100 - 120	68.8	355.6
140	413	.407	120 - 140	78.7	434.3
160	412	.406	140 - 160	81.2	515.6
180	365	.358	160 - 180	76.4	591.9
200	400	.394	180 - 200	75.2	667.1
219	400	.394	200 - 219	74.8	741.8

Printed on 10-01-92 at 10:55:58 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 2

single TUBE NO. 0002 DATE 28/10/91

PROBE NO. 164 WATER COUNT 944.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 21/ 8/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	238	.230	0 - 20	45.9	45.9	.7	.7
40	316	.309	20 - 40	53.8	99.7	2.0	2.6
60	320	.313	40 - 60	62.1	161.9	.8	3.4
80	340	.333	60 - 80	64.6	226.4	-.3	3.1
100	311	.304	80 - 100	63.7	290.1	.2	3.3
120	409	.403	100 - 120	70.7	360.8	1.9	5.2
140	410	.404	120 - 140	80.7	441.5	2.0	7.2
160	426	.420	140 - 160	82.4	523.9	1.2	8.4
180	352	.345	160 - 180	76.6	600.5	.2	8.6
200	401	.395	180 - 200	74.0	674.5	-1.1	7.4
219	416	.410	200 - 219	76.5	751.0	1.7	9.2

Printed on 10-01-92 at 10:58:37 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 3

single TUBE NO. 0002 DATE 21/11/91

PROBE NO. 164 WATER COUNT 944.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 22/10/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	341	.334	0 - 20	66.6	66.6	20.9	20.9
40	381	.375	20 - 40	76.9	143.7	17.0	38.0
60	376	.370	40 - 60	74.4	218.1	12.3	50.2
80	382	.376	60 - 80	74.5	286.6	9.4	60.2
100	385	.379	80 - 100	75.4	362.1	11.8	72.0
120	398	.392	100 - 120	77.1	439.1	6.4	78.5
140	412	.406	120 - 140	79.8	518.9	-.9	77.4
160	419	.413	140 - 160	81.9	600.9	-.5	76.9
180	366	.359	160 - 180	77.3	678.1	.7	77.6
200	399	.393	180 - 200	75.2	753.4	1.2	78.9
219	397	.391	200 - 219	74.5	827.8	-2.0	76.8

Printed on 10-01-92 at 11:06:54 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 4

single TUBE NO. 0002 DATE 17/12/91

PROBE NO. 164 WATER COUNT 938.0 COUNT TIME 16 SEC READING TIME 1200

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 21/11/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	360	.357	0 - 20	71.4	71.4	4.6	4.6
40	360	.357	20 - 40	71.4	142.7	.5	5.1
60	331	.327	40 - 60	68.4	211.1	-6.0	-1.0
80	336	.332	60 - 80	65.9	277.1	-8.6	-9.5
100	330	.326	80 - 100	65.8	342.9	-9.6	-19.1
120	395	.393	100 - 120	71.9	414.8	-5.2	-24.3
140	414	.412	120 - 140	80.5	495.3	.7	-23.6
160	405	.403	140 - 160	81.5	576.8	-.4	-24.1
180	368	.365	160 - 180	76.8	653.6	-.5	-24.5
200	406	.404	180 - 200	76.9	730.5	1.7	-22.8
219	390	.388	200 - 219	75.2	805.7	.7	-22.1

Printed on 10-01-92 at 11:02:50 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 5

single TUBE NO. 0002 DATE 16/ 1/92

PROBE NO. 184 WATER COUNT 932.0 COUNT TIME 16 SEC READING TIME 1326

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 17/12/91 1200 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	396	.395	0 - 20	76.9	76.9	5.6	5.6
40	373	.371	20 - 40	75.6	152.5	4.2	9.8
60	356	.354	40 - 60	72.5	225.0	4.1	13.9
80	369	.367	60 - 80	72.1	297.1	6.2	20.0
100	369	.367	80 - 100	73.4	370.6	7.6	27.6
120	393	.392	100 - 120	75.9	446.5	4.0	31.7
140	401	.400	120 - 140	79.2	525.7	-1.3	30.4
160	423	.423	140 - 160	82.3	607.9	.8	31.1
180	351	.349	160 - 180	77.1	685.1	.3	31.4
200	399	.398	180 - 200	74.7	759.7	-2.2	29.2
219	399	.398	200 - 219	75.6	835.3	.4	29.6

Printed on 28-01-92 at 11:34:33 hrs .

NEUTRON PROBE SOIL MOISTURE DATA OBS. 6

single TUBE NO. 0002 DATE 18/ 2/92

PROBE NO. 164 WATER COUNT 934.5 COUNT TIME 16 SEC READING TIME 1447

DEPTH	READING	MVF	LAYER	WATER IN LAYER	CUM	CHANGE SINCE 16/ 1/92 1326 LAYER	CUM
cm			cm	mm	mm	mm	mm
20	377	.374	0 - 20	74.9	74.9	-2.0	-2.0
40	388	.384	20 - 40	75.8	150.7	.2	-1.8
60	352	.349	40 - 60	73.3	224.0	.7	-1.1
80	342	.339	60 - 80	68.7	292.7	-3.4	-4.4
100	313	.309	80 - 100	64.7	357.5	-8.7	-13.1
120	393	.391	100 - 120	70.0	427.4	-5.9	-19.0
140	396	.394	120 - 140	78.5	505.9	-.7	-19.7
160	404	.402	140 - 160	79.6	585.5	-2.7	-22.4
180	362	.359	160 - 180	76.1	661.7	-1.0	-23.4
200	386	.386	180 - 200	74.5	736.1	-.2	-23.6
219	400	.393	200 - 219	74.5	810.6	-1.2	-24.7

