LV-2007/002

Lower Þjórsá River Basin

Hydroelectric Projects

Geological Investigations 2006

Landsvirkjun

Janúar 2007

Landsvirkjun

Lower Þjórsá River Basin

Hydroelectrical Projects

Geological Investigations 2006

Almenna Consulting Engineers

January 2006

Landsvirkjun

Key page

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Title: Lower Þjórsá River Basin
Hydroelectirc Project
Geological investigation 2006

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Prepared for: Landsvirkjun

Co operators: Jarðfræðistofan ehf., ÍSOR

Abstract: The report contains prelimiary information regarding geological investigation carried out 2006 for the Hydroelectric project of Hvammsvirkjun and Holtavirkjun. The information consist of borehole logs geological sections and informations of tests in holes and on core (Lugeon and Point load tests) Maps of surface deposits, general geology and basic geographic featurs are included. Reports of pump test and geophysical survey for Hvammsvirkjun are also included. Information regarding the third Hydropower Project, Urriðafossvirkjun are also included but as the investigation is still in progress they are less detailed than for the other projects.

The data in the report is still in draft form and is therefore subject to change

Keywords: Geology, Hvammsvirkjun, Holtavirkjun, Urriðafossvirkjun, Corelogs Lugeon tests Point load tests pump test seismic refraction surveyactive fissures temperature measurments Þjórsá Lava

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Landsvirkjun's project manager's signature

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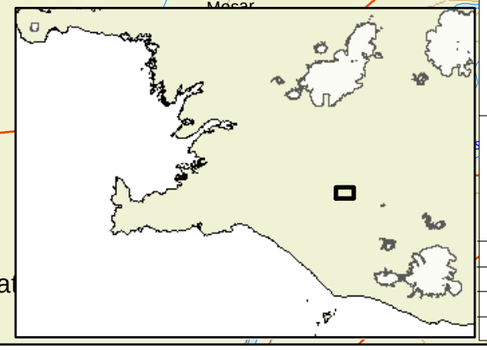
Hliðarfjall
Selgil
Mógilsbjargarg
Svörtubjargarg
Gylta
Galti
Núpstúnskista
Hlíðarkista
(Grjótsel)
Þorbjargarmúli
Þorsteinskrókur
Þorsteinsstaðaholt
Galtafell
Smárahlíð
Hrunamannahreppur
Skeiða- og Gnúpverjahreppur
Kálfá
Langagil
Mástungnafjall
Brúnir
(Ásasel)
Söðulhóll
Þverá
Smádalir
Þjófagil
Fangabrekka
Sandártungur
Þjór
Smárahlíð
Hlíð
Minni-Mástunga
(Þorsteinssel)
Vörðukinn
Svartagljúfur
Nónhjúfur
Selfitafjall
Núpsskógur
Núpstún
Skyggnir
Fossagil
Brúnir
Borgarhóll
Tungá
Stóra-Mástunga
Skyggnir
Villingadalsfjall
Ásólfsstaðanes
Þjórsá
Lambhagi
Nípa
Krókur
Krókholt
(Hliðargerði)
Hellnagil
Brandsgil
Skyggnir
Hagafjall
Urðarásar
Steinkerabrekkur
Síki
Öldumelar
Skeiða- og
Rangárþing
Hamarsklauf
Steinsholtsfjall
Kálfagil
Langimelur
Goluduður
Gaukshöfði
Miðtangi
Örnhóll
Hólahnúkar
Litlagjósta
Grettisgeil
Stekkjarás
Þverá
Fossnesgljúfur
Skyggnisfoss
Hrútaklettur
Hamar
Kringlutjörn
Kóngsás
Skógarhóll
Fossnes
Brattahlíð
Gaukshöfðavað
Stóra-Laxá
Steinsholt
Hellnaholt
Líkný
Myrarskógur
Hælsmýri
Langatjörn
Hamarsheiði
Háls
Móar
Viðihlíð
Háholtsfjall
Þvergil
Hæll
Lækjabrekka
Háholt
Hagi
Yrjaskeri
Þjórsá
Krókur
Austurhlíð
Steinholtsmýri
Ásar
Hamarsholt
Melhagi
Háholt
Tryni
Ásbrekka
Kambsholl
Hamraholt
Hamragil
Tíðholt
Ásamýri
Miðfell
Hagavað
Yrjaós
Skarfaneslækur
(Skarfanes)
(Ósgröf)
Litlilækur
(Forna-Skarfanes)
Hagaey
Karl
Karlsnes
Vaðeyri
Líknýjarhólmi
(Yrjar)
(Gamla-Ósgröf)
Langholt
Stórholt
Núpsmýri
Stórinúpur
Bæjarnes
Vestra-Geldingaholt
Eystra-Geldingaholt
Löngudæl
Leiti
Skaftholtsfjall
Skeljaholl
Núpsfjall
Yrjaheiði
Síðunes
Fagurholl
(Hamrar)
Hamratunga
Minninúpur
Ferjuhöfn
(Skarðssel)
Bæjarneshraun
Skaftholt
Hushólll
Nónásar
Reykjanes
Ármes
Réttarholt
Múli
Fimmhundraðarétt
Minnanúpshólmi
Gilsárholl
(Gamla-Skarðssel)
Fagurholl
Merkurhra
Skaftholtsrétt
Grenshals
Núpsheiði
Hvítaskriða
Skarðsheiði
(Eskiholt)
Grænaflöt
Merkurhraun
Grálaufsflesja
Hofsheiði
Hraunhólar
Knarrarholt
Þjórsárholtshólt
Olmóósey
(Á)
Hrossahnúkar
Litlivöllur
(Mörk)
Stórahof
Þjórsárholt
Krókur
Skarðsfjall
Miðmorgunsholt
Varmahraun
Vaðvöllur
Hrosshylur
Mosar
(Norðurgarður)
Ferjuklettur
Baðsheiði
Dagmálaholl
Hvammur
(Hvammshjáleiga)
Grávallahólar
(Árbær)
(Gloppa)
Búðafoss
Árbæjarheiði
Vaðeyri
Tjarnatorfa
Blindabrún
Vindásnes
Nautavað
Vindáshólmi
Vaðvöllur
Hruni
Krókatorfa
Vindásós
Fjártangi
Miðfell
(Skarð)
(Erill)
Garðatjörn
Baðheiðarhóll
Vindás
Víxlahnúkur
Hellar
(Hátún)
Skarð
Engigarður
Flatahraun
(Gamli-Galtalækur)
Tjarnalækur
Stóruvallarrétt
(Múli)
Skógafoss
Miðás
(Fellsmúli)
(Króktún)
Stórikloft
Fellsmúli
Flagbjarnarholt
Pinghóll
Tjakelda
Vindástjörn
Flagbjarnarholt
Hruni
Magnhildartjörn
Brúarlundur
Borgarbæli
Tjarnalækur
Minnivellir
Leirtjörn
Stórholt
Dráttarhóll
Stóruvellir
Borg
Miðmelabót
Höfði
Kolbeinsholt
Heysholt
Minnivallalækur
Stóruvellir
Borgarsíki
0 500 1.000 1.500 2.000 m



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HVAMMSVIRKJUN
HYDROELECTRIC PROJECT
HVAMMSVIRKJUN
LOCATION MAP

Hannað	ÁÓT	Athugað	JS	M.	1:50.000
Samþ.	SPS			Kt.	
Dags.	Des. 2006	Nr.	1227.110-J-002		

Áritanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179


20051216.102918 /gis/i/ah/n-thjorsa/aa_busk_gsj.aml
Búðafoss - Núpur
Jarðfræðikort - Geological map
THI Búrfellshraun 1100 f.Kr.
Burfell lava, 1100 BC
THB Þjórsárhraun 6600 f.Kr.
The great Thjorsa lava, 6700 BC
Laust yfirborðsset og mýrlendi
Loose overburden
TSG Foksandsteinn
Aeolian sandstone (Tephra sand group)
UTS Siltsteinn og jökulgarðar frá síðjökultíma
Late glacial siltstone and end-moraines
HIB Hlýskeiðshraun í Holtum, öl.basalt (N)
Holt interglacial basalt
LTS Neðra jökulberg/silt
Lower tillite/silt series
HIT Hlýskeiðsþóleiít í Hreppum(N)
Hreppar Interglacial tholeiites
SKH Móberg í Skyggni
Skyggnir hyaloclastite
NP5 Efra Fossnesþóleiít (R)
Upper Fossnes tholeiite
NP4 Fossnesjökulberg
Fossnes tillite
NP3 Neðra Fossnesþóleiít (R)
lower Fossnes tholeiite
NSH Núpsmóberg (R)
Núpur hyaloclastite formation
NSH Minnanúpsþóleiít (R)
Minninúpur tholeiite
NSH Núpsset
Núpur sedimentary series
SPG Skarðsfjallsdílabasalt (R)
Skarðsfjall porphyritic group
NTG Skarðsfjallsset
Sedimentary layer in Skarðsfjall north
NTG Núpsþóleiít (R)
Núpur tholeiite group
SH3 Innskot í Skarðsfjalli (N)
Skarðsfjall intrusive rock
SH2 Skarðsfjallsmóberg (N)
Skarðsfjall hyaloclastite
SH1 Þjórsárholtsset
Þjórsárholt sedimentary group
STG Víxlahnjúkur, dílabasdalt (N)
Víxlahnjúkur porphyritic basalt layer
STG Skarðsfjallsþóleiít efri hl. (N)
Upper Skarðsfjall tholeiitic group
STG Skarðsfjall, set
Sediments inside Skarðsfjall thol. group
STG Skarðsfjall þóleiít Neðri hl. (N)
Skarðsfjall lower tholeiite group
LPG Líparítgjóska
Rhyolite, tuff and ignimbrite
LPH Líparírhraun eða innskot
Rhyolite lava or intrusion
GL Geldingaholtsmyndun (innskot ofl.)
Geldingaholt complex (basic intrusions)
Misgengi og sprungur
Faults and fissures
Jarðskjálftasprunga
Earthquake fissure
Berggangur
Dyke
Strik og halli
Dip and strike
Lind < 100 l/s
Spring < 100 l/s
Stór lind > 100 l/s
Spring > 100 l/s
Lindasvæði > 100 l/s
Spring area > 100 l/s
Hverir, laugar
Hot spring
Rétt segulstefna
Normal paleomagnetism
Öfug segulstefna
Reverse paleomagnetism
Borhola
Drillhole
Vatnsból
Water supply
Jarðlagasnið
Geologic section
Árni Hjartarson, Páll Einarsson
og Snorri P. Snorrason 2001.
Keiluvörpun, viðmiðun ISN93
Unnið í landfræðilegu upplýsingakerfi
(Arc/Info®).
© Orkustofnun, Reykjavík
Byggt á/ Based on:
Ingvar B. Friðleifsson o.fl. 1980:
Gnúpverjahreppur, jarðfræðikort
Maryam Khodayar and Páll Einarsson 2001:
Geological map of Núpur area
Páll Einarssonar et al. 2001:
Faults and fractures near the SISZ near Þjórsá
Snorri Páll Snorrason 2002:
Núpsvirkjun Preliminary Geological Report
Orkustofnun: Borholuskrá
Drawing 1
20051216
0
1
2 km
Grímshólar
Núpstún
Hríshólar
Fótarholt
Vatnsás
Örnhóll
Hólahnúkar
Grjótás
Hjallás
Krókshólt
Hamar
Gjósta
Háholtsfjall
Kolgrafarholt
Hreppshólar
Matseld
Þvergil
Sauðhúsbakki
Hólakot
Háholt
Hælsmýri
Stóra-Laxá
Laxárholt
Glórugil
Ásbrekka
Gönguskörð
Kumbutjarnir
Knarrarholt
Langholt
Nánasar
Geldingaholt
Tjarnarholt
Tíðholt
Stórholt
Fagurhóll
Skyggnir
Tröllaskörð
Kambur
Einfaraholt
Skarð
Miðfjall
Dagmálaás
Þrándarskarð
Þrándarholt
Stöðulfell
Miðhúsafjall
Bólstaður
Miðhús
Kirkjuholt
Kálfá
Reykjanes
Árnes
Hofsheiði
Miðhúsahólmi
Stórahof
Miðmorgunsholt
Minnahof
Gálgaklettur
Þinghólar
Akbraut
Hestafoss
Hnúkar
Strymphóll
Lækjarey
Selhnúkur
Bjallar
Lækur
Lyngholt
Leira
Árneskvísl
Búðahraun
Búðatóttir
Búðafoss
Vindásnes
Setberg
Miðás
Flagbjarnarholt
Blautasund
Skammbeinsás
Þingholt
Illakelda
Stórholt
Heysholt
Hofsvaðsheiði
Brúnir
Borgarholt
Hlíðargerði
Fossag
Hellnagil
Fjárhúsgil
Grettisgeil
Steinsholt
Lækjarbrekka
Ásgeirsholt
Hæll
Hamraholt
Hamar
Brandsgil
Krókar
Stóru-Mástungur
Hundraðsfit
Austurhlíð
Ásar
Ásamýri
Löngudælaholt
Strýtuhóll
Fjallsmýri
Skaftholtsfjall
Skaftholt
Múli
Skeljahóll
Skaftholtsrétt
Núpsmýri
Stórinúpur
Þjórsárholt
Ferjuklettur
Hrosshylur
Varmahraun
Vaðvöllur
Þjórsá
Vaðeyri
Nautavað
Vindáshólmi
Vaðhólmi
Fjartangi
Vindás
Minnivallalækur
Árbæjarheiði
Mosar
Hruni
(Gamli-Vindás)
Brúarlundur
Minnivellir
Stóruvellir
Skjöldalir
Krókur
Ölmóðsey
Hákarlaklettur
Viðey
Skógarholt
Hólar
Engjagil
Bleiksteinsflatir
Hamarsheiðarfjall
Hamarsheiðargil
Borgarmýri
Kóngsás
Núpsgróf
Háls
Austurásar
Gráásmýri
Miðfell
Eyvindargil
Núpur
Minninúpur
Ferjuhólar
Hamarsheiði
Kálfagil
Hellnaholt
Skyggnir
Sauðhúsgljúfur
Stekkjarnes
Skyggnisforfur
Fossnes
Fossnesgljúfur
Hagaásar
Hagi
Langimel
Brattahlíð
Hagafjall
Urðarásar
Háhnúkur
Likny
Hagalækur
Villinga
Goludalur
Hagaey
Karl
Dýrasker
Hagavað
Vaðeyri
Karlsnes
Bæjarnes
Dauðsmannshóll
Yrjaheiði
Líknýjarhólmi
Skarfaneslæk
Svelti
(Skarðssel)
Gilárahóll
Skarðsheiði
Eskiholt
Hvítaskriða
Skarðsfjall
Grænaflöt
Miðfell
Hellar
Víxlahnúkur
Múli
Gravallahólar
Kroktún
Skarð
Klofalækur
Stóriklofi
Fellsmúli
Y=395000

Hagi

Þjórsá

Sk

NK-17

NK-26

NK-5

Stórinúpur

Núpur

Minninúpur

NK-8

Viðey

Hagaey

Karlsnessporður

Bæjarnessporður

NL-48 NL-47 NK-49 NK-48 NL-28 NL-02 NL-00 NL-08 NL-29 NL-05 NL-04 NL-30 NL-27 NK-21 NL-42 NL-16 NK-28 NK-31 NK-29 NK-30 NK-10 NK-34 NK-47 NL-25 NL-24 NL-23 NK-46 NK-32 NL-22 NL-21 NK-18 NK-19 NK-20 NK-33 NL-20 NL-18 NL-17 NL-1 NL-15 NL-14 NK-11

NL-31 NL-32 NL-33 NL-34 NL-35 NL-36 NL-37 NL-38 NL-39 NL-40 NL-41

NL-07 NL-08 NL-09

Vesturhraun

Bæjarnes

Austurhraun

Yrjaheiði

NK-1

Vesturjaðar

Austurjaðar

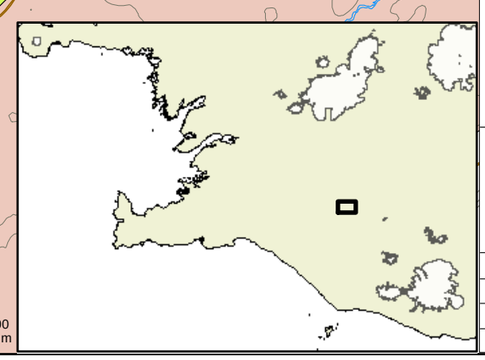
Skarðsheiði

Skarðsfjall

Hvammur

DRAFT

0 200 400 600 800 1.000 m



Legend

- Fluvial deposits
- Eolian soil
- Peat
- Þjórárhraun lava -Scoria
- Bedrock covered with discontious weathered material
- Core hole
- Percussion hole

Constructions according to Project Planning Report

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HVAMMSVIRKJUN HYDROELECTRIC PROJECT MAP OF SUPERFICIAL DEPOSITS

Hannað	ÁÓT	Athugað	M. 1:20.000
Samþ.	SPS		Kt.
Dags.	Jan. 2006	Nr.	1227.110-G-XXX

Áritanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179

Steinsholt
Lækjabrekka
Hæll
Steinholtsmýri
Austurhlíð
Ásar
Hamragil
Hamraholt
Kambshóll
Stórholt
Löngudæl
Núpsmýri
Skaftholtsfjall
Skeljahóll
(Hamrar)
Hamratunga
Skaftholt
Réttarholt
Múli
Fimmhundraðarétt
Skaftholtsrétt
Heiðarbrún
Núpsheiði
Hraunhólar
Knarrarholt
Þjórsárholtsholt
heiði
Varmahraun
Þjórsárholt
Hrosshylur
Vaðvöllur
Ferjuklettur
(Árbær)
Þjórsá
Vaðeyri
Árbæjarheiði
Nautavað
Vindáshólmi
Vaðvöllur
Vindásós
Fjártangi
Hruni
Stóruvallarrétt
Hellnaholt
Hamarsheiði
Víðihlíð
Háls
Móar
Hamarsholt
Ásamýri
Miðfell
Stórinúpur
Núpsfjall
Minninúpur
Ferjuhólar
Minnanúpshólmi
Hrossahnúkar
Krókur
Mosar
(Norðurgarður)
Hvammur
(Hvammshjáleiga)
Miðfell
(Skarð)
(Erill)
Víxlahnúkur
Garðatjörn
Hellar
(Múli)
(Fellsmúli)
Fellsmúli
Háholt
Hagi
Melhagi
Líkný
Krókur
Þjórsá
Yrjasker
Yrjaós
Skarfanestækur
(Yrjar)
Hagavað
Karl
Kerlingarnes
Hagaey
Vaðeyri
Líknýjarhólmi
Bæjarnes
Skeiða- og Gnúpverjahreppur
Rangárþing ytra
(Skarðssel)
Húsholl
Sílduholl
(Gamla-Skarðssel)
Grenisháls
Hvítaskriða
Grænaflöt
Yrjaheiði
Bæjarneshraun
Fagurhóll
Skarðsheiði
(Eskiholt)
Merkurhraun
(Mörk)
Litlivöllur
Skarðsfjall
Baðsheiði
Grávallahólar
Blindá
Skarð
(Króktún)
Stóriklofi
Fellsmúli

DRAFT

Legend

Active fissures and faults

- Skarðsfjall mapped by ÍSOR 2006
- Waterfilled areas mapped by ÍSOR 2006
- Mapped by ÍSOR 2006
- Mapped by HÍ 2000
- Core hole
- Percussion hole

0 200 400 600 800 1.000 m

Constructions according to Project Planning Report

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HVAMMSVIRKJUN
HYDROELECTRIC PROJECT
ACTIVE FAULTS AND FISSURES

Hannað ÁÓT	Athugað	M.	1:30.000
Samþ. SPS		Kt.	
Dags. Jan. 2006	Nr. 1227.110-G-XXX		

Áritanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179

Hvammsvirkjun Hydroelectric Project

Cross sections

Longitudinal section of Intake Powerhouse and Tailrace tunnell/canal

Cross section A-A' Powerhouse area SW-NA

Cross section B-B' Powerhouse site and intake

Cross section C-C' Main Dam and Powerhouse site.

Cross section D-D' Tailrace tunnel

Cross section E-E' Tailrace tunnel

Cross section F-F' Tailrace tunnel

A

A'

m a.s.l.

m a.s.l.

NK-10

NL-16

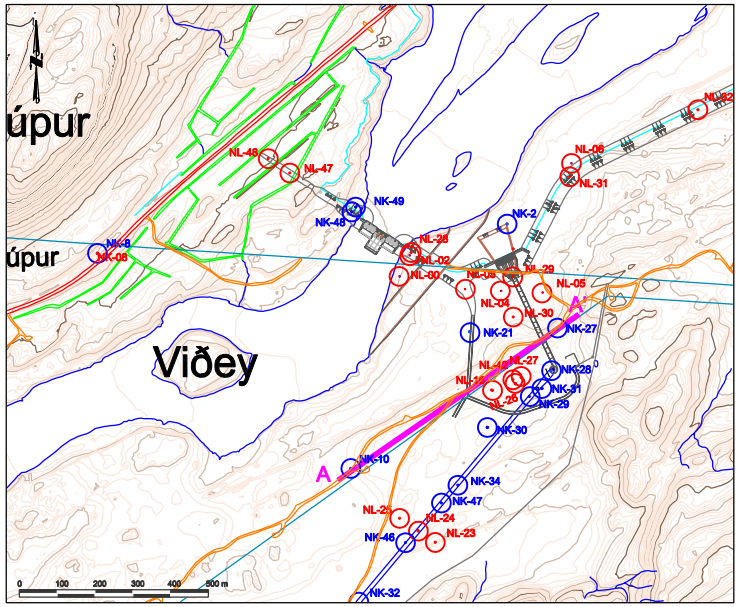
NK-27

Þjórsárhraun - lava

Skarðsfjall hyaloclastite

DRAFT

1:5.000



Constructions according to Project Planning Report

Legend

- Soil
- Tephra sand & gravel
- Þjórsárhraun lava - Scoria
- Hyaloclastite
- Þjórsárhraun lava

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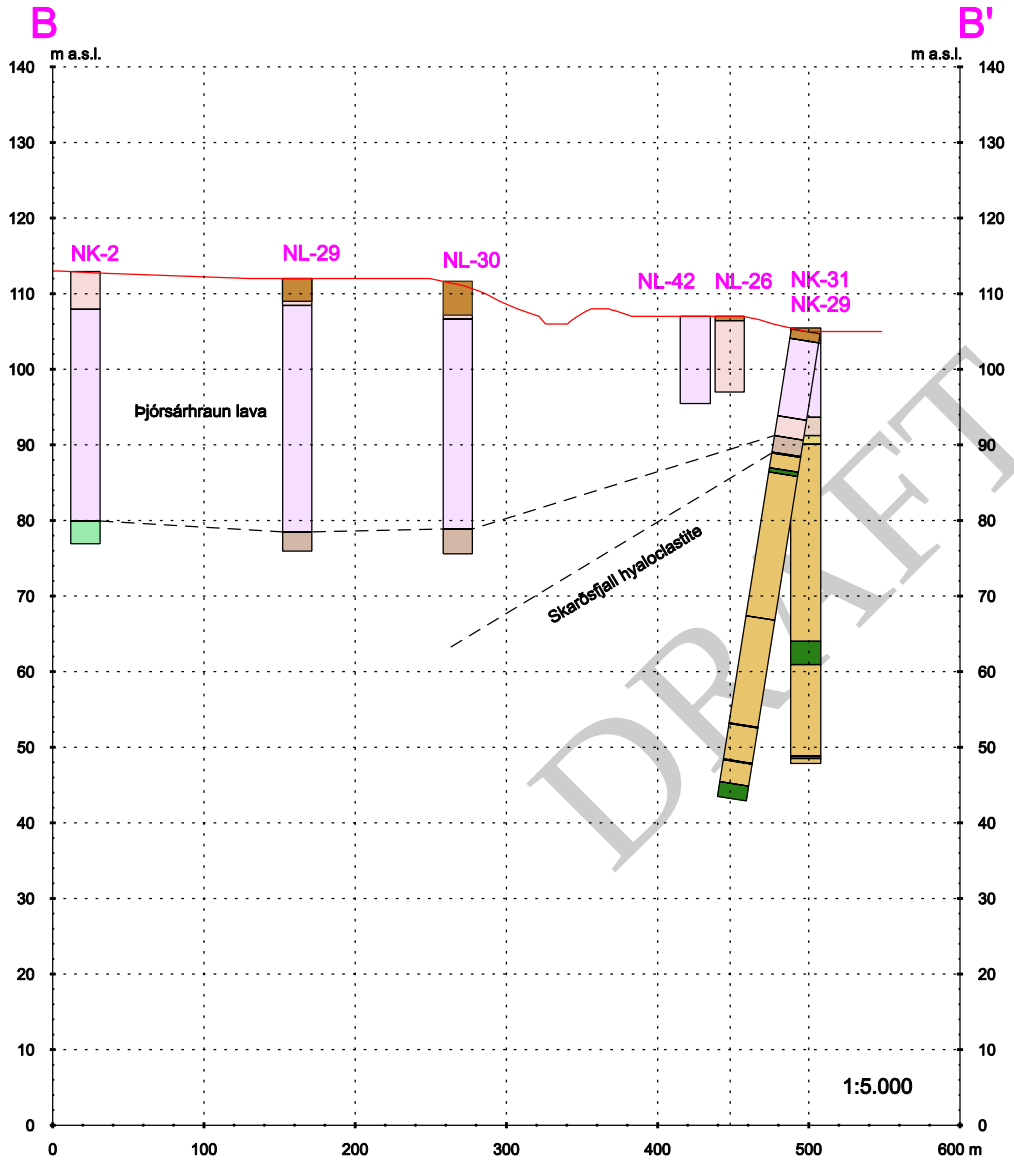
Hvammsvirkjun HEP
Powerhouse site
Geological section A-A'

Design	ÁÓT	Checked	Scale
Appr.	SPS		Kt.
Date	Jan. 2007	No.	1227.110-G-XXX

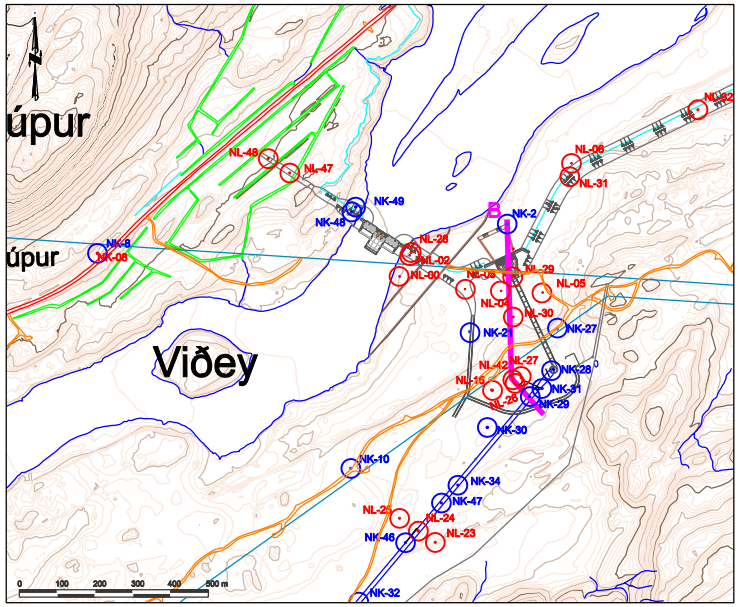
Áritanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179



DRAFT

Legend

- Soil
- Tephra sand & gravel
- Dyke
- Þjórsárhraun lava - Scoria
- Hyaloclastite
- Þjórsárhraun lava
- Porphyritic basalt



Constructions according to Project Planning Report

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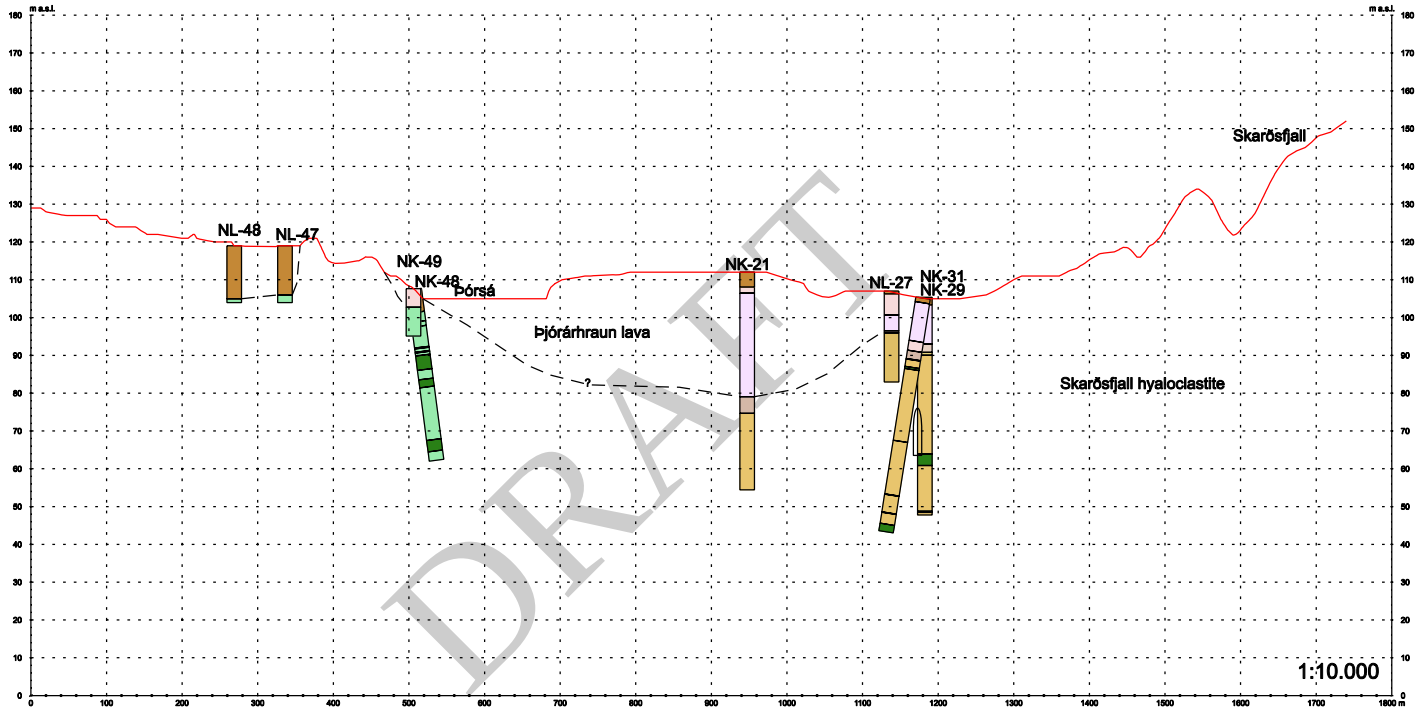
Hvammsvirkjun HEP
Powerhouse site
Geological section B-B'

Design	ÁÓT	Checked	Scale
Appr.	SPS		Kt.
Date	Jan. 2007	No.	1227.110-G-XXX

Ártanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179

C

C´



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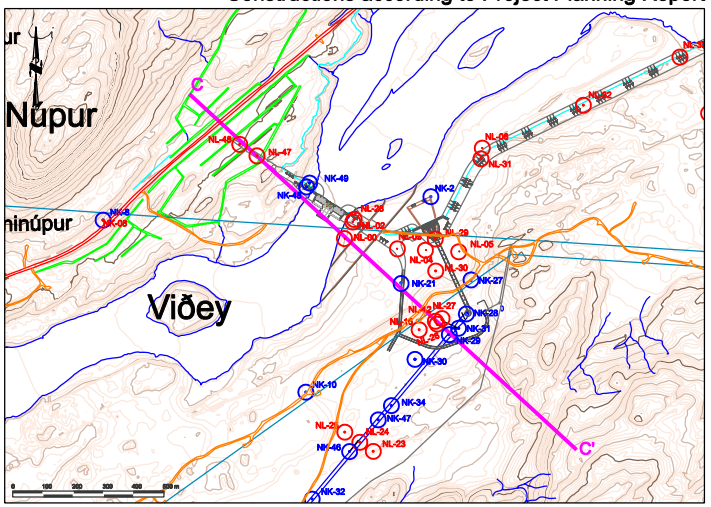
Constructions according to Project Planning Report



Legend

- Soil
- Tephra sand & gravel
- Þjórsárhraun lava - Scoria
- Hyaloclastite
- Þjórsárhraun lava
- Dyke

Tunnel proposed in Project Planning Report - 2006

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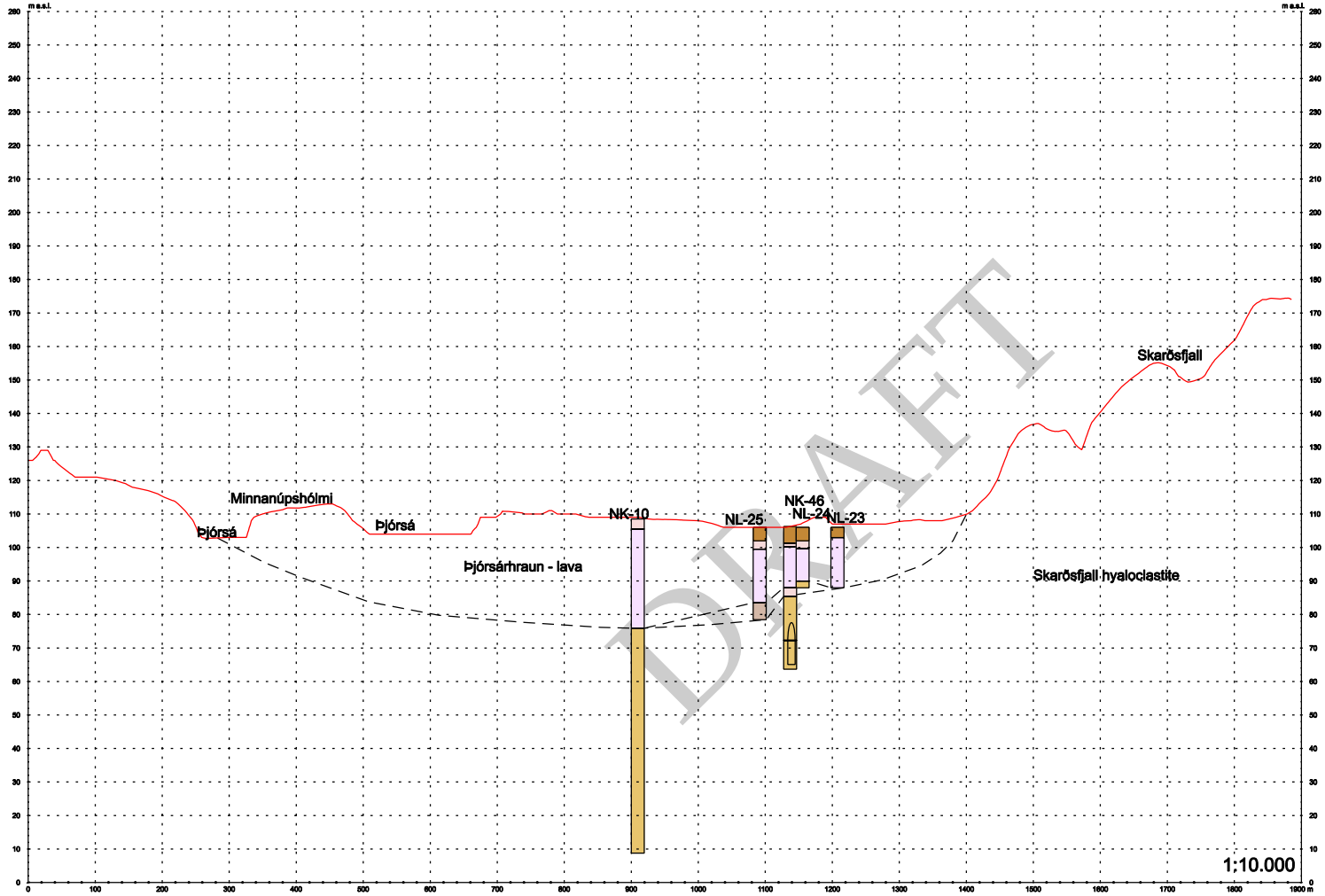
Hvammsvirkjun HEP
Powerhouse site
Geological section C-C'