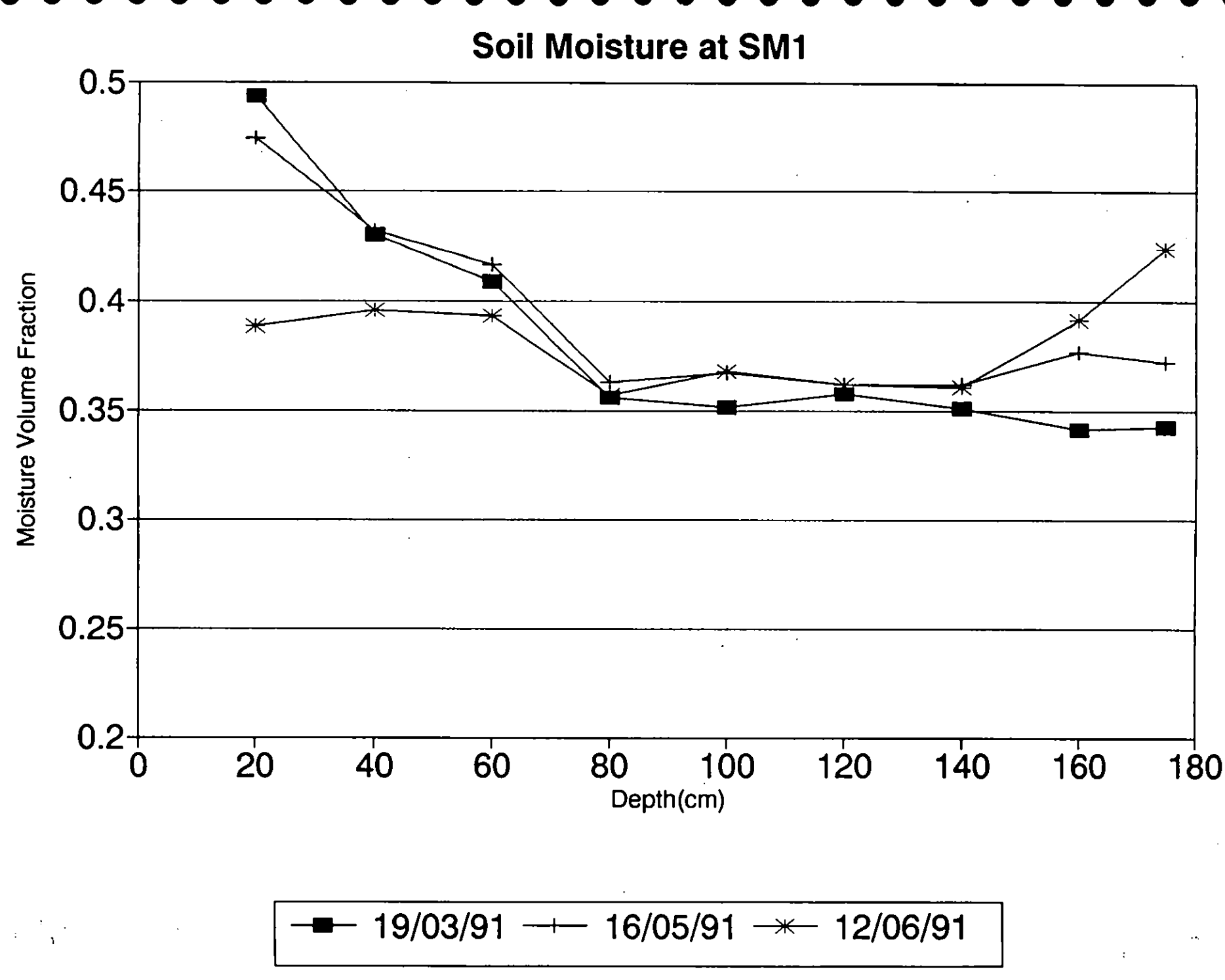
Printed on 05-03-92 at 15:44:42 hrs .

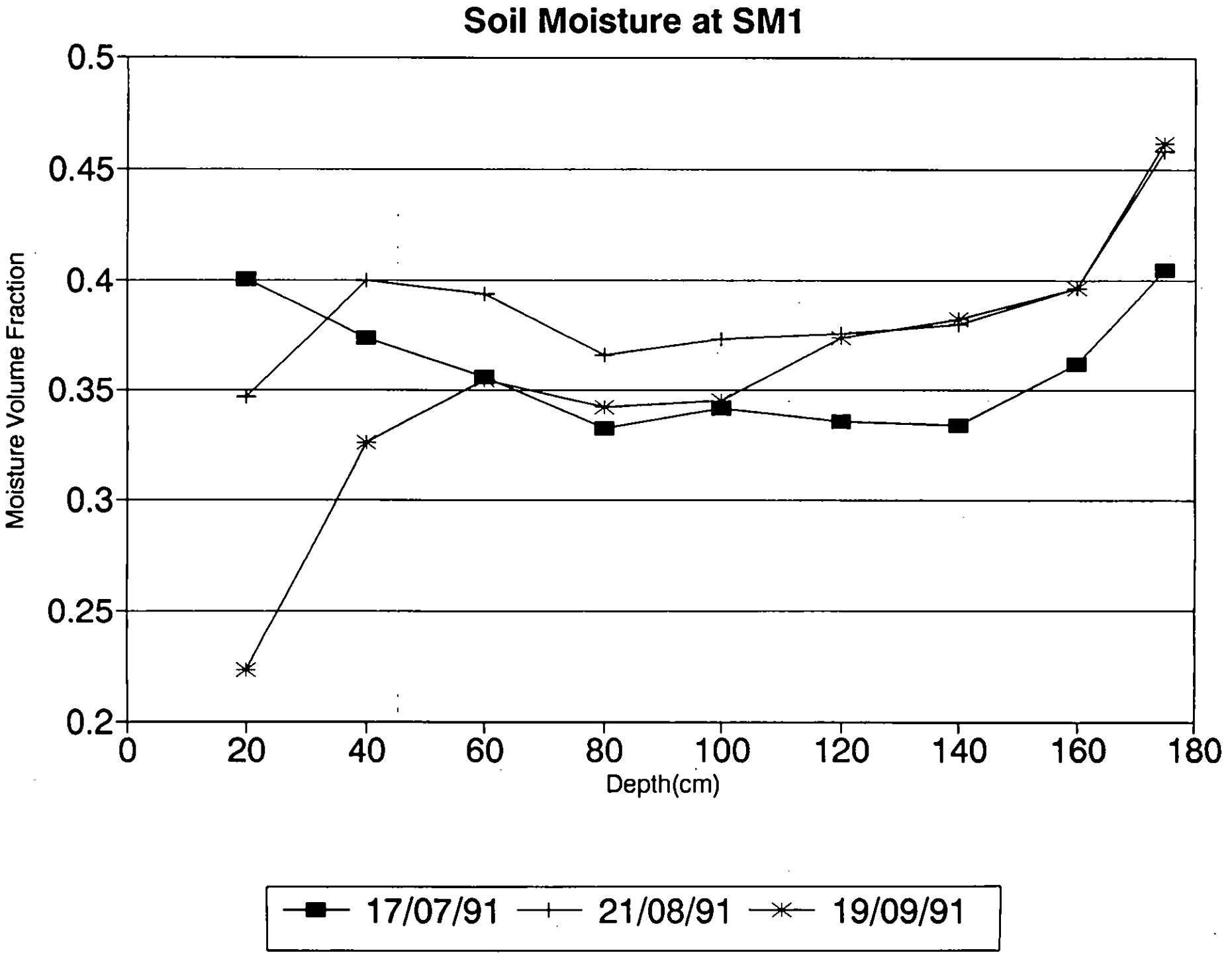
SOIL MOISTURE SUMMARY FOR SINGLE TUBE NO. : 0602

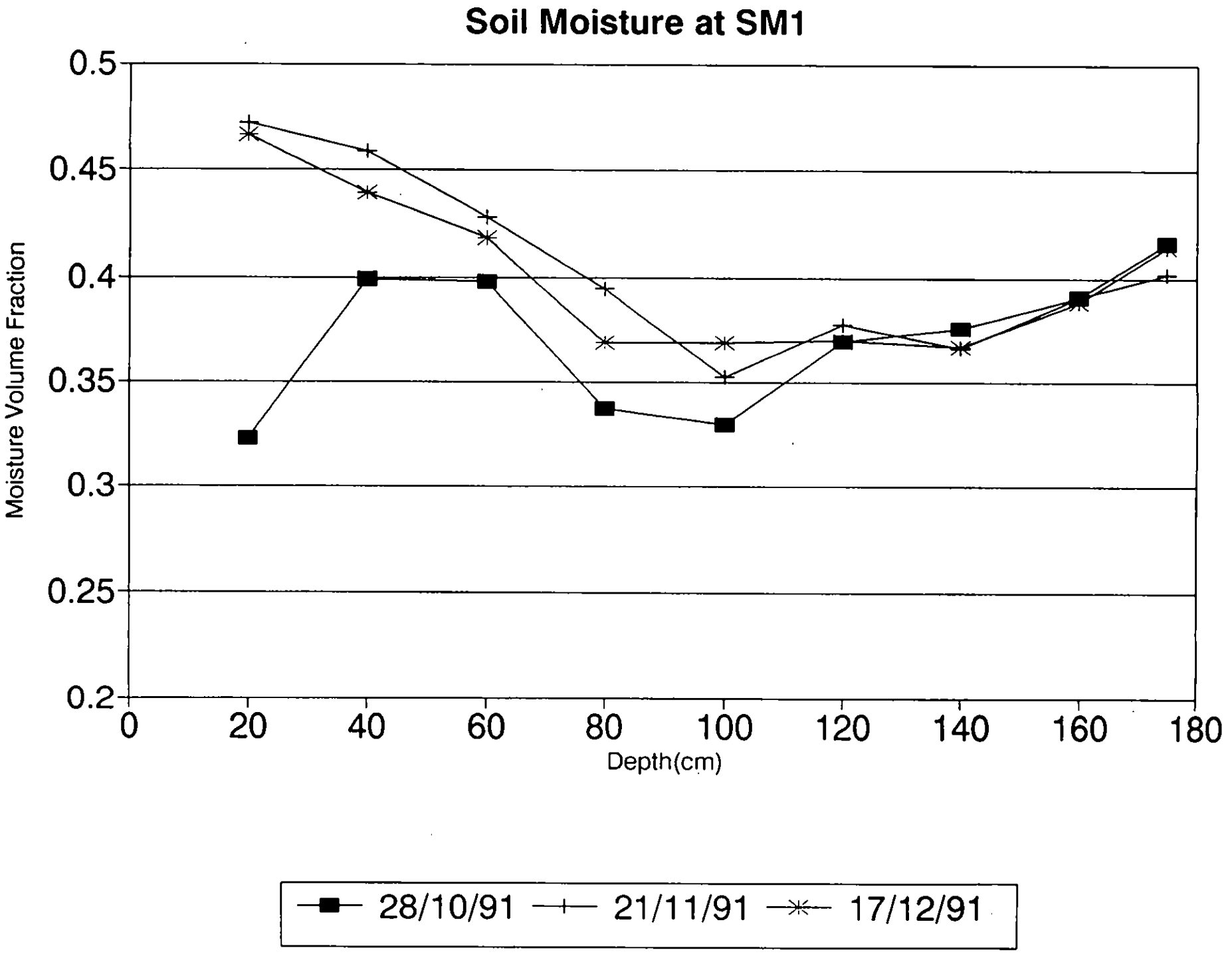
VOLUMETRIC AND TOTAL PROFILE WATER CONTENTS

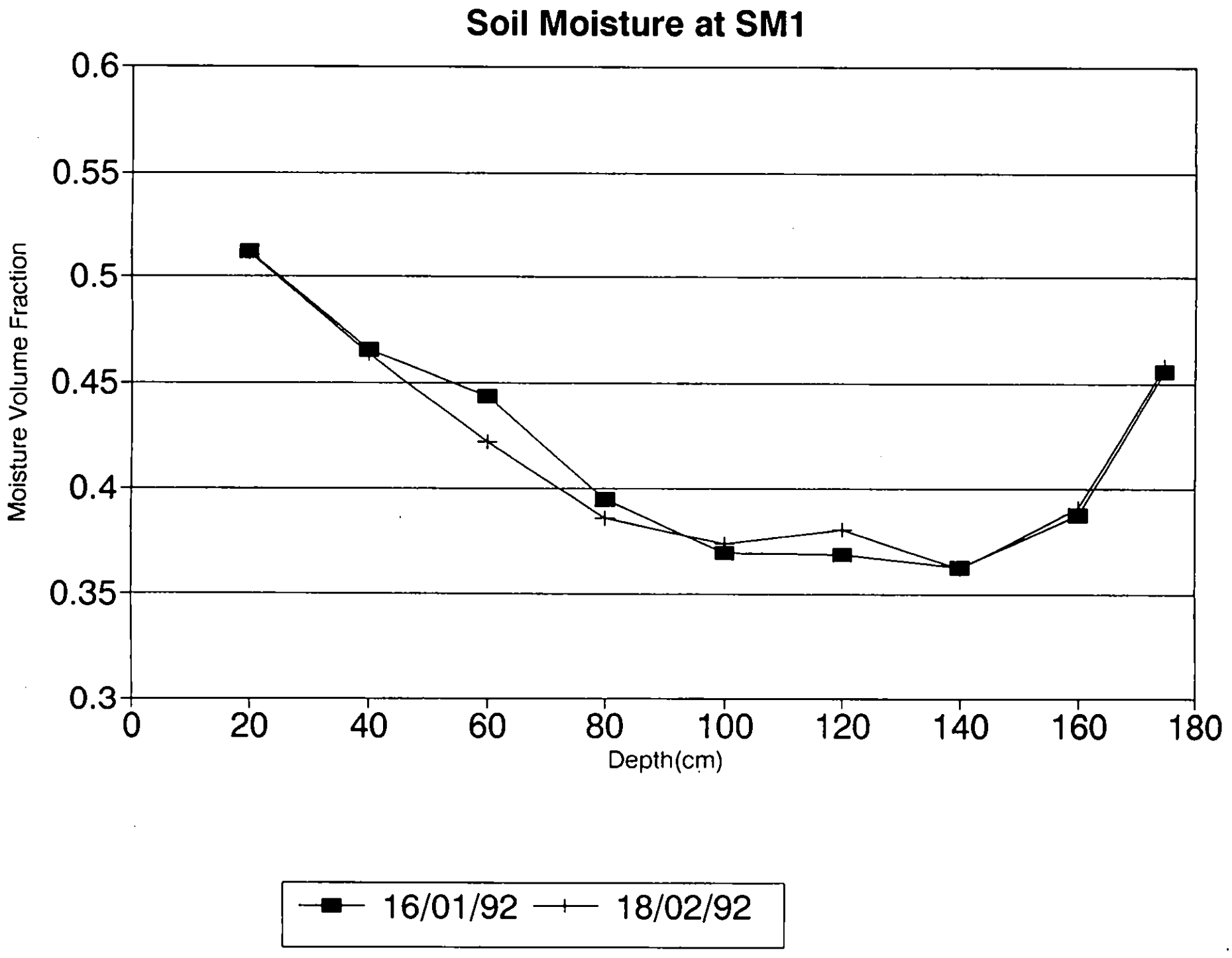
DEPTH cm.	20	40	60	80	100	120	140	160	180	200	210	TOTAL mm.
21/ 8/91 1200	.225	.252	.322	.326	.307	.380	.407	.408	.358	.394	.364	741.9
28/10/91 1200	.239	.309	.313	.330	.304	.403	.436	.420	.346	.395	.417	751.0
21/11/91 1200	.334	.375	.370	.379	.379	.392	.406	.413	.359	.399	.351	827.8
17/12/91 1200	.357	.357	.327	.352	.326	.393	.412	.409	.365	.404	.366	805.7
16/ 1/92 1226	.385	.371	.354	.367	.367	.392	.400	.423	.349	.399	.366	825.3
18/ 2/92 1447	.374	.384	.349	.339	.303	.331	.394	.402	.359	.366	.339	810.6
MEAN VALUE	.318	.348	.339	.345	.332	.362	.404	.411	.358	.385	.335	795.4