Design	ÁÓT	Checked	Scale
Appr.	SPS		Kt.
Date	Jan. 2007	No.	1227.110-G-XXX

Áritanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179

D

D´



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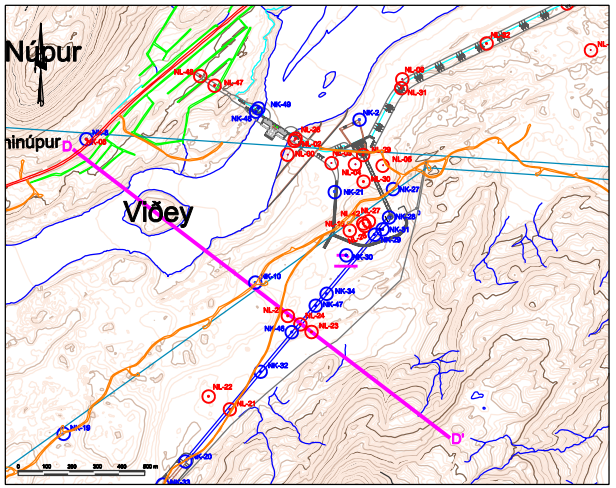

Constructions according to Project Planning Report

Legend

- Soil
- Tephra sand & gravel
- Þjórsárhraun lava - Scoria
- Hyaloclastite
- Þjórsárhraun lava
- Tunnel proposed in Project Planning Report - 2006

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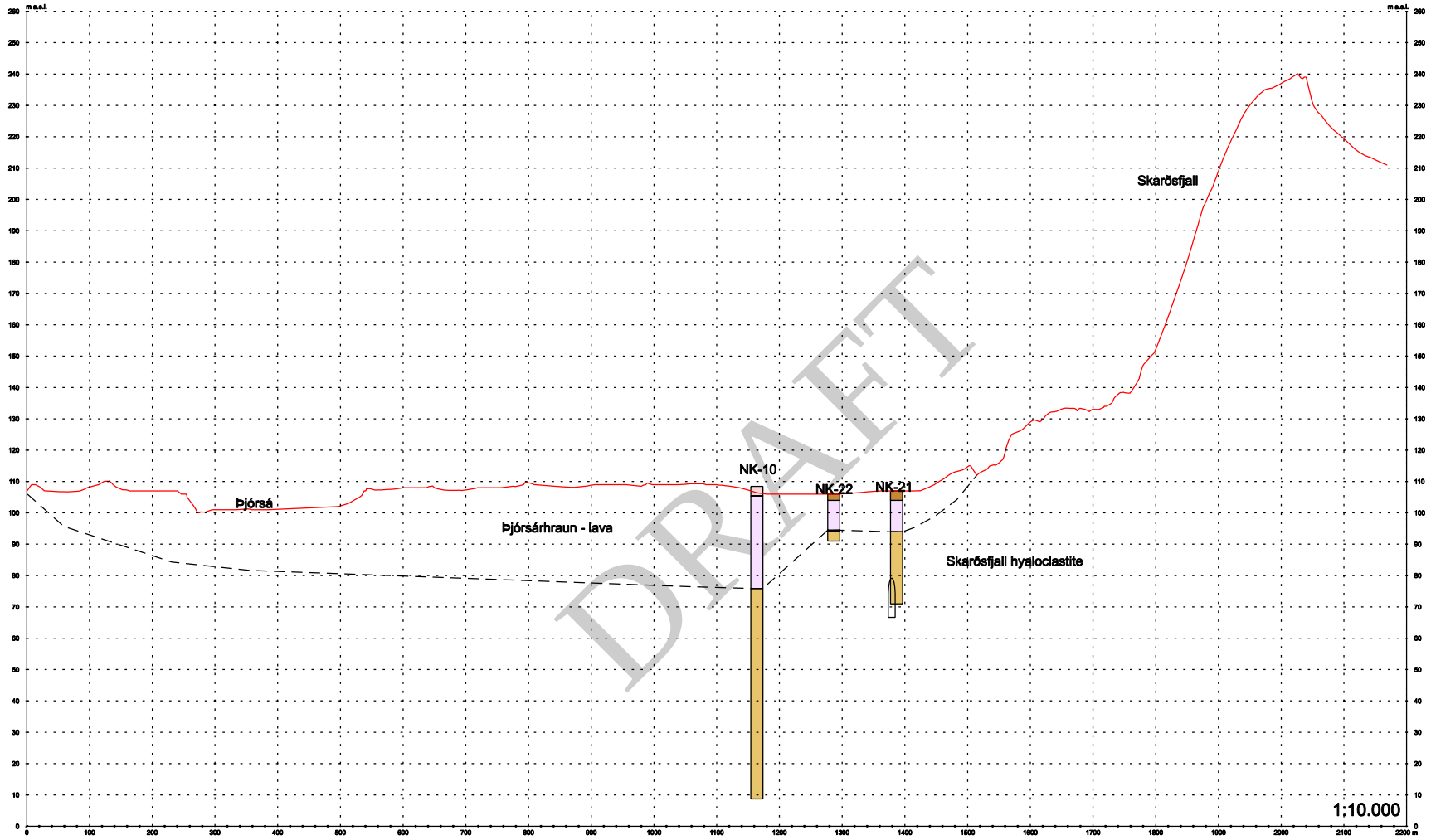
Hvammsvirkjun HEP
Powerhouse site
Geological section D-D'

Design	ÁÓT	Checked	Scale
Appr.	SPS		Kt.
Date	Jan. 2007	No.	1227.110-G-XXX

Ártanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179

E

E´



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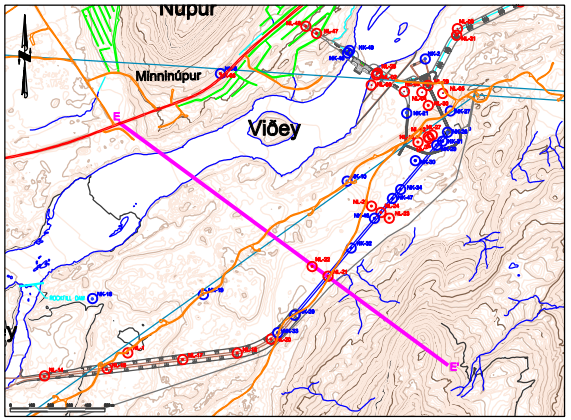
Legend

- Soil
- Tephra sand & gravel
- Tunnel proposed in Project Planning Report - 2006
- Þjórsárhraun lava - Scoria
- Hyaloclastite
- Þjórsárhraun lava
- Dyke

Constructions according to Project Planning Report



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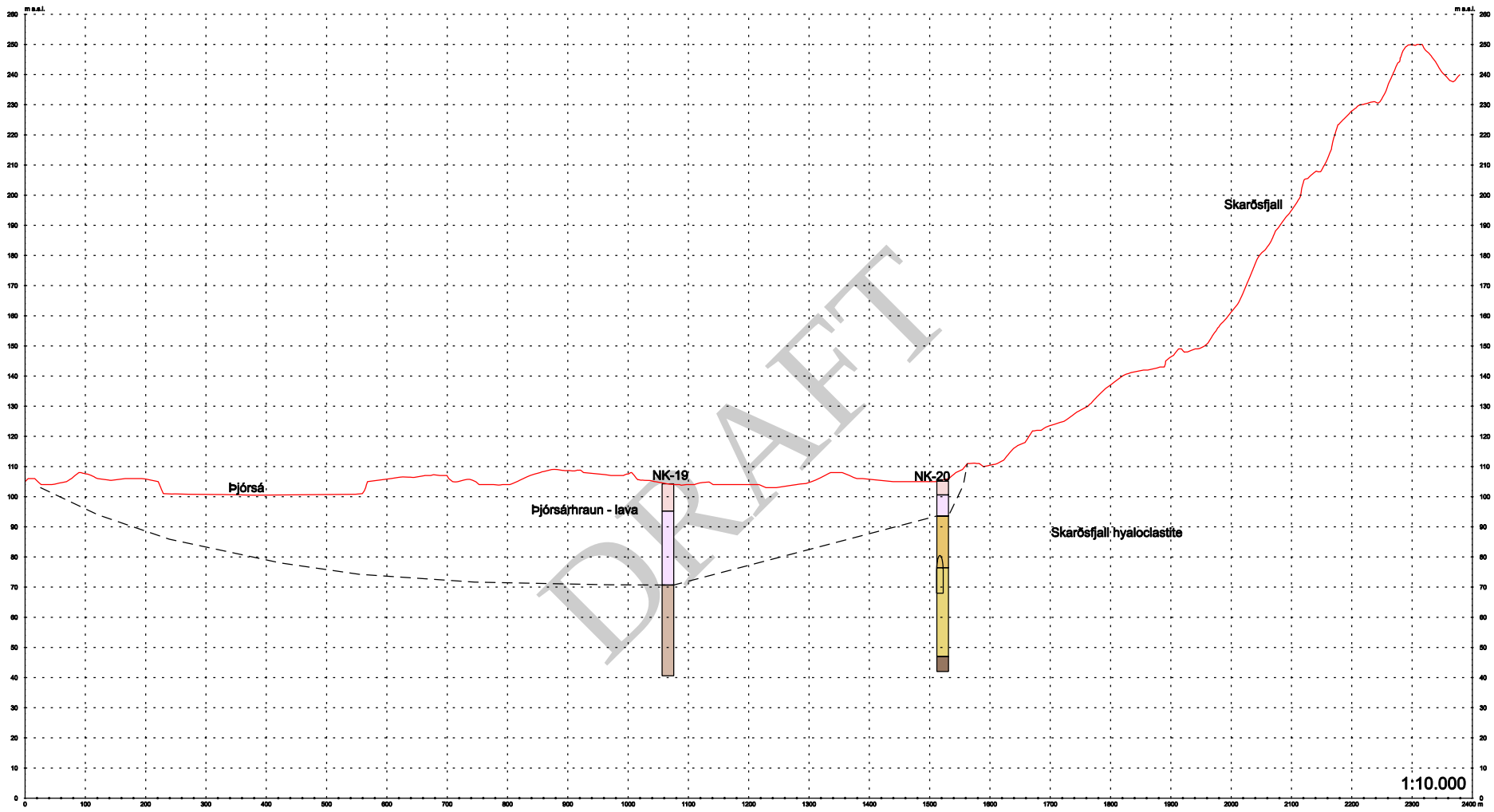
Hvammsvirkjun HEP
Powerhouse site
Geological section E-E'

Design	ÁÓT	Checked	Scale
Appr.	SPS		Kt.
Date	Jan. 2007	No.	1227.110-G-XXX

Ártanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179

F

F´



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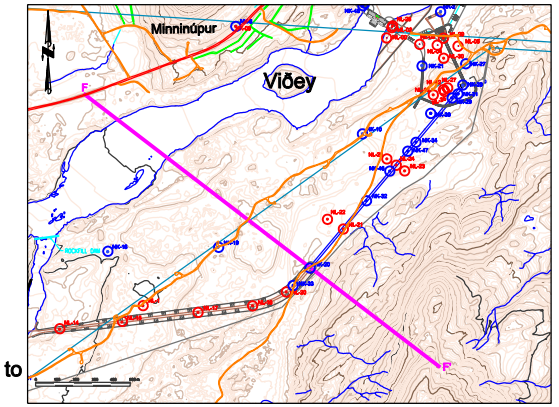
Legend

- Soil
- Hyaloclastite
- Þjórsárhraun lava - Scoria
- Conglomerate
- Þjórsárhraun lava
- Silt

Tunnel proposed in Project Planning Report - 2006

Constructions according to Project Planning Report



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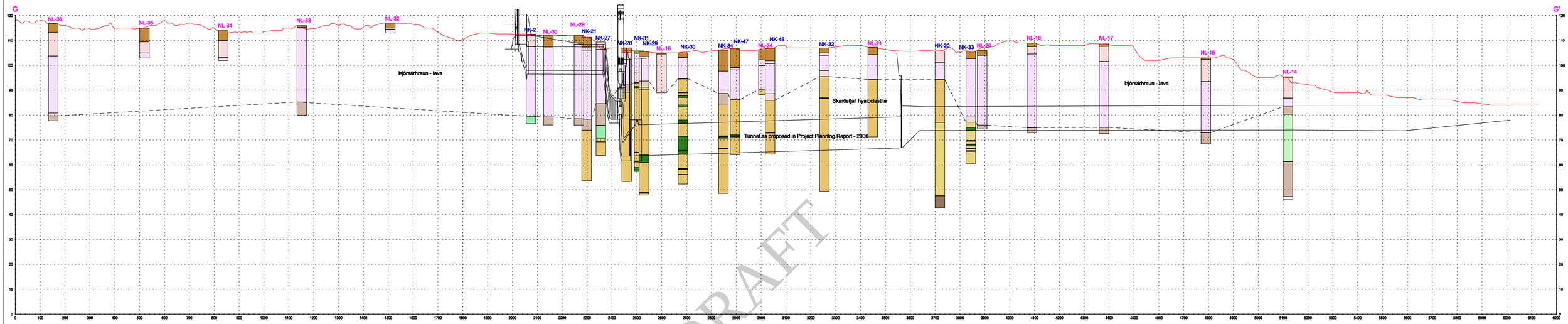
Hvammsvirkjun HEP
Powerhouse site
Geological section F-F'

Design	ÁÓT	Checked	Scale
Appr.	SPS		Kt.
Date	Jan. 2007	No.	1227.110-G-XXX

Áritanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179



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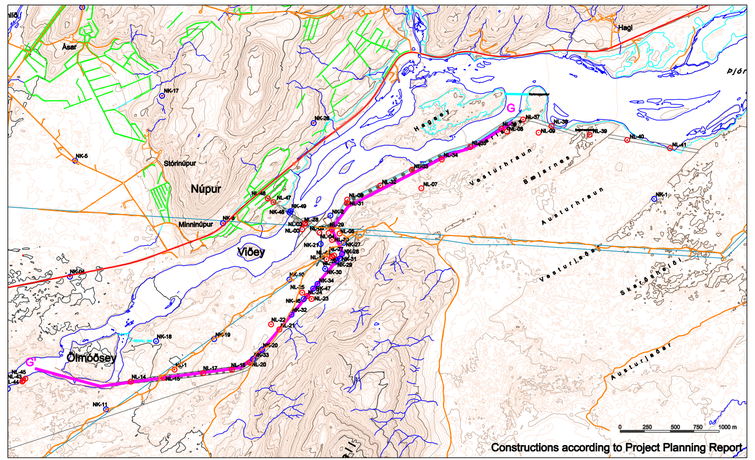
Legend

- Soil
- Þjórsárhraun lava - Scoria
- Þjórsárhraun lava
- Tephra sand & gravel
- Hyaloclastite
- Porphyritic basalt
- Dyke
- Silt
- Olivin basalt



Constructions according to Project Planning Report

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Hvammsvirkjun HEP
Powerhouse site
Geological section G-G'

Design	ÁÖT	Checked	Scale
Appr.	SPS		XL
Date	Jan. 2007	No.	1227.110-G-XXX

Allur réttur áskilinn um öll afnot Almenna verkfræðistofunnar hf. kt. 470201-2170

Hvammsvirkjun Hydroelectric Project

Core hole logs

Logs of cored holes NK-29 to NK-35 and NK-46 to NK-49

Almenna Consulting Ltd.

Landsvirkjun

Cored Boreholes

January 2007

Legend

Plio-Pleistocene rocks

- Hyaloclastite
- Conglomerate
- Porphyritic basalt
- Olivin basalt
- Dyke

Pleistocene rocks

- Akbraut interglacial olivine basalt

Holocene lava

- Þjórsárhraun lava - Scoria
- Þjórsárhraun lava

Holocene sedimentary series

- Soil
- Tephra sand & gravel
- Silt/siltstone
- Tillite

WL=34
HD=65 — Water level/depth of hole

1,4 LU — Permeability

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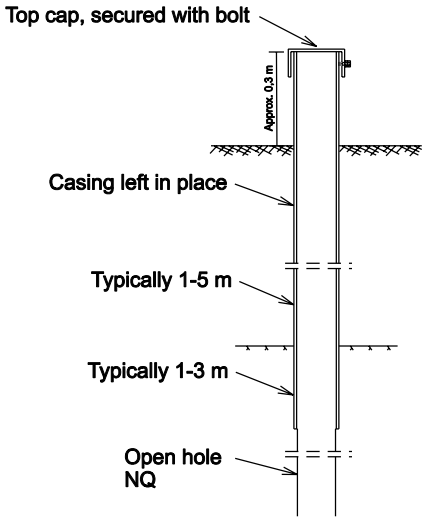
Typical design of a cored borehole



The position of the holes is found with two diffrent methodes:
GPS survey and GPS handheld instrument.

Accuracy of GPS measurement

GPS survey is written as: XXXXXX,XX
YYYYYY,YY
ZZZ,ZZZ

Position measured with handheld instrument is written as: XXXXXX
YYYYYY

Elevation taken from a map: ZZZ

Icelandic grid (ISN93), Datum WGS84

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Landsvirkjun

Hvammsvirkjun HEP
NK-29

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 07-08.09.2006	Drawn: MM
Coordinates: ISN93 X: 444977,66 Y: 394029,73 Elevation: 105,5	Drawing no. 1 of 2

Elev. m a.s.l.	Depth m	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
103,5	2	**Soil**	2	3" ODEX casing			
		Þjórsá-lava Holocene basalt with large plagioclase phenochrystals <10mm Vesicular down to 5,02m. Scattered vesicles to 6m, massive below.			96	36/0/0/0 $Q = \frac{66}{9} \times \frac{3}{1-2} \times \frac{1}{2,5}$ **Q = 4 - 9**	WL=5,8m
					82	50/0/0/0	HD=57,5m
						66/32/17/0	
					100	94/72/0/0	
					83	71/33/0/0	7-15m 133 LU
93,7	11.5	**Sand and gravel** No core recovery					
91,3	14.16	**Conglomerate**			100 100 100	17/17/0/0 83/0/0/0 52/0/0/0	
90,4	15.07	**Skarðsfjall hyaloclastite** Dark, almost black hyaloclastite. Hydrothermally altered, Zeolites in vugs and cells.			98	68/10/0/0	
		Brown sandstone filling			100	86/33/0/0	
						83/47/16/10	
					92	75/45/18/0	
		Joints healed with green clay minerals, pyrite <1mm thick			100	91/33/19/0 $Q = \frac{83}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$ **Q = 4 - 8**	17-40m 4,3 LU
					98	90/39/0/0	
74,4 72,1	31,15 33,40	**Dyke** Cooling margins inclined					
					99	91/78/52/52	
		Inclined joint with dark red and green clay filling <10cm thick.		Core loss			
					93	82/46/36/36	
					102	88/59/19/0	
	41.36				82	59/38/22/0	
64,1		**Dyke** Highly jointed dyke, joints mostly filled w/ beige clay and zeolites. Red clay fillings <4mm in 41,5m; 41,7m; 42,1; and 42,26m.				$Q = \frac{45}{20} \times \frac{3}{2-4} \times \frac{1}{2,5}$ **Q = 0,68 - 1,35**	
					91	55/0/0/0	
	44.48				89	**45/0/0/0** 0/0/0/0	40-48m 9,6 LU
61,0		**Skarðsfjall hyaloclastite cont.**			99	65/65/0/0	
					97	83/59/19/0	
					100	77/55/0/0	

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Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NK-29

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 11.09.2006	Drawn: MM
Drawing no. 2 of 2	

Coordinates: ISN93 X: 444977,66 Y: 394029,73 Elevation: 105,5

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
	52		Skarðsfjall hyaloclastite cont.	52		98	86/11/0/0	48-57,5m 17,8 LU
	54			54				
	56			56		99	92/79/45/0	
49			56.54			100	100/100/0/0	
48,6			56.86 Dyke					
48			Skarðsfjall hyaloclastite cont.			97	82/45/0/0	
	58		Bottom 57.5m	58				
	60			60				
	62			62				
	64			64				
	66			66				
	68			68				
	70			70				
	72			72				
	74			74				
	76			76				
	78			78				
	80			80				
	82			82				
	84			84				
	86			86				
	88			88				
	90			90				
	92			92				
	94			94				
	96			96				
	98			98				
	100			100				

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Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NK-30

Contractor: RSFS | Drill: Langbráður
Site: Hvammur | Diameter: ODEX 3"/NQTT
Date of drilling: 12-22.09.2006 | Drawn: MM
Drawing no. 1 of 2

Coordinates: ISN93 X: 444866,44 Y: 393947,98
Elevation: 106,4 m.a.s.l
Inclination: 49°
Direction of inclination: xx°

Elev. m a.s.l.	Depth m	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % / Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
106,1	0,5	Soil					
	2	Þjórsá-lava Holocene basalt with large plagioclase phenocrystals	2	3" ODEX casing		$Q = \frac{42}{9} \times \frac{3}{1-2} \times \frac{1}{2,5}$	
		Scoria (Incl. of hole 49,3°)				**Q = 3 - 6**	
	4		4		49	25/0/0/0	
		Solid lava			73	60/0/0/0	
	6		6		95	36/0/0/0	
		Scattered vesicles				**42/9/0/0**	
	8	Belted lava	8		59	48/14/0/0	
		Vesicular lava					
	10	Solid lava	10		25	0/0/0/0	WL=10,4m
							HD=81,5m
	12		12		53	35/0/0/0	
		Vesicular lava					
	14		14		81	59/27/0/0	Not tested
	15,08						
95,0	16	Sandstone	16		0	0/0/0/0	
94,9	16,20				100	83/0/0/0	
		Skarðsfjall hyaloclastite			100	0/0/0/0	
					44	0/0/0/0	
	18		18		42	25/0/0/0	
					110	89/31/0/0	
						$Q = \frac{18}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	
	20		20			**Q = 0,6 - 7,5**	
					101	92/35/24/0	
	22		22			**18/10/0/0**	
					99	85/43/17/0	
	24		24				
89,0	24,53						
88,9	24,78	Dyke			100	48/0/0/0	18-33,5m 7 LU
		Skarðsfjall hyaloclastite cont.			114	95/55/0/0	
	26		26				
87,5	26,73						
		Tuff			100	88/41/0/0	
86,8	27,76				102	102/0/0/0	
	28	Skarðsfjall hyaloclastite cont.	28				
	28,21						
	28,70	Dyke					
		Joint (fissure?). Beige colored clay.			95	84/40/0/0	
	30	Skarðsfjall hyaloclastite cont.	30				
					103	103/49/27/0	
	32		32				
	32,49						
83,4		Tuff			100	68/0/0/0	
		Joints (fissures?), beige colored clay (1mm)			100	100/0/0/0	
82,6	33,69						
	34	Skarðsfjall hyaloclastite cont.	34				
					98	88/59/43/43	
	36	Fissure?, ~10cm thich clayfill, Green, orange color.	36			$Q = \frac{69}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	
						Q = 2,3 - 6,9	
	38	Joints: white clay green-gray clay beige clay	38		97	70/43/24/0	34-42m 23 LU
						69/47/31/15	
	40	beige clay (Incl. of hole 48,5°)	40		88	58/48/30/0	
		Broken zone between 41m and 41,79m. Beige clay coating on surfaces.					
76,9	41,79				4	0/0/0/0	
	42	Dyke Broken zone between 42,22m and 43,43m. Some healed fissures w/light clay.	42		100	52/0/0/0	
					17	0/0/0/0	
					0	0/0/0/0	
	43,78				33	0/0/0/0	
75,4					106	83/0/0/0	
	44	Fissure?, ~10cm thich clayfill, brown color.	44		100	70/38/0/0	43-81,5m 0,6 LU
		Hvammsvirkjun tailrace tunnel alignment			99	88/88/88/0	
	46	**As presented in Hvammsvirkjun project planning report**	46			$Q = \frac{84}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	
					101	91/22/22/0	45-54,5m 1,1 LU
	48	Joint (fissure?), beige clay coating.	48			**Q = 3,7 - 8,4**	
		Joint, lightgray clay coating					
	50	Joint, 2-3mm thich coating, green-brown clay.	50		97	87/29/0/0	

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Landsvirkjun

Hvammsvirkjun HEP
NK-30

Contractor: RSFS | Drill: Langþráður
Site: Hvammur | Diameter: ODEX 3"/NQTT
Date of drilling: 12-22.09.2006 | Drawn: MM
Drawing no. 2 of 2

Coordinates: ISN93 X: 444866,44 Y: 393947,98
Elevation: 106,4 m.a.s.l
Inclination: 49°
Direction of inclination: xx°

Elev. m a.s.l.	Depth m	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
		Skarðsfjall hyaloclastite cont.				84/32/16/0	
69,7	52	Joint (fissure?), 3mm thich coating, green clay.	52		100	46/0/0/0	
		51,9 Tuff			86	68/48/0/0	
	54		54		87	85/85/85/84	
						$Q = \frac{90}{9} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	
	56	Joint, green clay coat.	56		107	98/71/45/0	
						Q = 2 - 6	
	58	Joint, zeolites and beige clay coat.	58			90/63/38/13	
					97	95/53/27/0	
	60	Joint, zeolites and beige clay coat.	60				
63,6		60,57			100	0/0/0/0	
63,2		61,08 Dyke			99	99/99/0/0	
	62	Tuff Joint, white clay coat.	62		100	91/91/0/0	
61,9		62,89					
		Skarðsfjall hyaloclastite cont.			100	97/75/31/0	58-69,5m 1,7 LU
	64		64		100	95/72/22/0	
						$Q = \frac{94}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	
	66		66			Q = 2 - 6	
	68		68		103	97/87/64/36	
						94/68/32/11	
	70		70		100	82/82/0/0	
		Joint (fissure?), redbrown clay coat.			94	88/20/0/0	
55,8		71,62					
55,6		71,89 Dyke			100	100/0/0/0	43-81,5m 0,6 LU
55,3	72	72,23 Skarðsfjall hyaloclastite cont.	72		100	100/0/0/0	
55,2		72,38 Dyke Joint, beige clay coat.			103	81/0/0/0	
		Skarðsfjall hyaloclastite cont.					
	74		74		100	86/42/20/0	
53					100	0/0/0/0	
52,9		75,52 Dyke			104	104/0/0/0	70-81,5m 0,3 LU
	76	75,65 Joint, grey and red clay coat.	76				
		Skarðsfjall hyaloclastite cont.			99	84/65/54/0	
	78		78				
	80		80		99	96/64/49/0	
		Incl. of hole 48,3°					
48,8	82	Bottom 81.53m (57,65m below surface)	82				
	84		84				
	86		86				
	88		88				
	90		90				
	92		92				
	94		94				
	96		96				
	98		48				
	100		100				

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Landsvirkjun

Hvammsvirkjun HEP
NK-31

Contractor: RSFS | Drill: Langþráður
Site: Hvammur | Diameter: ODEX 3"/NQTT
Date of drilling: 23-27.09.2006 | Drawn: MM
Drawing no. 1 of 2

Coordinates: ISN93 X: 445010,95 Y: 394050,71
Elevation: 105,3 m.a.s.l
Inclination: 40,5°
Direction of inclination: 299°

Elev. m a.s.l.	Depth m	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
104,2	0	Soil	0	5" casing			
	1,6						
	2	Þjórsá-lava	2		81	60/26/0/0	WL=3,4
	4	Holocene basalt with large plagioclase phenochrystals <10mm. Incl. of hole 40,6°	4		102	85/18/18/0	HD=54,1
	6	Fresh joint surface, thin clay coating. Rough, undulating surface.	6			$Q = \frac{49}{9} \times \frac{3}{1-2} \times \frac{1}{2,5}$ Q = 3 - 6	WL=6,4
	8		8		91	58/0/0/0	HD=81,5
					99	45/0/0/0	
	10	Vesicular down to 7,5m. Scattered vesicles to 12,5m	10		91	54/0/0/0	Not tested
		Massive part of lava from 12,5-14,9.				49/14/5/0	
	12	Vesicle bands in massive part.	12		99	80/40/0/0	
		Probable fissure in 13m (vertical). Healed with light and dark colored clay minerals			98	86/44/26/0	
93,8	14		14		61	60/0/0/0	
	15,15						
	16	Þjórsá-lava	16				13-25m 42 LU
		Scoria			4	0/0/0/0	
	18		18				
91,2	18,53						
	20	Sand	20		7	0/0/0/0	
89,0	21,42						
88,9	21,6	Dyke Cooling margin incl.15° from horiz. Cooling margin incl.45° from horiz.			100	100/0/0/0	
	22	Skarðsfjall hyaloclastite Core loss	22				
		Small joint healed w/graybrown clay			100	97/54/22/0	
86,9	24		24				
	24,25				80	40/0/0/0	
	24,9	Dyke Cooling margins incl.45° from horiz.			101	88/88/0/0	
86,4							
	26	Skarðsfjall hyaloclastite cont.	26		93	89/81/81/0	Not tested
	28	Dark, almost black hyaloclastite. Hydrothermally altered. Zeolites in vugs and cells.	28		104	96/22/0/0	
	30	Long plagioclase needles visible (<2mm)	30				28-40m 1,49 LU
	32		32		96	85/60/60/0	
	34		34		106	84/0/0/0	
				Core loss			
	36		36		100	99/94/30/0	
	38	Joints. General descr.: Healed, filled with zeolites. Green clay minerals, pyrite <1mm thick.	38		99	94/57/31/0	
	40	Incl. of hole 40,3°	40				
		Joint (fissure?). Yellow/green/reddish soft clay minerals			100	94/65/39/0	
	42		42				39-54m 0,93 LU
	44		44		97	93/67/17/0	
				Core loss			
		Joint. Dark clay minerals on surface.					
	46		46				
	48		48		98	87/53/18/0	
				Core loss			
	50		50				

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Landsvirkjun

Hvammsvirkjun HEP
NK-31

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 23-27.09.2006	Drawn: MM
Drawing no. 2 of 2	

Coordinates: ISN93 X: 445010,95 Y: 394050,71 Elevation: 105,3 m.a.s.l Inclination: 40,5° Direction of inclination: 299°

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
	52		Core loss → Skarðsfjall hyaloclastite cont.	52		101	85/37/22/0	39-54m 0,93 LU
						85	58/28/0/0	
	54			54			**89/55/26/0**	
			Broken section. Red clay minerals on joint surfaces.			101	89/60/18/0	
	56			56			$Q = \frac{89}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	
	58			58			**Q = 3 - 9**	
						99	84/70/42/0	
	60			60				
			Vertical fissure w/red clay mineral. Core loss → Core loss →			98	92/62/16/0	55-70m 0,43 LU
	62			62				
	64		Core loss →	64		99	87/53/17/0	
	66		Fissure filled with sandstone. Breaks under force in hands.	66				
	68			68		107	96/29/0/0	
53,1			68,7 Dyke			90	0/0/0/0	
53,0			68,8			80	69/55/0/0	
	70		Skarðsfjall hyaloclastite cont.	70				
						101	77/37/17/0	
	72			72			**84/49/33/0**	
	74			74		100	97/62/62/0	70-82m 1,33 LU
48,3			74,99 Dyke			100	0/0/0/0	
48,2			75,14			91	90/0/0/0	
	76		Skarðsfjall hyaloclastite cont.	76				
						90	68/50/0/0	
	78			78			**69/26/0/0**	
			Old fissure filled with Chabasite			99	51/0/0/0	
45,3			78,95			100	99/0/0/0	
44,9			79,5 Dyke Olivinebasalt, slightly vesicular.			100	103/57/0/0	
	80		Dyke Tholeiite Massive, inclined cooling margin.	80		100	19/36/0/0	
			Smooth straight joint surface filled w/black clay minerals and zeolites (<2mm). zeol. on top of clay. Incl. of hole 40,5°				**36/25/0/0**	
43,3						99	76/0/0/0	
	82		Bottom 81.53m (62m below surface)	82				
	84			84				
	86			86				
	88			88				
	90			90				
	92			92				
	94			94				
	96			96				
	98			98				
	100			100				

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Landsvirkjun

Hvammsvirkjun HEP
NK-32

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 02-04.10.2006	Drawn: MM
Drawing no. 1 of 2	

Coordinates: ISN93 X: 444526,52 Y: 393485,76 Elevation: 106,8 m.a.s.l

Elev. m a.s.l.	Depth m	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
							Not tested
103,8	3	Soil		3" ODEX casing	51	0/0/0/0	
		Þjórsá-lava. Holocene basalt with large plagioclase phenocrystals. Generally vesicular and broken lava. Massive part between 5m and 6,4m.			55	32/19/19/0	2-12,5m 41 LU
						$Q = \frac{20}{9} \times \frac{2-3}{1-4} \times \frac{1}{2,5}$	
						Q = 0,4 - 2,7	
					30	23/14/0/0	WL = 8,5m HD = 24,53m
						20/12/7/0	
					18	0/0/0/0	
					220	0/0/0/0	
95,3	11,5	Scoria			24	0/0/0/0	WL = 11,4m HD = 57,53m
		Skarðsfjall hyaloclastite			100	32/0/0/0	
					28	0/0/0/0	
						$Q = \frac{76}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	Not tested
		General descr. Dark, almost black hyaloclastite. Hydrothermally altered. Zeolites in vugs and cells. Healed fissures. Long plagioclase needles visible (<2mm)			100	92/55/19/0	
						Q = 2,5 - 7,6	
					99	86/60/23/0	
						76/44/15/0	
					101	73/21/0/0	15-24,5 5 LU
86,7	20,2	Dyke. Contacts welded to hyaloclastite			100	100/0/0/0	
86,6	20,35	Skarðsfjall hyaloclastite cont.			95	94/94/0/0	
					99	95/33/19/0	
					94	69/50/23/0	
					97	78/49/25/0	24-33,5 0,09 LU
76,1							
		Joint w/ beige colored clayfill			100	94/62/36/0	
		Joint, healed w/zeolites				$Q = \frac{86}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	
					102	84/57/45/0	
		Hvammsvirkjun tailrace tunnel alignment				**Q = 2,9 - 8,6**	
		As presented in Hvammsvirkjun project planning report			99	94/47/47/0	
						86/60/33/0	
					101	99/85/47/0	34-48,5 0,02 LU
63,55							
					100	87/55/55/0	
					91	70/61/46/0	
					99	92/80/18/0	

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Landsvirkjun

Hvammsvirkjun HEP
NK-32

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 02-04.10.2006	Drawn: MM
Drawing no. 2 of 2	

Coordinates: ISN93 X: 444526,52 Y: 393485,76 Elevation: 106,8

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
	52–56		Skarðsfjall hyaloclastite cont.	52–56		96	86/73/20/0	49-57,5 0,4 LU
						88	84/52/29/0	
49,3	58		Bottom 57.53	58				
	60–100			60–100				

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Landsvirkjun

Hvammsvirkjun HEP
NK-33

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 05.10.2006	Drawn: MM
Drawing no.	