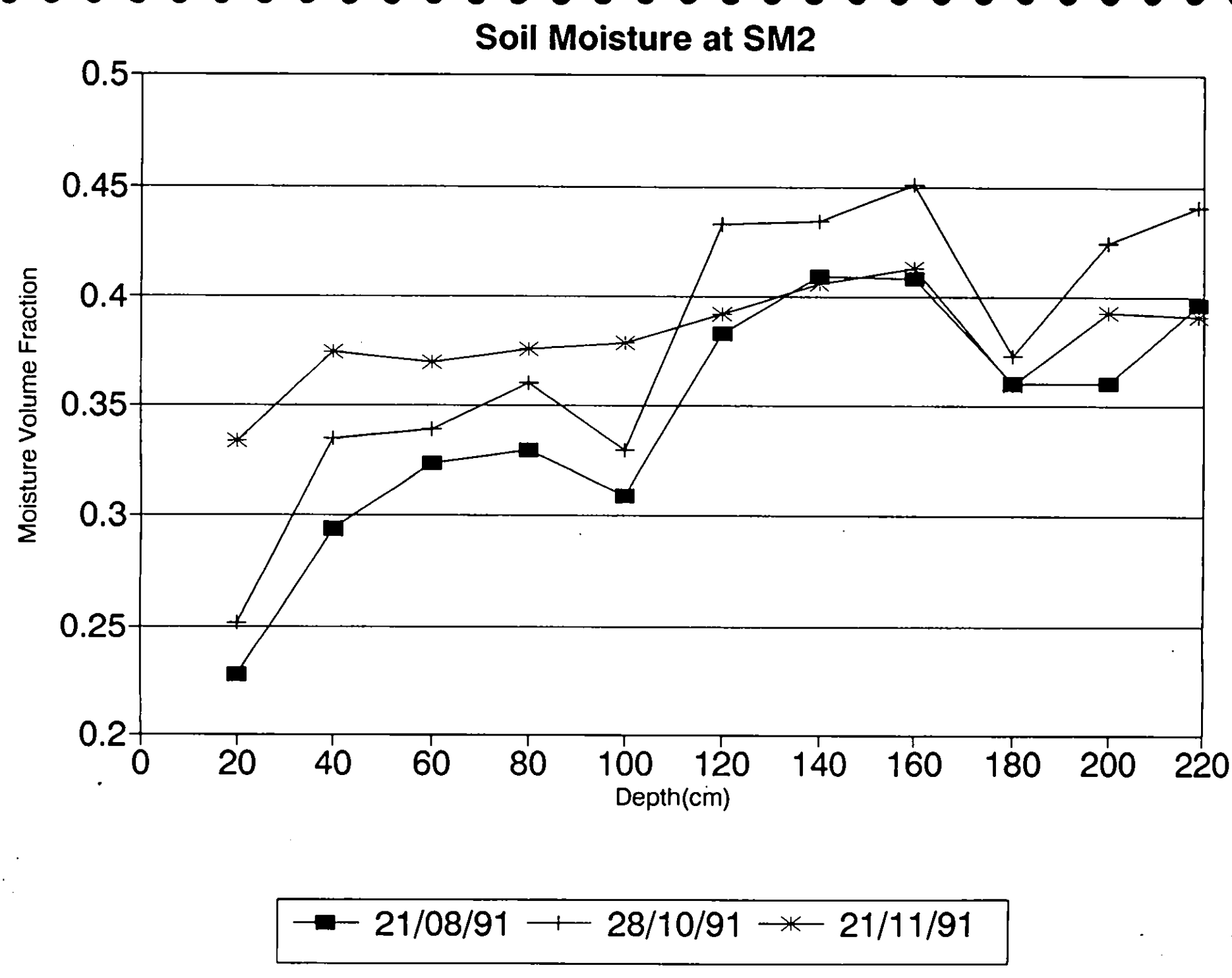
Printed on 09-03-92 at 10:11:01 hrs .