Coordinates: ISN93 X: 444138,09 Y: 393037,52 Elevation: 105,2

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
102,2	2		Soil	2	3" ODEX casing			
	4		Þjórsá-lava. Holocene basalt with large plagioclase phenocrystals	4				Not tested
	6		Vesicular down to 8m	6				
	8			8				WL= 10,7m
	10			10		93	0/0/0/0	
	12			12		83	58/25/0/0	HD=39,5m
	14		Jointed 8-18m with scattered vesicles	14		93	60/0/0/0 $Q = \frac{65}{9} \times \frac{2-3}{1-4} \times \frac{1}{2,5}$ Q = 1,4 - 6	WL= 12m
	16			16		96	64/13/0/0	WL= 21,5m
	18			18		91	50/18/0/0	
	20			20		91	43/0/0/0	7m-21,5m 55,51 LU
	22		Massive part of lava 18-25m	22		82	82/66/20/0	
	24			24		103	65/32/11/0 94/74/47/0	Not tested
80,1	26		End of massive parrt 25,98	26		100	72/26/0/0	
	28		Þjórsá-lava Scoria/sand Core loss	28		0	0/0/0/0	
76,4			28,79			0	0/0/0/0	24,7m-39,5m 20,67 LU
	30		Conglomerate/Sandstone Upper part, sediment. Light brown coat on fissure surface	30		100	46/0/0/0	
74,5			30,69			99	82/46/0/0	
			Dyke Margins incline 85°			100	100/0/0/0	
73,3	32		Apparent cooling margins welded with conglomerate. 31,9	32		100	100/100/71/0	
	34		Conglomerate	34		98	98/73/73/73	
	36		Stratification visible 32-36m, slightly inclined faint below 36m Groundmass: Finesand-silt. Pebbles <2cm	36		101	89/39/27/0 $Q = \frac{78}{6} \times \frac{2-4}{2-4} \times \frac{1}{2,5}$	31m-39,5m 1,16 LU
	38		Joint, old, lightbrown clay coat (fissure?)	38			Q = 3,5 - 10	
	40		Healed fissures, lightbrown clay coat. Steeply inclined fissures with zeolite fillings. Surfaces coated with brown clay minerals.	40		99	93/58/35/35 78/36/23/17	
	42			42		86	61/26/0/0	
	44			44		105	75/31/0/0	Not tested
60	46		Bottom 45.16	46		86	50/0/0/0	
	48			48				
	50			50				

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Landsvirkjun

Hvammsvirkjun HEP
NK-34

Contractor: RSFS
Site: Hvammur
Date of drilling: 06-07.10.2006
Drill: Langþráður
Diameter: ODEX 3"/NQTT
Drawn: MM
Drawing no. 1 of 2

Coordinates: ISN93 X: 444788,52 Y: 393795,14 Elevation: 106,9 m.a.s.l

Elev. m a.s.l.	Depth m	Core/cuttings description	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
98,5	0–8,4	Soil	3" ODEX casing			Not tested; WL = 8,2m; HD = 57m
	8,4–17,1	Þjórsá-lava. Holocene basalt with large plagioclase phenochrystals. Broken zone 9-10,5m. Surfaces coated w/beige clay. Massive lava. Lowest part broken, sand in between		115	0/0/0/0	
				97	41/25/0/0	
				100	68/0/0/0	WL = 13m; HD = 51,6m
					$Q = \frac{62}{9} \times \frac{2-3}{1-4} \times \frac{1}{2,5}$	
					Q = 1,4 - 8	
				101	81/68/29/0	
					62/40/10/0	
89,6	17,1–22,03	Sand and gravel. Gravel pebbles poorly rounded. Core loss and erosion of matrix during drilling		90	63/51/0/0	15,8-24,4m 71,7 LU
				13	0/0/0/0	
					0/0/0/0	
				3	0/0/0/0	
				20	0/0/0/0	
84,9	22,03–34,33	Skarðsfjall hyaloclastite. Well consolidated, almost black hyaloclastite. Hydrothermally altered		0	0/0/0/0	
				101	83/58/58/0	
					$Q = \frac{86}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	
					Q = 1,4 - 8	
				99	90/45/0/0	
					86/51/26/0	
				97	83/48/18/0	
76,1		**Hvammsvirkjun tailrace tunnel alignment** **As presented in Hvammsvirkjun project planning report**				25-39,5m 15,5 LU
				101	87/54/42/0	
72,6	34,33–34,67	Dyke — Cooling margins, upper part inclined		100	99/59/0/0	
72,3	34,67			100	100/0/0/0	
72	34,67–35,28	Dyke		102	102/102/0/0	
71,6	35,28–39,43	Skarðsfjall hyaloclastite cont.		100	98/0/0/0	
				98	63/0/0/0	
				94	71/20/20/0	
67,5	39,43	Dyke		100	100/0/0/0	
67,3	39,59–63,55	Skarðsfjall hyaloclastite cont.		108	0/0/0/0	
				98	97/55/30/0	
					$Q = \frac{80}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	
					Q = 3 - 8	
				101	96/67/17/0	
		Large cavities filled with zeolites. Healed joints			**80/36/15/0**	40-51,6m 0,07 LU
				99	89/35/0/0	
				92	61/13/0/0	

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Landsvirkjun

Hvammsvirkjun HEP
NK-34

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 06-07.10.2006	Drawn: MM
Drawing no. 2 of 2	

Coordinates: ISN93 X: 444788,52 Y: 393795,14 Elevation: 106,9

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
	52		Skarðsfjall hyaloclastite cont.	52		90	29/0/0/0	
	54			54		96	84/55/25/0	52-57m 0,07 LU
	56			56		91	72/24/24/0	
49,9	58		Bottom 56,99	58				
	60			60				
	62			62				
	64			64				
	66			66				
	68			68				
	70			70				
	72			72				
	74			74				
	76			76				
	78			78				
	80			80				
	82			82				
	84			84				
	86			86				
	88			88				
	90			90				
	92			92				
	94			94				
	96			96				
	98			98				
	100			100				

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Landsvirkjun

Hvammsvirkjun HEP
NK-35

Contractor: RSFS	Drill: Langbráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 11.10.2006	Drawn: MM
Drawing no.	

Coordinates: ISN93 X: 441661,95 Y: 392736,84 Elevation: 90,93 m.a.s.l

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
87,4	0		Soil	0	3" ODEX casing			
	3,55		Þjórsá-lava. Lava, vesicular			52	35/35/22/0	
	5,1		Holocene basalt with large plagioclase phenochrystals					
			Scoria / uncemented			41	0/0/0/0	
	8,3		Scoraceous/ highly vesicular			110	27/0/0/0	
						50	6/0/0/0	
	10,6					103	45/31/0/0	
						106	89/38/0/0	
			Vesicular 10,6-16,5m			27	12/0/0/0	
			Broken 10,6-16m				$Q = \frac{40}{9} \times \frac{2-3}{1-4} \times \frac{1}{2,5}$	
	16,0						**Q = 1 - 3,5**	
	16,5					95	81/75/47/0	
			Massive part of lava, 16,5-20,5m				**40/28/18/0**	
	20,5					96	86/64/54/0	
	21,5		Scoria/Gravel					
			Core loss and erosion of matrix during drilling			25	11/0/0/0	
66,4			Scoria fragments and gravel pebbles <4cm					
			Sand and gravel			9	0/0/0/0	
			Rounded gravel and sand, pebble size <5-6cm. Scoria fragments in gravel.					
62						12	0/0/0/0	
			Bottom 28,79m					

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Landsvirkjun

NK-46

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 7.-8.12.2006	Drawn: MM
Drawing no. 1 of 1	

Coordinates: ISN93 X: 444650 Y: 393643 Elevation: 106 m a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
	2		Soil	2	3" ODEX casing			
	4			4				
	6		Þjórsá lava	6				
			Holocene lava with large plagioclase phenocrystals			84	41/0/0/0	WL=7,5m
	8			8		99	55/0/0/0	HD = 42,5
	10			10		25	13/0/0/0	
	12			12			$Q = \frac{35}{9} \times \frac{2-3}{1-4} \times \frac{1}{2,5}$	
							Q = 0,02 - 5	
	14		Vesicular and broken down to 14,5m. Massive below.	14		0	0/0/0/0	
						39	0/0/0/0	
	16			16		103	97/97/97/0	
							35/14/11/0	
	18			18		90	58/33/33/0	
						100	71/56/0/0	
	20		Sand and gravel	20		0	0/0/0/0	
						4	0/0/0/0	
			Scoria fragments and rounded pebbles					
	22		Skarðsfjall hyaloclastite	22		100	0/0/0/0	
						97	83/47/22/0	
	24		Secondary minerals. Healed joints. Dark colored clay minerals and zeolites on joint surfaces and in vesicles.	24				
	26			26		102	93/53/0/0	
						97	85/85/85/0	
	28			28		96	79/27/0/0	
	30			30			$Q = \frac{85}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$	
							Q = 3 - 8,5	21-42,5m
	32			32		100	86/59/47/0	0,04 LU
							85/47/21/0	
	34		Dyke	34		100	99/0/0/0	
						100	0/0/0/0	
	36		Skarðsfjall hyaloclastite cont.	36		97	82/25/25/0	
	38			38		95	78/34/21/0	
	40			40				
	42			42		99	99/99/73/0	
			Bottom 42,53m					
	44			44				
	46			46				
	48			48				
	50			50				

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Landsvirkjun

NK-47

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 8.12.2006	Drawn: MM
Drawing no. 1 of 1	

Coordinates: ISN93 X: 444745 Y: 393748 Elevation: 106 m a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
	0–8		Soil	0–8	3" ODEX casing			WL=7,2m HD = 42,5m
	8–16		Þjórsá lava Holocene basalt with plagioclase phenochrystals Vesicular down to 11m Massive below	8–16		77 108 81 100 51	7/0/0/0 35/0/0/0 59/0/0/0 $Q = \frac{57}{9} \times \frac{2}{1} \times \frac{1}{2,5}$ **Q = 1,3 - 7,6** 93/75/21/0 **57/30/8/0** 26/0/0/0	13-42,5m 22 LU
	16–20		Sand and gravel Mostly gravel. Rounded pebbles and scoria fragments. Fragments of porphyritic basalt from the lavas in NK48 and 49.	16–20		7 8 65	0/0/0/0 0/0/0/0 0/0/0/0	
	20–34		Skarðsfjall hyaloclastite Secondary minerals. Healed joints. Dark colored clay minerals and zeolites on joint surfaces and in vesicles.	20–34		98 94 41 109 97 84 100	40/0/0/0 57/13/0/0 41/41/0/0 86/15/0/0 $Q = \frac{65}{6} \times \frac{2-3}{2-4} \times \frac{1}{2,5}$ **Q = 3 - 8,5** 73/42/26/0 **65/7/5/0** 55/10/0/0 96/96/0/0	22-42,5m 0,11 LU
	34–36		Dyke Inclined cooling margins			100	94/61/61/0	
	36–42		Skarðsfjall hyaloclastite cont.	36–42		93 91 93	78/0/0/0 68/25/0/0 0/0/0/0	
	42–50		Bottom 42,53m	42–50				

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Landsvirkjun

NK-48

Contractor: RSFS	Drill: Langþráður
Site: Núpur	Diameter: ODEX 3"/NQTT
Date of drilling: 8.12.2006	Drawn: MM
Drawing no. 1 of 1	

Coordinates: ISN93 X: 444508 Y: 394518 Elevation: 106 m a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
	2		Soil	2	3" ODEX casing			WL=2,5 HD = 42,5
	6		Porphyritic basalt 10% plagioclase and 1% pyroxene chrystals visible, evenly dispersed.	6		139 100	101/0/0/0 94/62/62/62	
	8		Scoria belt	8		95 100	87/0/0/0 100/100/0/0	
	10		Porphyritic basalt cont.	10		110	93/69/69/0	
	12		General. description: Joints coated with greenish clay minerals. Secondary minerals, mostly zeolites and chabasite.	12		101	45/0/0/0	7-42,5m 14,8 LU
	14			14		104	72/34/0/0	
	16		Dyke Very fine vesicles. plg. phenochrysts visible (5%). Scattered vesicles. Dyke	16		100 112	0/0/0/0 100/0/0/0 108/85/85/0	
	18		Dyke	18		100	100/72/0/0	
	20			20		96	99/83/83/37	
	22		Porphyritic basalt cont. Scattered vesicles below 22m	22		100 107 95	65/0/0/0 94/53/0/0 69/38/0/0	16-42,5m 11,5 LU
	24		Dyke	24		100 100	97/63/0/0 86/78/48/0	
	26		Porphyritic basalt cont.	26		98	88/55/0/0	
	28			28		101	94/78/22/0	
	30		Reddish color section 29,5-29,9m Sedimentary fills in 30,4-30,5m	30				
	32			32		96	57/10/0/0	
	34			34		83	60/21/0/0	
	36		Joint in 35,7m. Light, soft clay filling. (Fissure?)	36		104	84/54/0/0 78/50/5/0	
	38			38		97	80/67/0/0	
	40			40		100	104/70/0/0	
	42		Dyke Joint in 42,6m, brown soft clay	42		93 103 100	77/68/42/0 94/71/0/0 69/0/0/0	
	44		Porphyritic basalt cont. Joint in 42,6m, lightbrown soft clay	44		94	72/24/24/0	
	46		Bottom 45,53m	46				
	48			48				
	50			50				

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Almenna Consulting Ltd.

Landsvirkjun

NK-49

Contractor: RSFS	Drill: Langþráður
Site: Núpur	Diameter: ODEX 3"/NQTT
Date of drilling: 8.12.2006	Drawn: MM
Drawing no. 1 of 1	

Coordinates: ISN93 X: 444508 Y: 394518 Elevation: 106 m a.s.l.

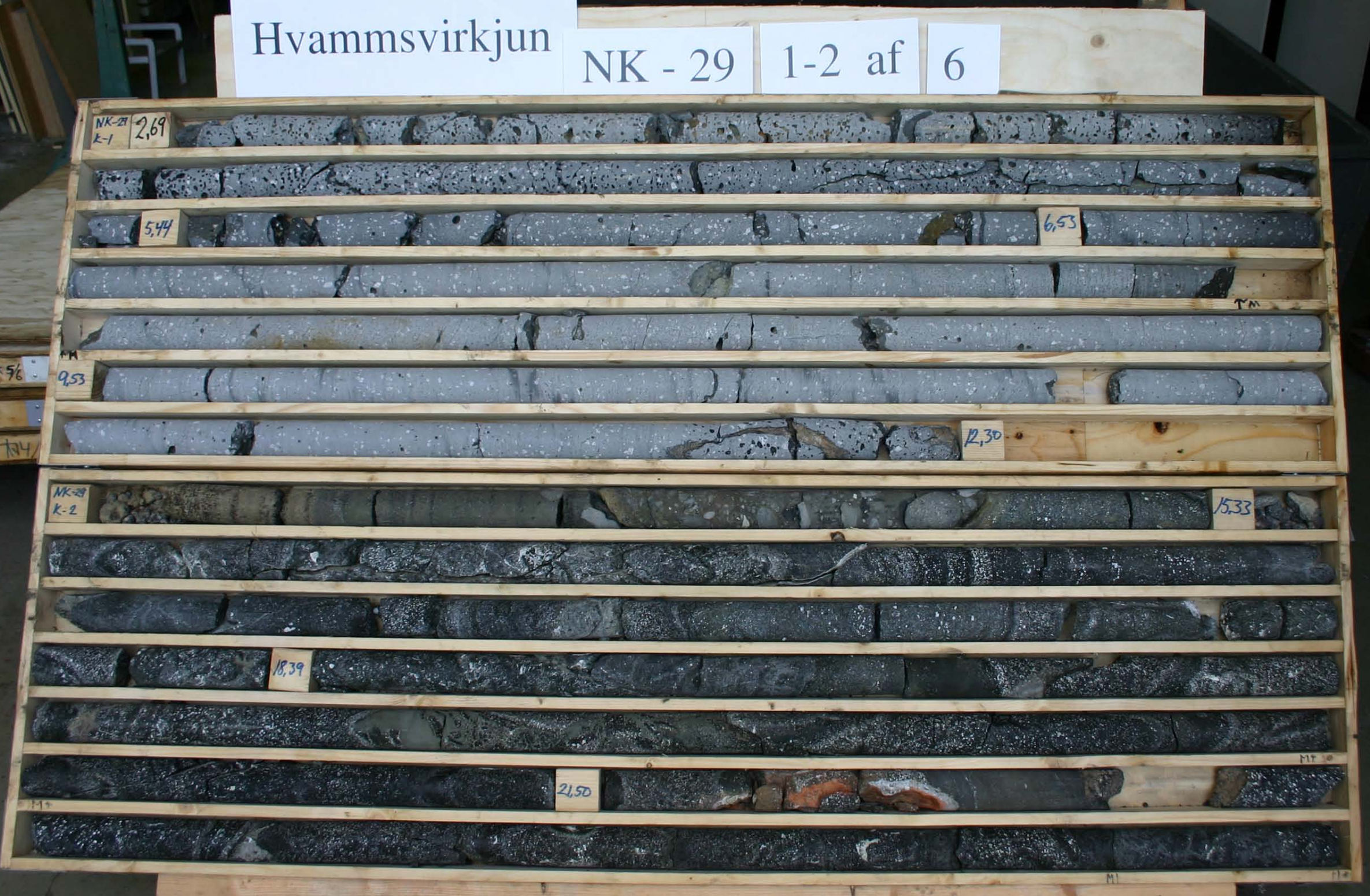
Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
	2		Þjórsá lava	2		17	3/0/0/0	
			Scoria				**2/0/0/0**	
	4			4		0	0/0/0/0	
	6		Porphyritic basalt	6		103	42/0/0/0	
			Reddish section 6,5-6,7m			103	94/58/0/0	
	8		Secondary minerals, mostly zeolites and chabasite	8		97	94/57/21/0	
	10		Plagioclase (10%) and pyroxene (1%) phenochrysts nvisible. Evenly dispersed.	10			**88/53/24/0**	
			Scattered vesicles.			101	95/63/38/0	
	12			12				
	14		Bottom 12,53m	14				
	16			16				
	18			18				
	20			20				
	22			22				
	24			24				
	26			26				
	28			28				
	30			30				
	32			32				
	34			34				
	36			36				
	38			38				
	40			40				
	42			42				
	44			44				
	46			46				
	48			48				
	50			50				