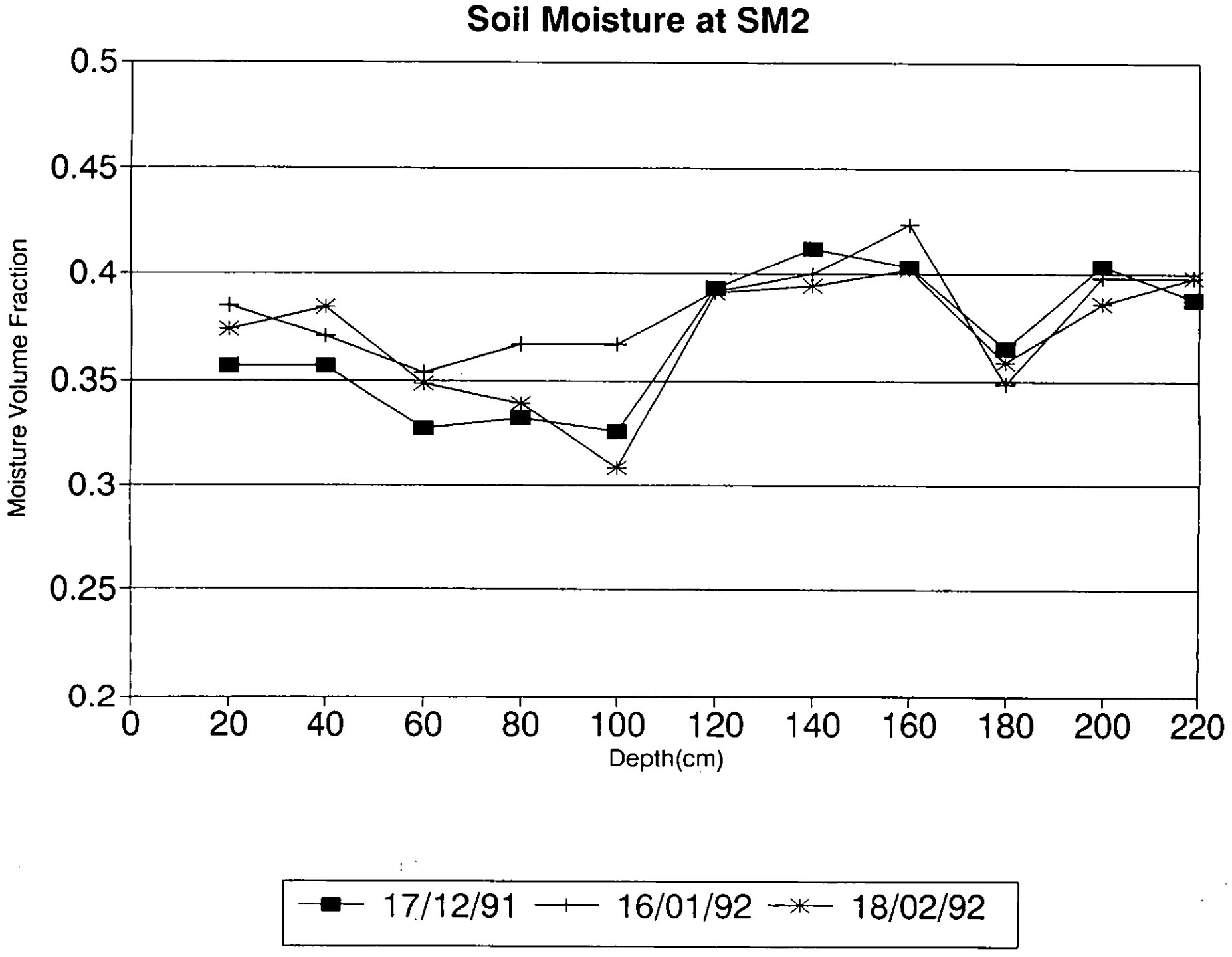

Soil Moisture at SM1
Moisture Volume Fraction
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0
20
40
60
80
100
120
140
160
180
Depth(cm)
19/03/91
16/05/91
12/06/91


Soil Moisture at SM1
Moisture Volume Fraction
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0
20
40
60
80
100
120
140
160
180
Depth(cm)
17/07/91
21/08/91
19/09/91


Soil Moisture at SM1
Moisture Volume Fraction
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0
20
40
60
80
100
120
140
160
180
Depth(cm)
28/10/91
21/11/91
17/12/91


Soil Moisture at SM1
Moisture Volume Fraction
0.6
0.55
0.5
0.45
0.4
0.35
0.3
0
20
40
60
80
100
120
140
160
180
Depth(cm)
16/01/92
18/02/92


Soil Moisture at SM2
Moisture Volume Fraction
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0
20
40
60
80
100
120
140
160
180
200
220
Depth(cm)
21/08/91
28/10/91
21/11/91


Soil Moisture at SM2
Moisture Volume Fraction
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0
20
40
60
80
100
120
140
160
180
200
220
Depth(cm)
17/12/91
16/01/92
18/02/92

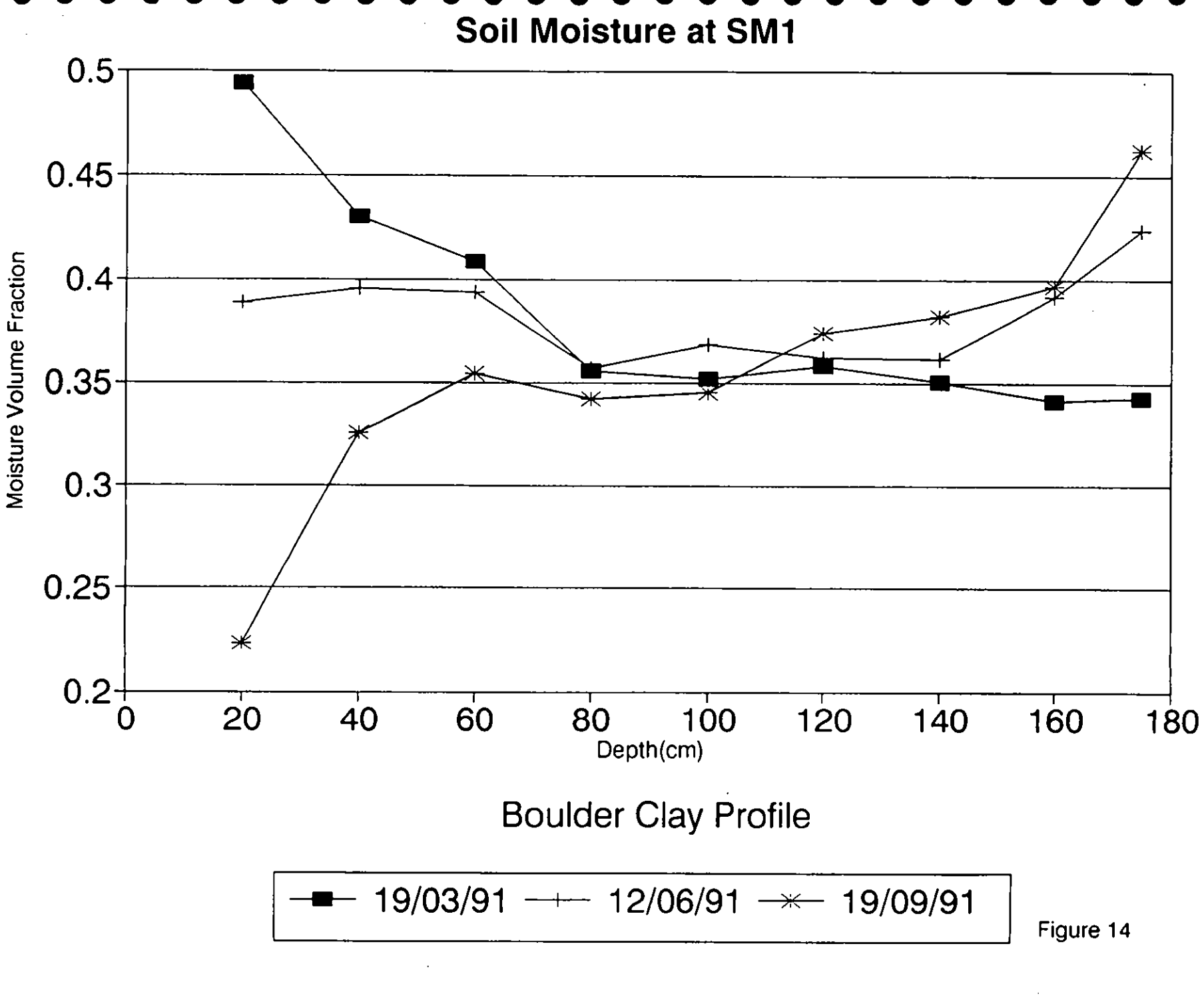

Soil Moisture at SM1
Moisture Volume Fraction
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0
20
40
60
80
100
120
140
160
180
Depth(cm)
Boulder Clay Profile
19/03/91
12/06/91
19/09/91