DRAFT

Hvammsvirkjun Hydroelectric Project

Photos of core

Photos of cores in NK-29to NK-35 and NK-46 to NK-49


Hvammsvirkjun
NK - 29
1-2 af 6
NK-29 K-1
2,69
5,44
6,53
9,53
12,30
NK-29 K-2
15,33
18,39
21,50

Hvammsvirkjun NK - 29 3-4 af 6

NK-29
K-3

24,32

22,39

30,48

NK-29
K-4

33,53

36,53

39,53

42,26


Hvammsvirkjun
NK - 29 5-6 af 6
NK-29 K-5
43,60
44,31
45,53
48,40
51,50
NK-29 K-6
54,53
57,53

Hvammsvirkjun NK-30 1-2 af 9

NK-30 K-1 3,00 4,44 5,92 7,09 9,59 10,63 12,58 15,64 16,46

NK-30 K-2 16,91 17,53 18,53 21,53 24,5

Hvammsvirkj NK-30 3-4 af 9

NK-30 K-3

27,53

30,53

33,53

NK-30 K-4

36,53

38,98

41,30

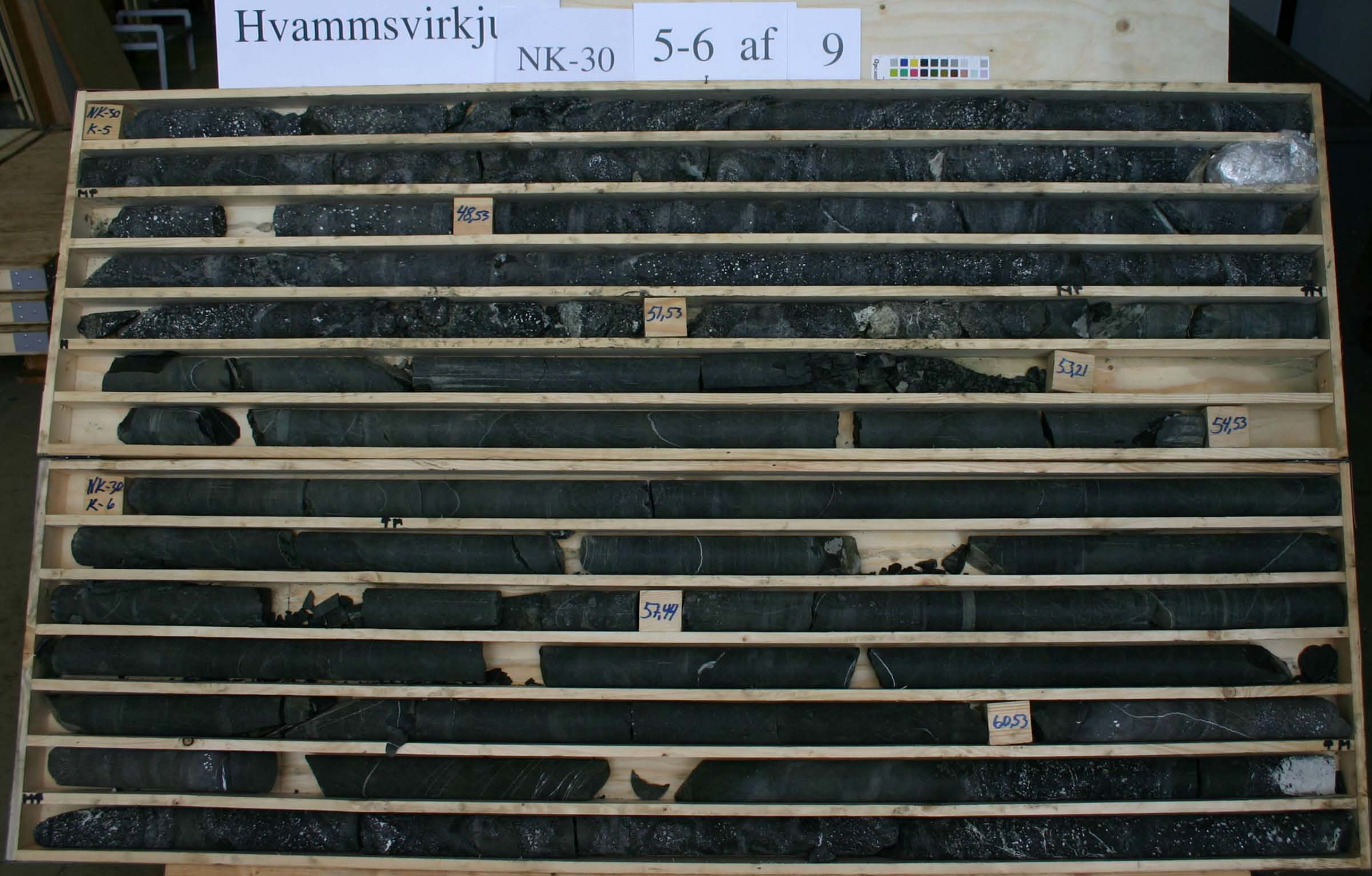
42,22

42,80

42,98

43,43

44,80

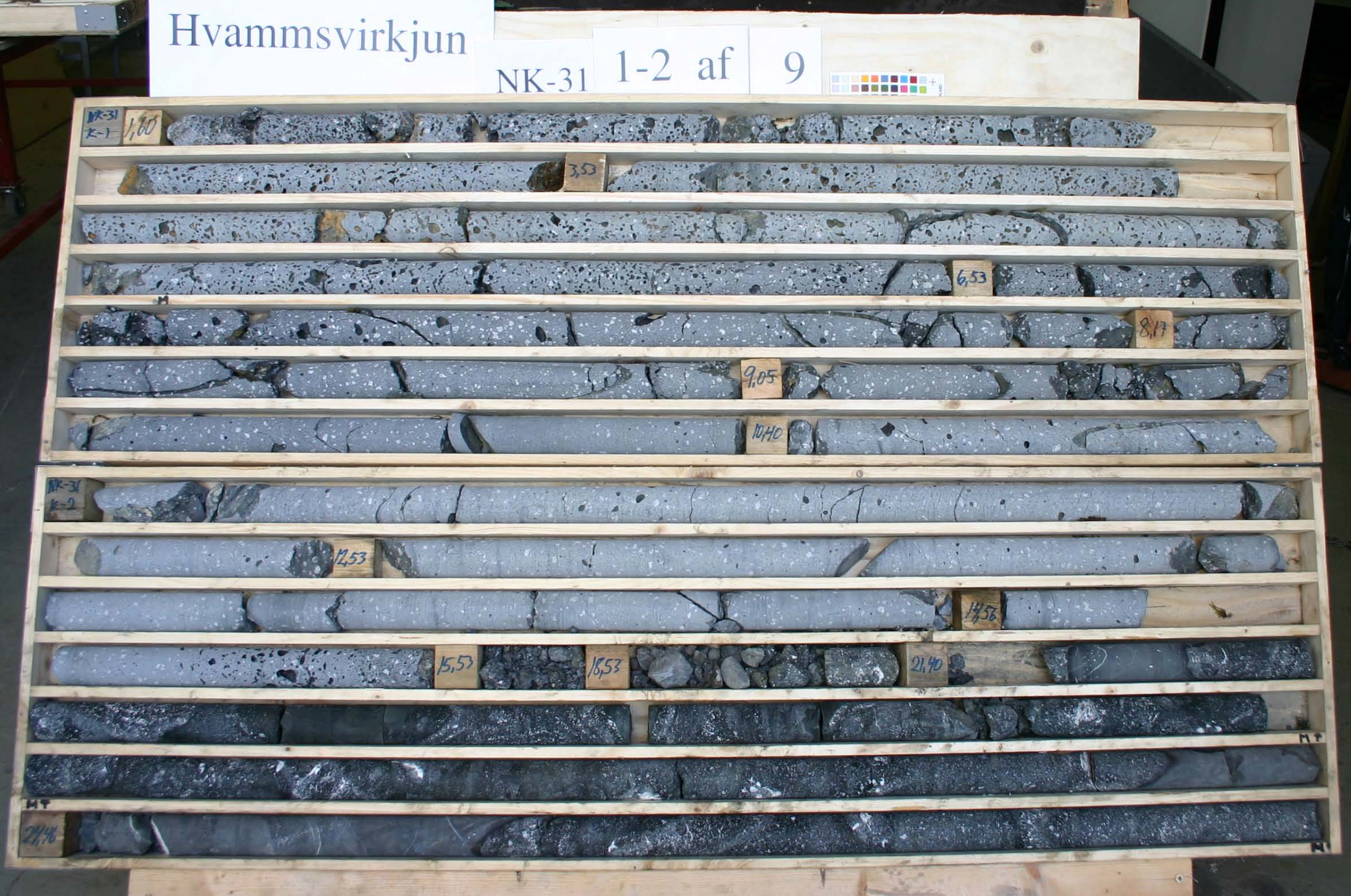

Hvammsvirkju
NK-30
5-6 af 9
NK-30
K-5
48,53
51,53
53,21
54,53
NK-30
K-6
57,44
60,53

Hvammsvirkjun NK-30 7-8 9

NK-30 K-7 6353 6653 6990

NK-30 K-8 72,53 75,53 78,53


Hvammsvirkjun
NK-30
9
81,53


Hvammsvirkjun
NK-31 1-2 af 9
NK-31 K-1
1,60
3,53
6,53
8,17
9,05
10,40
NK-31 K-2
12,53
14,56
15,53
18,53
21,40
21,76


Hvammsvirkjun
NK-31
3-4 af 9
NK-31
K-3
27,53
34,53
33,53
34,14
NK-31
K-4
36,53
39,53
42,53


Hvammsvirkjun
NK-31
5-6 af 9
NK-31
K-5
45,53
48,53
51,53
NK-31
K-6
54,08
57,18
60,26


Hvammsvirkjun
NK-31
7-8
9
NK-31
K-7
63,36
64,41
69,50
NK-31
K-8
72,53
75,55
77,57
78,55
80,77


Hvammsvirkjun
NK-31
9
NK-31
K-9
81,53


Hvammsvirkjun
NK-32
1-2 af 6
334
9,36
11,03
11,08
11,87
12,53
15,53
18,53
21,53
24,53

Hvammsvirkjun

NK-32 3-4 af 6

NK-32
K-3

3353

3453

3553

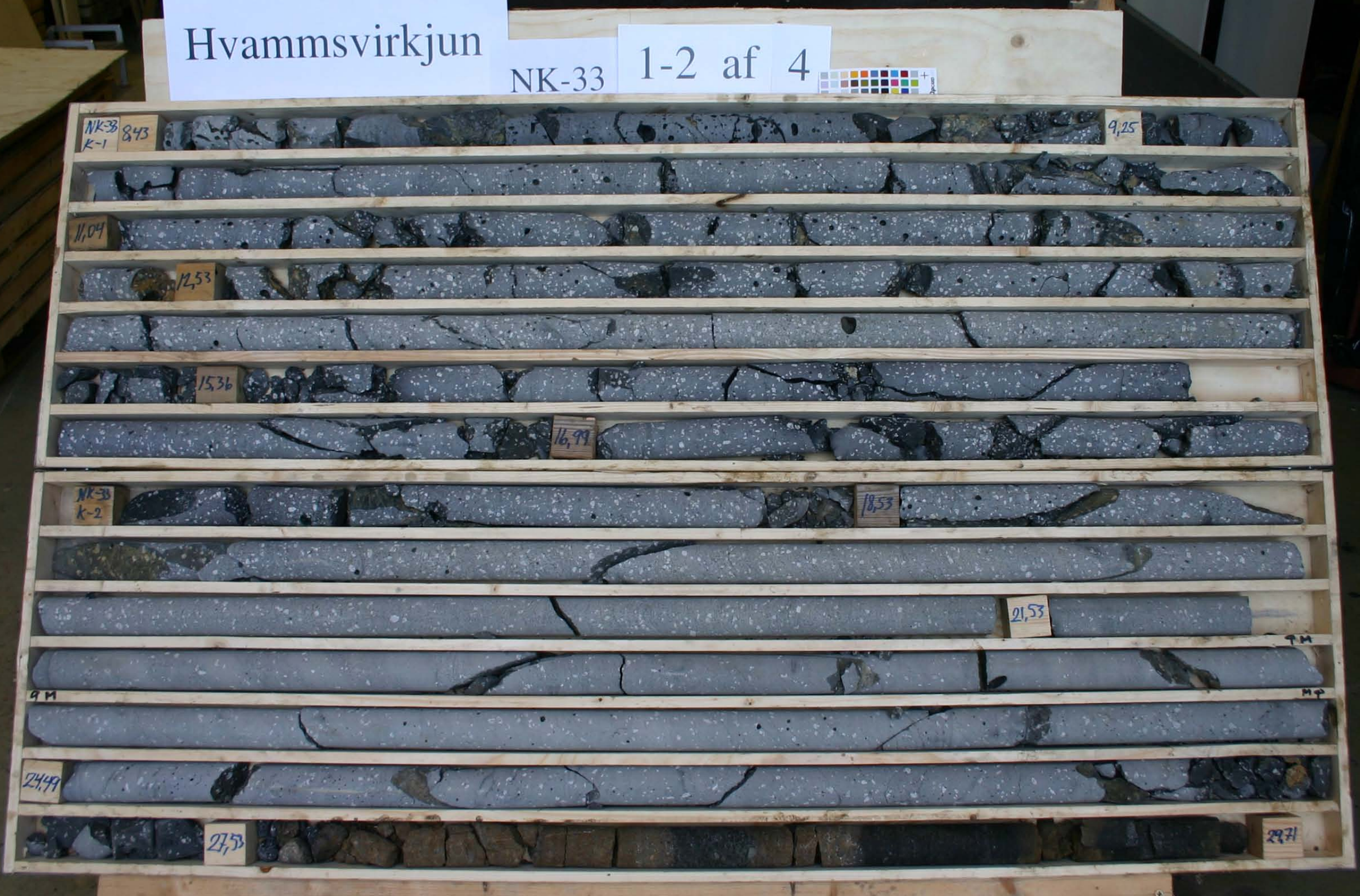
NK-32
K-4

3653

3753

4253


Hvammsvirkjun
NK-32
5-6 af 6
NK-32
K-5
45,53
48,53
51,53
54,53
NK32
K-6
57,53


Hvammsvirkjun
NK-33
1-2 af 4
NK-33
K-1
8,43
9,25
11,04
12,53
15,36
16,99
NK-33
K-2
18,53
21,53
24,49
27,53
29,71


Hvammsvirkjun
NK-33
3-4 af 4
NK-33
K-3
30,53
33,53
36,53
NK-33
K-4
39,53
41,05
42,10
45,16