Figure 14

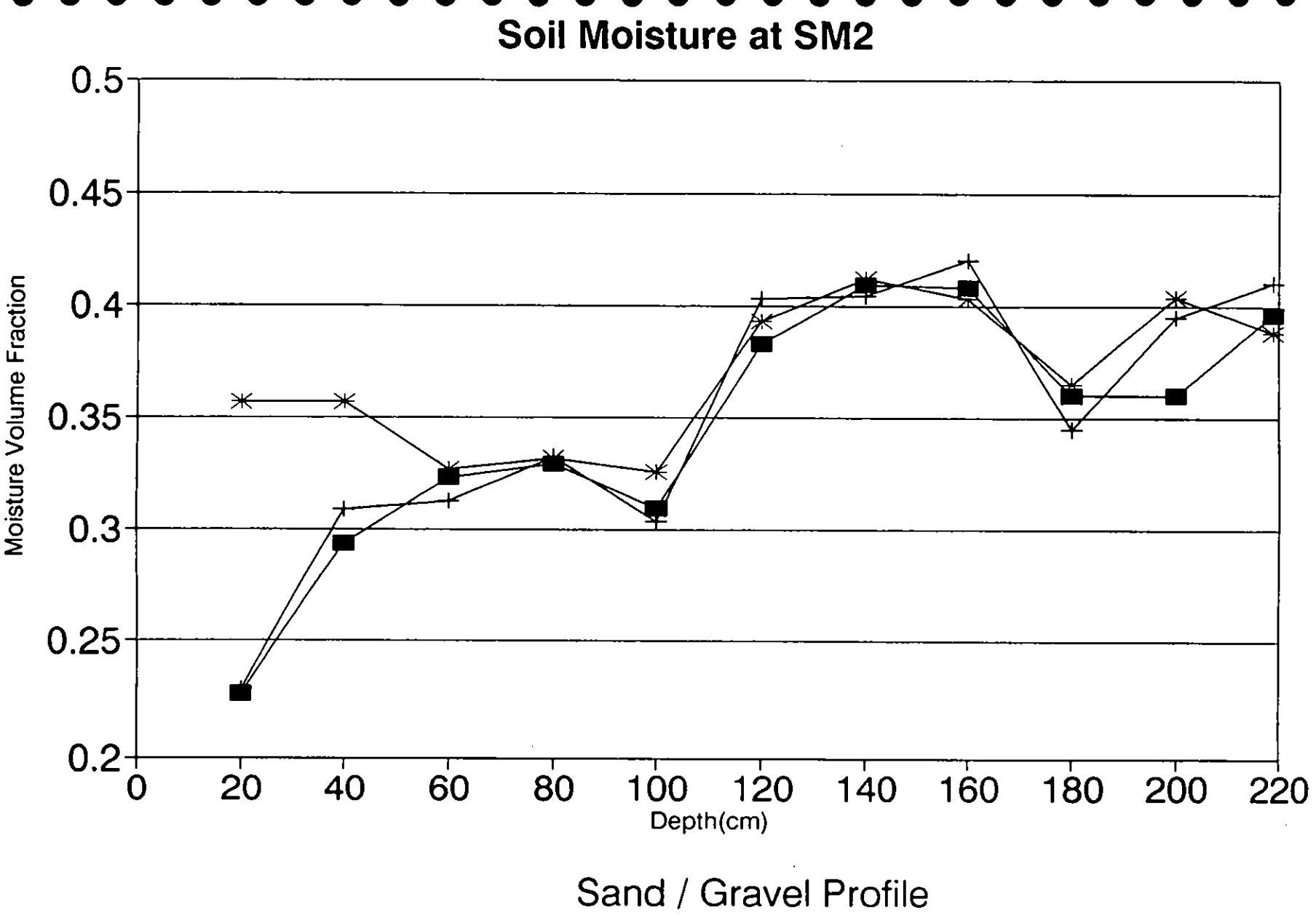

Soil Moisture at SM2
Moisture Volume Fraction
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0
20
40
60
80
100
120
140
160
180
200
220
Depth(cm)
Sand / Gravel Profile
21/08/91
28/10/91
17/12/91

Figure 15

Appendix VII

HISTORICAL DATA FROM KDC1 BOREHOLE

RECORD OF WELL (SHAFT OR BORE)

185

N.S. 186 ?
O.S. 52 NW.
Reg. 185 / 191

191

At: Cransley reservoir

Town or Village: Kettering County: Northants Six-inch quarter sheet: 31NE

Exact site: SP 87 NW 8041 7685 (Tracing from 6-inch map or from a map is very desirable)

in parish of: Mawsley

Level of ground surface above sea-level (O.D.) ____ ft. If well starts below ground surface, state how far ____ ft.

Shaft ____ ft., diameter ____ ft. Bore ____ ft. Diameter of bore: at top ____ ins.; at bottom ____ ins.

Details of permanent lining tubes (internal diameters preferred) ____

SP87/33

Water struck at depths of (feet): c 132m.

Rest-level of water below/above top of well ____ feet. Suction at ____ feet. Yield on ____ hours'/days' test ____ gallons per ____ (with pump of capacity ____ g.p.h.); depressing water level to ____ feet below top. Time of recovery ____ hrs. Amount normally pumped daily ____ g.p.h. for ____ hours.

Quality (attach copy of analysis if available) ____

Sunk by: Isler and Co. for ~~Mr.~~ Kettering U.D.C. Date of well: June 1934

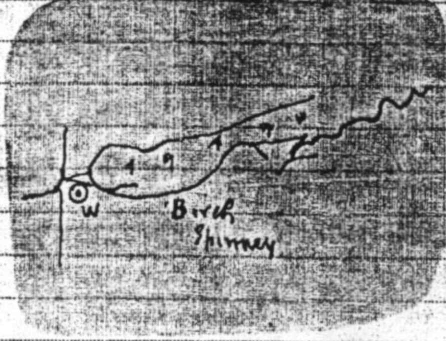
Information from ____

(For Survey use only). GEOLOGICAL CLASSIFICATION.	NATURE OF STRATA (and any additional remarks).	THICKNESS Feet.	THICKNESS Inches.	DEPTH Feet.	DEPTH Inches.
	Ground soil	2	0	0.61 2	0
	Ironstone and ballast	5	0	2.13 7	0
	Ironstone	6	0	4.0 13	0
	Ironstone and bluestone 5. Sm	5	0	5.5 18	0
	Blue clay	15	0	10.1 33	0

This is almost certainly the boring put down by Islers for Kettering UDC in 1934 west of the west end of Birch Spinney ½ mile W of Cransley Lodge.
A well was sunk on or close to site soon afterward.