Hvammsvirkjun

NK-34

1-2 af 5

Hvammsvirkjun

NK-34 3-4 af 5

NK-34
K-3

33,53

M M

34,53

M

39,53

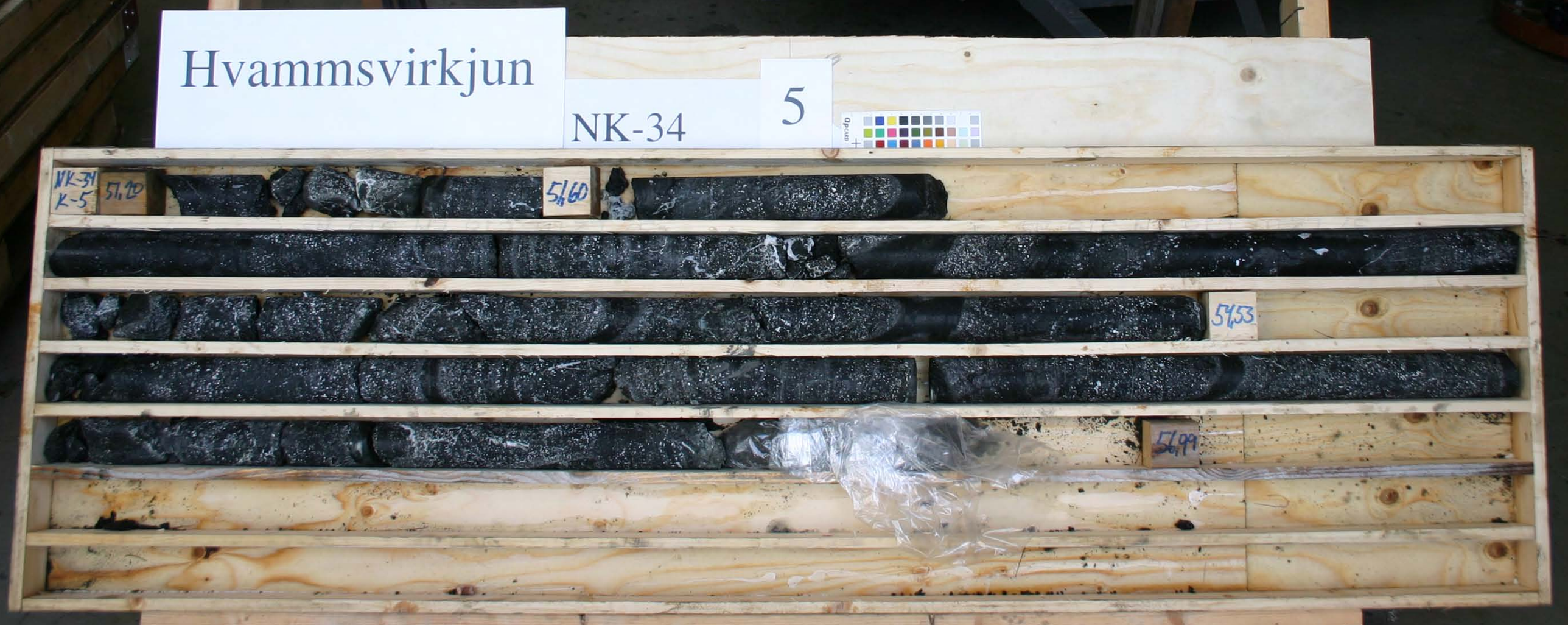
M

NK-34
K-4

42,53

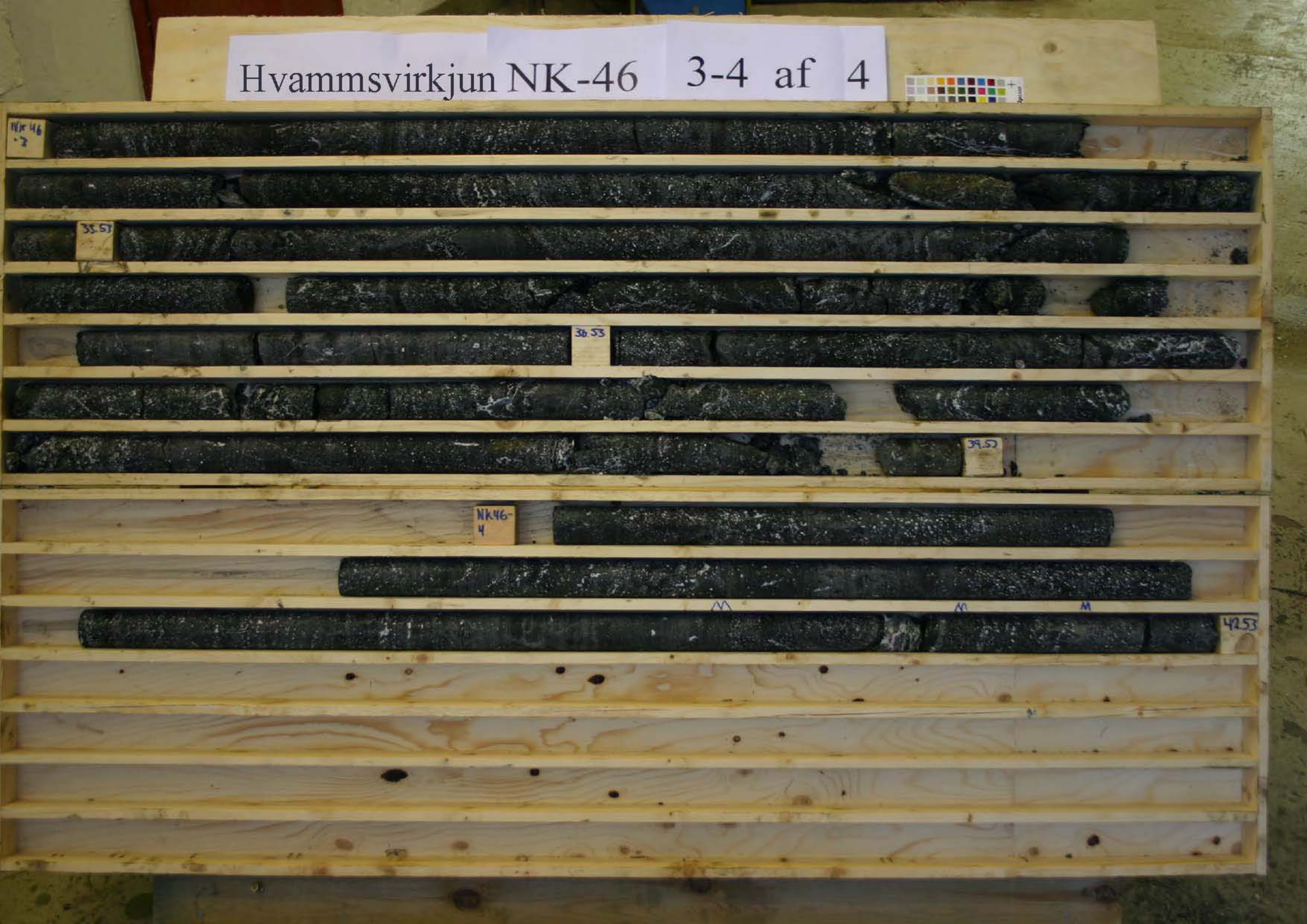
45,53

48,53

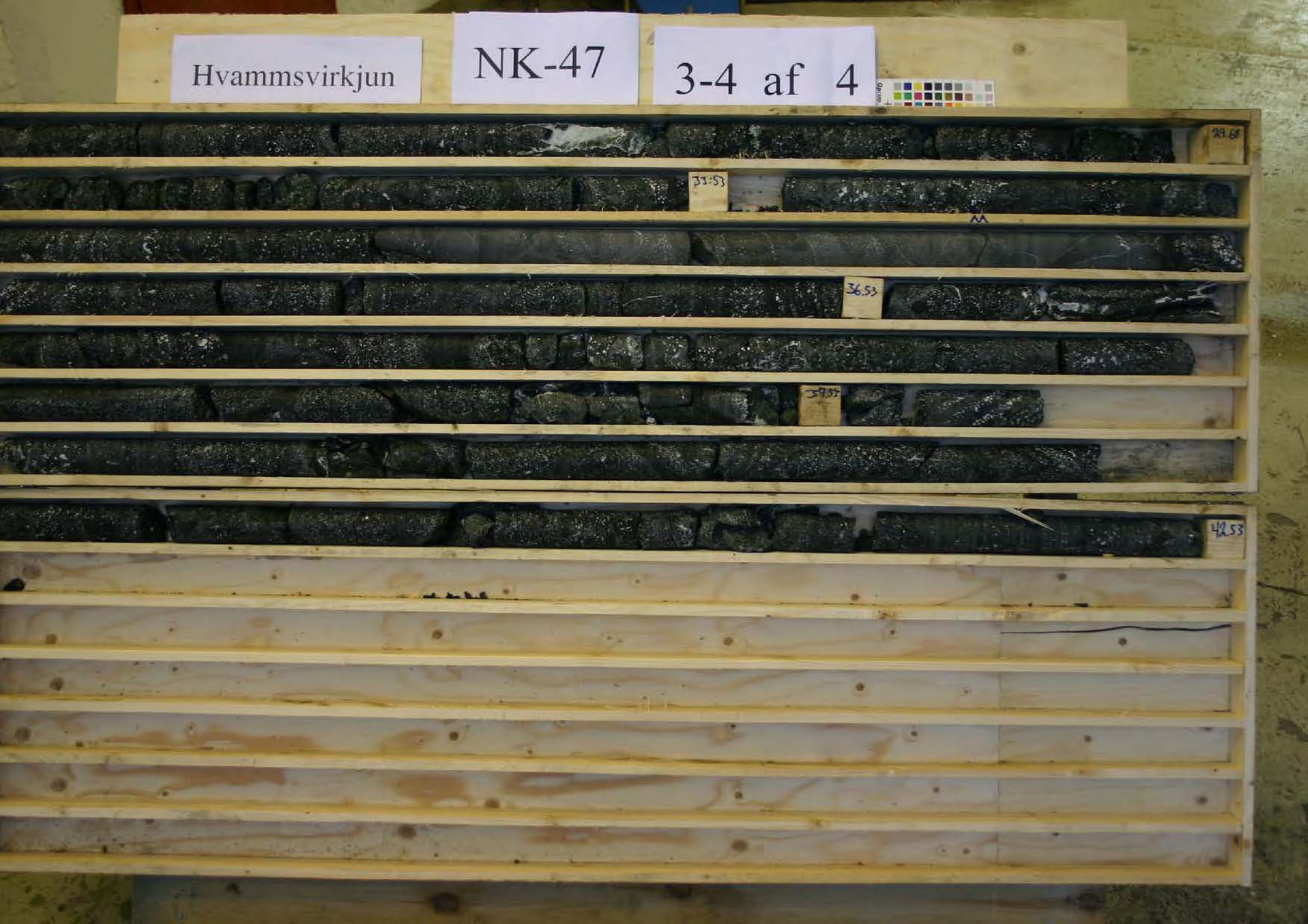

Hvammsvirkjun
NK-34
5
NK-34
K-5
51,20
51,60
54,53
56,99


Brúarstæði gengt
Þjórsárholti
NK-35
1-2 af 2
NK-35
K-1
3,55
6,53
8,13
8,83
10,46
11,49
12,53
15,53
NK-35
K-2
18,53
21,53
24,53
27,53
28,79


Hvammsvirkjun NK-46 1-2 af 4
NK-46 K-1
6,10
8,10
9,53
12,03
14,07
14,63
15,53
17,51
18,53
20,91
NK-46 K-2
23,99
26,82
27,53
30,53


Hvammsvirkjun NK-46 3-4 af 4
NK 46 -3
35.53
36.53
39.53
NK46-4
42.53


Hvammsvirkjun
NK-47
1-2 af 4
NK47
8,50
11.18
12.53
15.57
18.53
20.43
20.63
21.57
24.23
24.98
27.53
30.53


Hvammsvirkjun
NK-47
3-4 af 4
29.68
33.53
36.53
39.53
42.53


Hvammsvirkjun
NK-48
1-2 af 5
NK-48 K-1 6,10
6,53
9,53
12,53
14,26
NK-48 K-2
15,53
18,51
21,53


Hvammsvirkjun
NK-48 3-4 af 5
NK-48
K-3
22,92
24,53
27,53
30,53
NK-48
K-4
33,53
34,95
36,53


Hvammsvirkjun
NK-48
5
af 5
NK-48
K-5
POINT LOAD
41,40
42,53
POINT LOAD


Hvammsvirkjun
NK-49 1-2 af 2
NK-49
K-1
0,50
3,16
5,86
6,53
9,53
NK-49
K-2
12,53

Holtavirkjun Hydroelectric Project

Percussion hole logs

Logs of NL-14 to NL-18, NL-20 to NL-45 and NL-47 to NL-48

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-14

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
15.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 442903,17 Y: 392805,89 Elevation: 92,95 m.a.s.l.

Elev. m a.s.l.	Depth m	Core/cuttings description	Depth m	Casing
92.5		Soil		
	2	Þjórsá-lava Holocene lava with large plagioclase phenochrystals	2	
	4	Scoria	4	
	6		6	
	8		8	
84.5		Þjórsá - lava Solid lava Lightgrey basalt cuttings with large plagioclase phenochrystals.		
	10		10	
81	12	Sand and gravel Fine gravel and sand. Rich in tephra. Rounded pebbles of various origin <2cm. Plg. crystal fragments visible. Rock fcuttings of Þjórsá-lava visible in this range.	12	
	14		14	
78		Rounded pebbles <2cm of various origin dominating. Rock cuttings of Olivine basalt found in this range.		
	16		16	
		Rock cuttings of Olivine basalt. Rounded pebbles also found at this range.		
	18		18	
		Olivine basalt rock cuttings dominating. Small rounded pebbles <5mm also found at this range.		
	20		20	
		Akbraut interglacial olivine basalt Lightgrey mediumgrained rock cuttings with olivine, pyroxene and plg. crystals visible.		
	22		22	
	24		24	
		Olivine basalt rock fragments dominating. Small rounded pebbles entering sample (<5%).		
	26		26	
	28		28	
	30		30	
		Rock cuttings of Olivine basalt dominating with some small rounded pebbles (<5%).		
	32		32	
59	34	Fine gravel with tephra sand Poor cutting recovery in this layer	34	
	36		36	
		Mixture of rock fragments, tephra sand and pebbles of various origin.		
	38		38	
	40		40	
		Rock fragments, tephra sand and rounded pebbles <1cm of various origin, mostly basalt.		
	42		42	
	44	Pebbles and rock fragments <5mm in size and fine tephra sand.	44	
	46	Sand and gravel	46	
46.5		Dark tephra sand and coarse gravel. Large rounded pebbles <2cm, some broken from the drill cutting. Mostly basalt but some ryolite fragm (10%).		
45	48	Bottom at 48m	48	

3" ODEX casing

WL=8.06 (14.09.06)
HD=48

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Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-15

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
15.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 443232,80 Y: 392843,27 Elevation: 102.72 m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
102.2	0			Soil		
	2			Þjórsá-lava Holocene lava with large plagioclase phenochrystals		
	4			Scoria		3" ODEX casing
	6					
	8					
93.2	10			Þjórsá-lava cont. Solid lava. Lightgrey mediumgrained porphyritic basalt cuttings. Some fragments vesicular. 10,5-11m brownish drilling fluid.		
	12					
	14					
	16					
	18					
	20			Porphyritic mediumgrained rock cuttings.		
	22					
	24					
	26			Porphyritic mediumgrained rock cuttings.		
	28					
72.7	30			Sand and coarse gravel Gravel w/rounded pebbles of various origin <2,5 cm, rhyolite pebbles (10%), solid basalt rock and scoria fragments. Coarse sand with tephra grains.		
	32					
68.2	34			Finer gravel size <1cm.		
	36			Bottom at 34.5m		
	38					
	40					
	42					
	44					
	46					
	48					

WL=15.28 (14.09.06)

HD=34.5

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-16

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQ
Date of drilling: 16.08.2006	Drawn: ÁÓT/MM
Drawing no.	WATERHOLE

Coordinates: ISN93 X: 444880,24 Y: 394045,89 Elevation: 106,48

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description
102,5	4			Scoria
				Þjórsá-lava
				Holocene lava with large plagioclase phenocrystals.
				Solid lava. Porphyritic basalt.
				Lightgrey porphyritic basalt fragments.
94	12			Þjórsá-lava
				Porphyritic scoria fragments.
90,5	16			Hyaloclastite. Vesicular fragments with zeolites.
				Bottom at 16m

Depth m / Casing: 3" ODEX casing

WL=6.77 (14.09.06)
HD=16

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-17

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
17.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 443635,54 Y: 392895,25 Elevation: 108,97

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
108	0			Soil	0	
	2			Þjórsá-lava	2	
	4			Holocene lava with large plagioclase phenochrystals.	4	3" ODEX casing
	6			Scoria	6	
102	8			Þjórsá-lava cont.	8	
	10			Solid lava.	10	
	12			Lightgrey basalt with large plagioclase phenochrystals. Olivine and pyroxene crystals also visible.	12	
	14				14	
	16			Relatively faster drilling in section between 12 and 21m	16	
	18			Porphyritic rock cuttings. Small fragments (<5mm).	18	
	20				20	
	22			Porphyritic rock cuttings.	22	
	24				24	
	26				26	
	28			Porphyritic rock cuttings.	28	
	30				30	
	32				32	
75,5	34			Sand and gravel Black tephra sand. Gravel w/rounded pebbles of various origin (10%) <2-3cm.	34	
73	36			Bottom at 36m	36	
	38				38	
	40				40	
	42				42	
	44				44	
	46				46	
	48				48	

WL=18.37 (14.09.06)

HD=36

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-18

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
18.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 443923 Y: 392934 Elevation: 109,36

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description
				Soil
107,9	2			Þjórsá-lava Holocene lava with large plagioclase phenochrystals
	4			Scoria
104,9				
	6			
	8			Þjórsá-lava
	10			Solid lava. Porphyritic basalt cuttings.
	12			Drilling goes faster in sections marked between dashed lines
	14			
	16			Darkgrey dense rock cuttings with large plagioclase phenochrystals.
	18			
	20			
	22			Darkgrey dense rock cuttings with large plagioclase phenochrystals.
	24			
	26			Mediumgrained, porphyritic rock cuttings.
	28			
	30			Lightgrey porphyritic basalt cuttings.
	32			
75,4	34			Sand and gravel Tephra sand. Scoria fragments. Rounded gravel pebbles
73,4	36			<2cm, mostly basalt. Other origin 5%.
				Bottom at 36m
	38			
	40			
	42			
	44			
	46			
	48			

Depth m | Casing

3" ODEX casing

WL=17.50 (14.09.06)

HD=36

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-20

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
21.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 444102,32 Y: 393003,42 Elevation: 106,98