S.E. Hollingworth
1/3/42

Reported to have yielded 180000 gpd.
see Harrington File (Air Ministry)



135 SP87/33 Mr Spires 185/191

Borough of Kettering

191

J. P. HAUGH, F.S.I.,
M. INST. M & CY. E., A.M.I.W.E.,
BOROUGH SURVEYOR AND
WATER ENGINEER

FRANK SMITH,
A.M. INST. C.E.
M. INST. M. & CY. E.
A.M. INST. W.E.
ACTING BOROUGH SURVEYOR
AND WATER ENGINEER.

TELEPHONE No. 2662 (2 LINES)

Surveyor's Department,
3 Gold Street,
Kettering.

YOUR REF. 185/191/R.H.S.
OUR REF. FS/DS.

16th July 1942.

Dear Sir,

Wells and Bore Holes.

I thank you for your letter of the 14th instant in connection with the above, and have pleasure in supplying you with the necessary information on this matter, which is as follows:-

During the 1933-1934 drought, a bore hole was sunk to a depth of 33 feet at Mawsley Wood which is the head of the stream which feeds one arm of the Cransley Reservoir. It was found that the last 13 feet of the bore hole was in the blue lias clay, and the bore hole did not provide sufficient water to keep a large pump running, so that operations were stopped.

In order to increase the flow supplying the stream which feeds the reservoir, trenches were sunk with a view to concentrating the springs at one point to facilitate pumping. Water obtained from the trenches was piped and conveyed into a well 32 feet deep, from which the water was pumped into the stream feeding the reservoir. The quantity pumped was approximately 180,000 gallons per day for a period of seven months.

The scheme was purely an emergency measure which was put into operation during the 1933-1934 drought and has not been used since that date.

If there is any further information you require on the subject, I shall be pleased to supply it.

Yours faithfully,

Frank Smith

Acting Borough Surveyor.

The Director,
Geological Survey & Museum,
London, S.W.7

W. Birch Spinney

Appendix VIII

DAILY RAINFALL RECORDS

Institute of Hydrology
Annual summary of daily data - Rainfall

Station number : 1 Name : cransley lodge rainfall

Basin no. : 0 Latitude : 0: 0: 0 N Longitude : 0: 0: 0 E Altitude : 134.15

Year : 1990/1991

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	-	-	-	-	-	-	-	1.50	.00	.50	.00	.00
2	-	-	-	-	-	-	-	.00	.00	4.00	.00	.00
3	-	-	-	-	-	-	-	.50	.00	6.50	.00	.00
4	-	-	-	-	-	-	-	3.50	.00	.00	.00	.00
5	-	-	-	-	-	-	-	.00	2.00	.50	.00	.00
6	-	-	-	-	-	-	-	.00	1.00	2.00	4.50	.00
7	-	-	-	-	-	-	-	.00	.50	4.00	8.50	.00
8	-	-	-	-	-	-	-	.00	2.00	1.00	.50	.00
9	-	-	-	-	-	-	-	.00	1.50	.00	.00	.00
10	-	-	-	-	-	-	-	.00	.50	.00	.00	.00
11	-	-	-	-	-	-	-	.00	1.00	.00	.00	.00
12	-	-	-	-	-	-	-	.00	2.00	.50	.00	.00
13	-	-	-	-	-	-	-	.00	2.00	.00	.00	.00
14	-	-	-	-	-	-	-	.00	.00	.00	.00	.00
15	-	-	-	-	-	-	-	1.50	14.50	.00	.00	1.50
16	-	-	-	-	-	-	-	1.00	1.50	.00	.00	.50
17	-	-	-	-	-	-	-	2.50	.00	.00	.00	.00
18	-	-	-	-	-	-	-	.00	3.00	7.50	.00	.50
19	-	-	-	-	-	-	-	.00	4.50	.00	.00	.00
20	-	-	-	-	-	-	-	.50	.00	.00	.00	.00
21	-	-	-	-	-	-	-	.00	1.00	.00	.00	.00
22	-	-	-	-	-	-	1.00	.00	1.00	.00	3.00	3.00
23	-	-	-	-	-	-	.00	.00	14.50	.50	.50	2.00
24	-	-	-	-	-	-	.00	.00	.00	4.00	.00	.00
25	-	-	-	-	-	-	.00	.00	7.00	4.50	.00	2.00
26	-	-	-	-	-	-	.00	.00	2.00	.00	.00	2.00
27	-	-	-	-	-	-	.00	.00	10.00	.00	.00	25.00
28	-	-	-	-	-	-	.00	.00	.00	.00	.00	13.00
29	-	-	-	-		-	16.50	.00	.00	.00	.00	6.00
30	-	-	-	-		-	11.00	.50	.00	1.00	.00	.00
31	-		-	-		-		.00		13.50	.00	
Total	-	-	-	-	-	-	-	11.5	71.5	50.0	17.0	55.5
Maximum	-	-	-	-	-	-	-	3.5	14.5	13.5	8.5	25.0

Rainfall in millimetres

Insufficient data for annual statistics

Possible data flags

Missing - flag "-" Original - no flag set Estimate - flag "e"

Printed on 10/ 3/1992

Institute of Hydrology
Annual summary of daily data - Rainfall

Station number : 1 Name : cransley lodge rainfall

Basin no. : 0 Latitude : 0: 0: 0 N Longitude : 0: 0: 0 E Altitude : 134.15

Year : 1991/1992

	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
1	.50	6.00	.00	.00	.00	-	-	-	-	-	-	-
2	.00	.00	.00	.00	.00	-	-	-	-	-	-	-
3	.50	3.00	.00	.00	1.00	-	-	-	-	-	-	-
4	.00	9.50	.00	6.00	.50	-	-	-	-	-	-	-
5	1.50	1.00	.00	3.50	.00	-	-	-	-	-	-	-
6	.00	.50	.00	.50	.00	-	-	-	-	-	-	-
7	.00	1.00	.00	.00	.00	-	-	-	-	-	-	-
8	.00	3.00	.00	7.50	.00	-	-	-	-	-	-	-
9	1.00	.50	.50	23.50	2.00	-	-	-	-	-	-	-
10	.00	.50	.00	.50	1.50	-	-	-	-	-	-	-
11	.00	2.50	.00	.00	1.00	-	-	-	-	-	-	-
12	.00	5.00	.00	1.00	6.00	-	-	-	-	-	-	-
13	.00	.00	.00	.00	.00	-	-	-	-	-	-	-
14	.50	.00	.50	.50	1.50	-	-	-	-	-	-	-
15	.00	.00	1.00	.00	.00	-	-	-	-	-	-	-
16	3.00	.00	1.50	.50	.00	-	-	-	-	-	-	-
17	1.00	4.00	6.50	.00	.00	-	-	-	-	-	-	-
18	.50	8.00	3.50	.00	3.00	-	-	-	-	-	-	-
19	.00	24.50	.50	.50	-	-	-	-	-	-	-	-
20	.00	.00	2.50	.00	-	-	-	-	-	-	-	-
21	.00	1.00	3.00	.00	-	-	-	-	-	-	-	-
22	.00	.00	.50	.00	-	-	-	-	-	-	-	-
23	.00	.00	2.50	.00	-	-	-	-	-	-	-	-
24	.00	.00	.00	.00	-	-	-	-	-	-	-	-
25	1.00	.00	.00	3.00	-	-	-	-	-	-	-	-
26	.00	.00	.00	.50	-	-	-	-	-	-	-	-
27	.00	.00	.00	.00	-	-	-	-	-	-	-	-
28	.50	.50	.00	.00	-	-	-	-	-	-	-	-
29	1.50	.00	.00	.00	-	-	-	-	-	-	-	-
30	7.50	.00	.00	.00		-	-	-	-	-	-	-
31	1.00		.00	.50		-		-		-	-	
Total	20.0	70.5	22.5	48.0	-	-	-	-	-	-	-	-
Maximum	7.5	24.5	6.5	23.5	-	-	-	-	-	-	-	-

Rainfall in millimetres

Insufficient data for annual statistics

Possible data flags

Missing - flag "-" Original - no flag set Estimate - flag "e"

Printed on 10/ 3/1992

Appendix IX

HYDROCHEMICAL DATA

Winter Season Samples — Date Collected : 11-04-1991

Sample Locations

1. Pipe Outfall near KDC1
2. Drainage ditch past P1
3. Hydraulic Ram at S1
4. Village Stream at S2
5. Land drain outfall near Mawsley Lodge at S5
6. Land drain seepage near S7
7. Stream at Railway Bridge at S4
8. Groundwater from Pleistocene "Gravel" sand in BH6
9. Groundwater from Northampton Sand in BH2

Summer Season Samples — Date Collected : August - September 1991

Sample Locations

1. P1 Pipe Outfall near KDC1 on 21.08.91
2. P1 Pipe Outfall near KDC1 on 19.09.91
3. S1 Hydraulic Ram Weir on 21.08.91
4. S1 Hydraulic Ram Weir on 19.09.91
5. S5 Land Drain Outfall near Mawsley Lodge on 21.08.91

LYNE, MARTIN & RADFORD

Analysis & Consultancy Serving Society

25-27 Britten Road, (off Elgar Road South), Reading, Berkshire RG2 0AU
Telephone: (0734) 868877 Fax: (0734) 872614

CLIENT NAME: Mr N. Runnalls, Institute of Hydrology, Wallingford
OX10 8BB

CLIENT REF: Samples 1 - 9
ORDER NO: T62K 005024

DATE: 2nd July 1991

RECEIVED: 20/5/91

LAB NO: W9100212/1 - /9

RESULTS

Sample No	1	4	7	8	9
Calcium mg/l	183	184	168	322	122
Magnesium mg/l	18.8	12.9	19.8	55	5.2
Sodium mg/l	13.8	5.8	11.7	68	1.3
Potassium mg/l	1.6	<1	1.5	4.2	3.5
Iron μg/l	<5	<5	<5	<5	<5
Carbonates mg/l	20	0	0	0	20
Bicarbonate mg/l	300	190	250	150	210
Chloride mg/l	30	25	30	50	30
Sulphate mg/l	115	90	160	755	55
Nitrate mg/l as N	0.2	4.1	3.6	3.5	13.6
T.D.S. mg/l	595	390	560	1710	490

Sample No	2	3	5	6
Chloride mg/l	40	30	25	25
Iron μg/l	15	<5	<5	<5

Carol L. Bys

~~PUBLIC~~ ANALYST

Entered 1/10/91

LYNE MARTIN AND RADFORD LIMITED

CERTIFICATE OF ANALYSIS

N. Runnalls,
Institute of Hydrology,
Wallingford,
Oxfordshire OX10 8BB.

Date: 10 February 1992

Laboratory No: W9200021/TW
Client Order No: 007398
Of 5 samples of Water
Marked P1 21.8.91; P1 19.9.91 Pipe Outfall; S1 21.8.91; S1 19.9.91; S5 21.8.91
Received 23.01.92

I hereby certify that examination of the above mentioned sample gave the following results:

	1	2	3	4	5
Calcium as Ca	100	160	115	120	155
Magnesium as Mg	17	14	13	13	17
Sodium as Na	15	17	15	14	13
Potassium as K	2.4	5.3	1.8	2.1	4.1
Iron as Fe	0.11	0.47	0.03	0.16	0.14
Carbonate as CO_3	0	0	0	0	0
Bicarbonate as HCO_3	185	295	190	160	205
Chloride as Cl	25	30	30	30	20
Sulphate as SO_4	125	120	120	115	160
Nitrate as NO_3	0.04	9.9	0.08	<0.04	27.0
Total Dissolved Solids	475	575	490	465	622

Carol R. Boynes

CAROL R. BOYNES
PUBLIC ANALYST

PLEASE NOTE THE ABOVE SAMPLE(S) WILL BE DISPOSED OF 14 DAYS AFTER THE DATE OF THIS REPORT UNLESS ADVISED OTHERWISE BY YOURSELVES.

CRANSLEY LODGE

Regional Hydrochemistry of groundwater from Jurasssic sediments

	per h per 100,000					
	1	2	3	4	5	6
Physical Character						
Reaction	Alkaline		-	-	-	-
Colour	Clear Pale Blue	Opalesance	-	-	Slightly Yellowish	
Suspended Matter	Nil	Small	Heavy	-	Very Small	-
Task	Nil	Nil	-	-	-	-
Odoour when warmed to 37°C	Nil	Nil	-	-	-	-
Chemical Character						
Total Solid dried @ 100°C	41.00	55.6	60.2	58.5	57.6	60.0
Loss on ignition	1.5	-	-	-	-	-
Chlorine	1.45	2.23	1.40	2.40	3.08	2.10
Chlorine x 1.647 = Sodium Chloride	2.38	3.67	2.31	3.96	5.08	3.47
Silica					3.35	
Nitrates	Nil	-				
Nitrogen as Nitrates	0.16	-	0.03	0.60	-	0.04
Nitrogen as Nitrates	-	-	Nil	Nil		Nil
Saline Ammonia	Nil	0.001	0.001	0.0004	Nil	0.0004
Albuminoid Ammonia	0.002	0.003	0.002	0.0026	-	0.0012
Oxygen absorbed in 3 hours @ 37°C	0.014	0.14	0.13*	0.038	-	0.02*
Hardness - Total	29.0	25.5	46.0	47.5	41.7	48.6
Temporary	20.0	20.2	37.0	36.0	24.3	37.8
Permanent	9.0	5.3	9.0	11.5	17.4	10.8
Lead	Nil	-	Nil	Nil	-	Nil
Copper	Nil	-	Nil	Nil	-	Nil
Iron Oxide & Alumina	-	-	-	-	0.67	-

1. Rothwell UDC Water Supply (1934)
2. Pytchley (1901) Upper Estueron Limestone * @ 100°C
3. Orlingbury 27/9/1934 Northampton Sand + 4 hours @ 27°C
4. Orlingbury 28/1/1936 + 4 hours @ 27°C
5. Market Harborough 25/10/1935
6. Burton Latimer UDC 25/10/32 + 4 hours @ 27°C

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