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
105	0–2			Soil		
	2–4			Þjórsá-lava Holocene basalt with large plagioclase phenochrystals.		3" ODEX casing
	4–6					
	6–8			Solid lava. Porphyritic basalt.		
	8–10					
	10–12			Lightgrey porphyritic rock cuttings.		
	12–14					
	14–16			Lightgrey porphyritic rock cuttings mixed with finer cutting size fragments.		
	16–18					
	18–20			Fine cutting fragments, down to clay/sand size.		
	20–22					
	22–24					
	24–26			Porphyritic rock cuttings.		
	26–28					
	28–30			Mediumgrained, porphyritic rock cuttings. Brown drilling fluid below 27m.		
77	30			Sand and gravel Tephra sand. Rounded pebbles of various origin <1cm.		
75,5	32			Bottom 31.5m		
	34–48					

WL=13.32 (14.09.06)
HD=31.5

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-21

Contractor:	Drill:
RSFS	Langþráður
Site:	**Diameter:**
Hvammur	ODEX 3"/NQ
Date of drilling:	**Drawn:**
22.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 444404,49 Y: 393336,54 Elevation: 107,19

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description
	2			Soil
104,2	4			Þjórsá-lava Holocene basalt with large plagioclase phenochrystals. Vesicular fragments.
	6			
	8			Solid lava.
	10			Porphyritic rock cuttings
	12			Drilling goes faster between dashed lines.
94,2	14			Coarse vesicular basalt fragments w/plagioclase phenochrystals.
	16			Skarðsfjall-hyaloclastite
	18			Vesicular basalt cuttings with zeolite fillings, large fragments <2.5cm.
	20			
	22			Finer fragments <1cm.
	24			
	26			Fine vesicular basalt fragments <1cm, zeolites (20%).
	28			
	30			Vesicular basalt fragments <1.5cm, zeolites (20%).
	32			
	34			Cuttings fragmented <5mm. High zeolite percentage (25%).
71,2	36			Bottom 36m
	38			
	40			
	42			
	44			
	46			
	48			

Depth m | Casing

3" ODEX casing

WL=9.56 (14.09.06)

HD=36

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-22

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
23.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 444320,11 Y: 393387,71 Elevation: 106,70

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
104,7	0			Soil		
	2			Þjórsá-lava Holocene basalt with large plagioclase phenochrystals.		
	4			Solid lava. Large vesicular fragments <2cm.		
	6			Relatively faster drilling.		
	8			Vesicular porphyritic basalt fragments <2cm.		
	10			Vesicular porphyritic basalt cuttings. Fragments of sandstone also found. Faster drilling below 11m.		
95,2						
94,7	12			Skarðsfjall hyaloclastite Fine scoraceous basalt and hyaloclastite cuttings w/high percentage of zeolites (20%).		
91,7	14			Bottom 15m		
	16					
	18					
	20					
	22					
	24					
	26					
	28					
	30					
	32					
	34					
	36					
	38					
	40					
	42					
	44					
	46					
	48					

3" ODEX casing

WL=14.8 (14.09.06)
HD=15

DRAFT

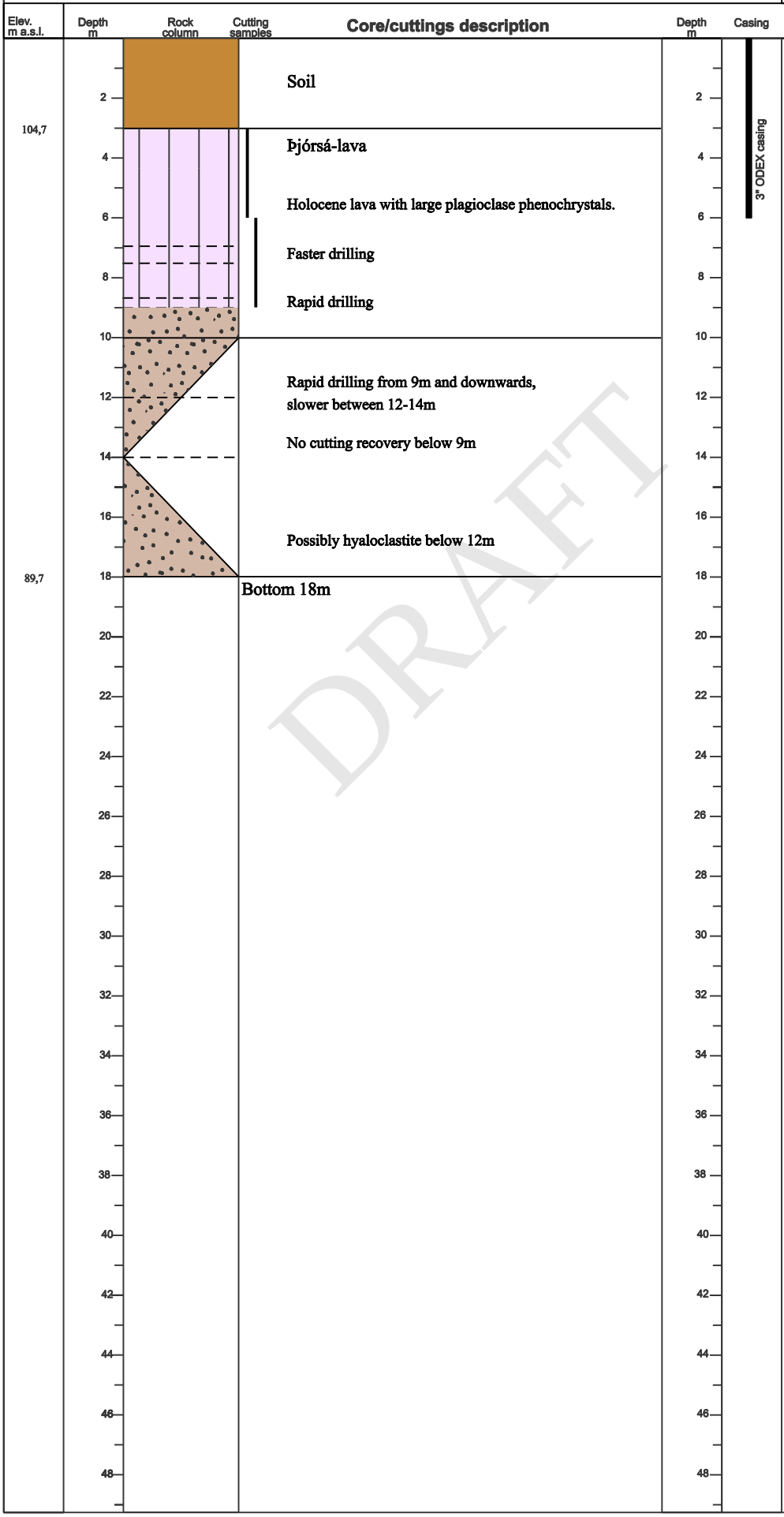
Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-23

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
23.08.2006	MM
Drawing no.	

Coordinates: ISN93 X: 444728,68 Y: 393643,68 Elevation: 107,66



DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-24

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
24.08.2006	MM
Drawing no.	

Coordinates: ISN93 X: 444684,07 Y: 393673,69 Elevation: 106,12

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
	0–4			Soil		
102,1	4–6			Þjórsá-lava Holocene lava with large plagioclase phenochrystals. Scoria.		
99,8	6–16			Þjórsá-lava Solid lava. Porphyritic basalt. Rapid drilling 11,5-12m Large cuttings of porphyritic basalt <2cm. Basalt fragments <3cm.		3" ODEX casing
90,1	16–18			Skarðsfjall hyaloclastite Fine cuttings of vesicular basalt fragm. filled with zeolites. Also single plg/olivine chrystals and zeolites (20%).		
88,1	18			Bottom 18m		

WL=7.40 (14.09.06)
HD=18

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-25

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
24.08.2006	MM
Drawing no.	

Coordinates: ISN93 X: 444634,47 Y: 393707,31 Elevation: 106,08

Elev. m a.s.l.	Depth m	Core/cuttings description	Depth m	Casing
	2	Soil		
102,1	4	Þjórsá-lava Holocene basalt with large plagioclase phenochrystals. Scoria.		
99,6	6	Þjórsá-lava cont. Rapid drilling 7-7,3m and 8,2-8,3		3" ODEX casing
	8	Solid lava.		
	10			
	12	Porphyritic rock cuttings. Fractions <2.5cm.		
	14			
	16	Cont. porphyritic rock cuttings.		
	18	Finer rock cuttings <5mm. Sandstone fragments found (5%).		
	20	Slower drilling below 19,5		
	22	Porphyritic rock cuttings.		
83,6		Fine sand Black tephra sand. Other fragments <5%.		
82,1	24	Sand and gravel Tephra sand and gravel, rounded basalt pebbles <1cm. Zeolites in some pebbles.		
	26			
78,6		Finer gravel pebbles <5mm.		
	28	Bottom 27.5		
	30			
	32			
	34			
	36			
	38			
	40			
	42			
	44			
	46			
	48			

WL=7.49 (14.09.06)
HD=27.5

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-26

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
24.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 444940,83 Y: 394062,87 Elevation: 107.55 m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
107	0			Soil	0	
	2			Þjórsá-lava	2	
				Scoria		
	4			No cutting recovery	4	
				Rapid drilling 2-3,8; 6,2-8 and 8,5-9		
	6				6	
				Porphyritic scoraceous basalt fragments <1cm		
	8				8	
				No cutting recovery		
97.5	10			Bottom 10m	10	

3" ODEX casing

WL=7.78 (14.09.06)
HD=10

DRAFT

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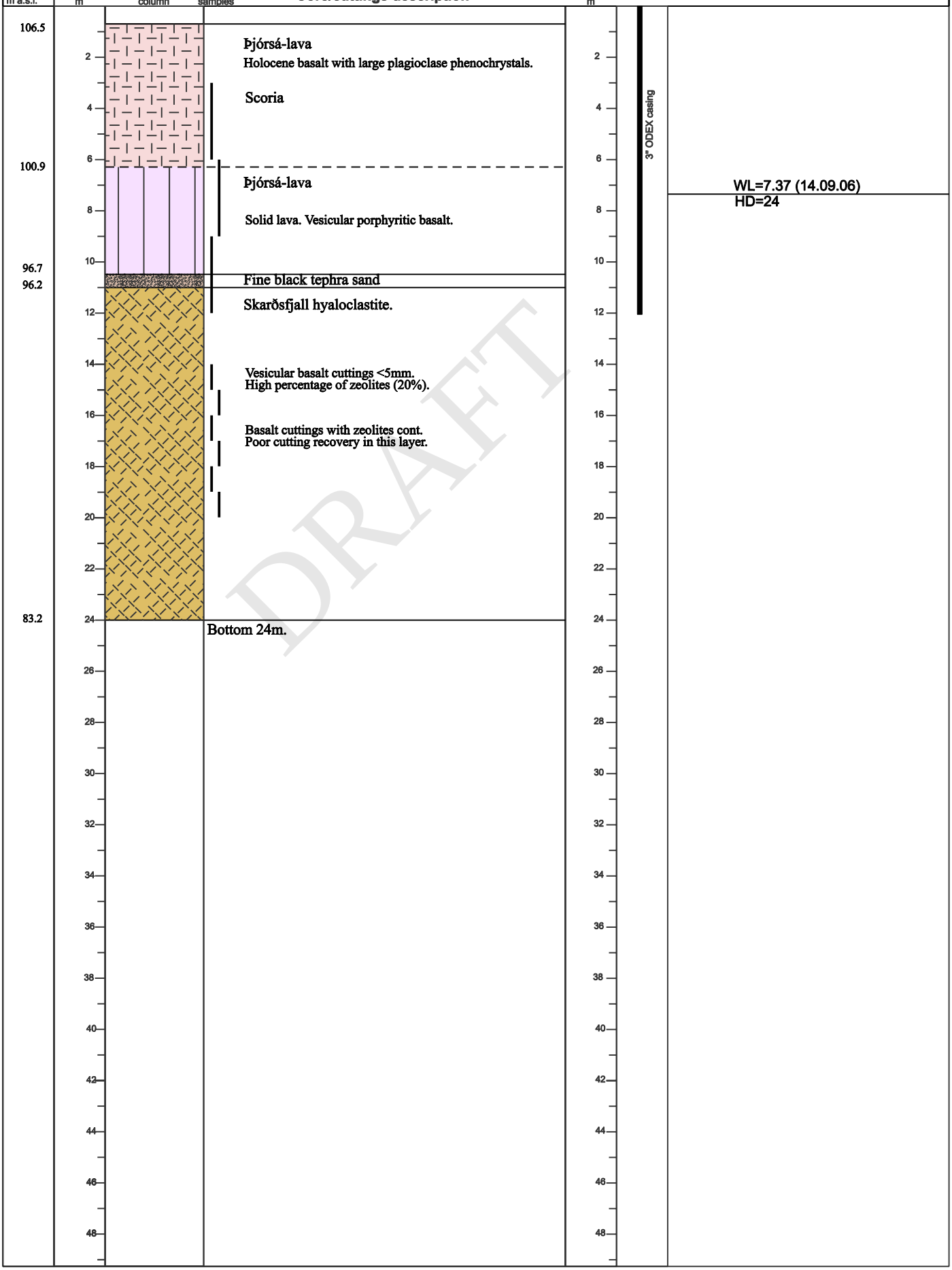
Landsvirkjun

Hvammsvirkjun HEP
NL-27

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
28.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 444955,53 Y: 394079,81 Elevation: 107.15 m.a.s.l.



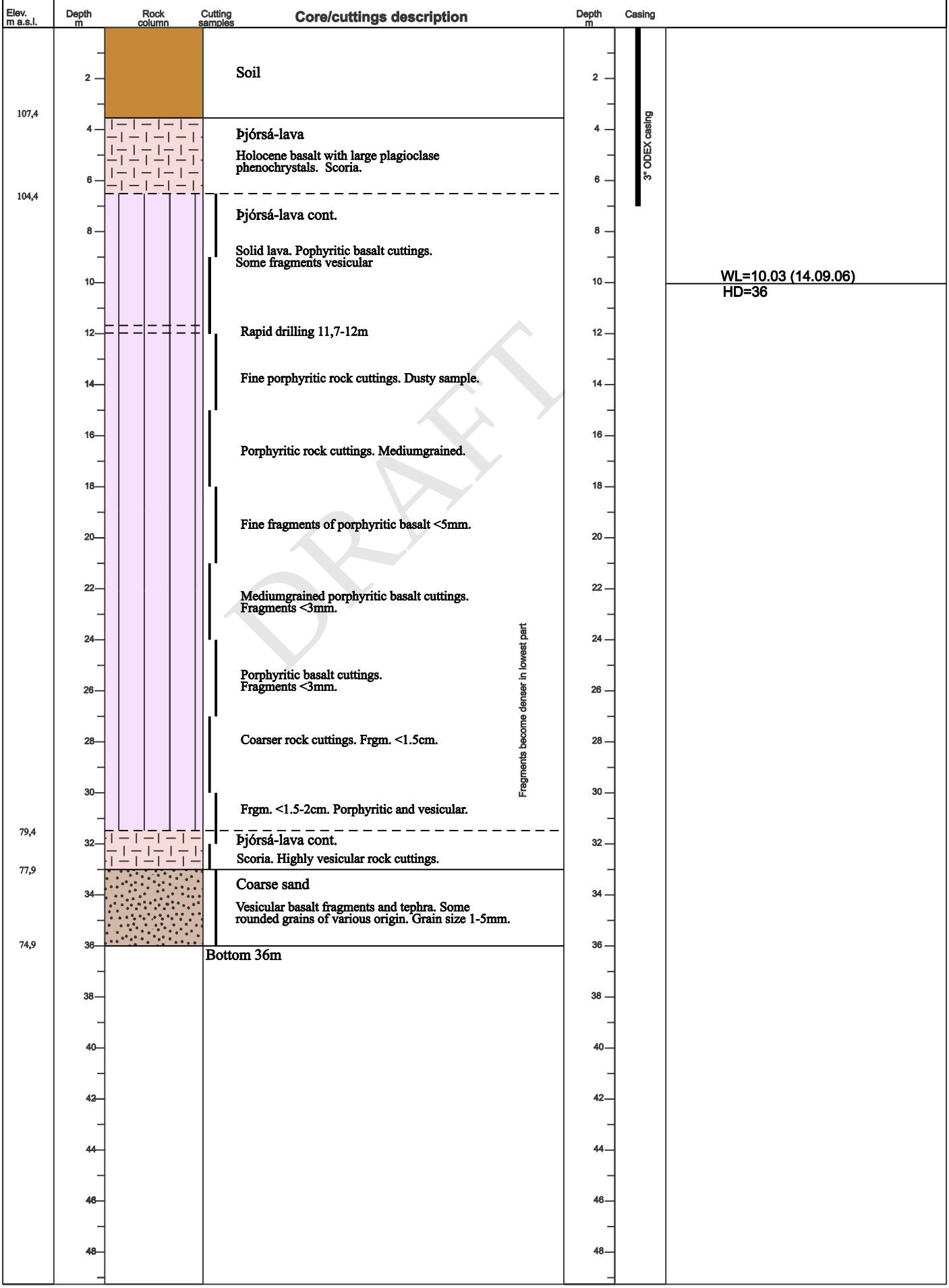
Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-28

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
29.08.2006	MM
Drawing no.	

Coordinates: ISN93 X: 444665,30 Y: 394410,70 Elevation: 110,93 m.a.s.l.



Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-29

Contractor:	Drill:
RSFS	Langbráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
30.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 444933,43 Y: 394345,99 Elevation: 112,34 m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description
	0			Soil
109,3	2			
108,8	3			Þjórsá-lava. Scoria.
	4			Þjórsá-lava
	6			Holocene basalt with large plagioclase phenochrystals.
	8			Porphyritic cuttings <1cm. Silt/sand fragments found. Some fragments vesicular
	10			Lightgrey porphyritic cuttings <1cm. Some fragments vesicular
	12			Porphyritic vesicular basalt cuttings
	14			
	16			Very fine cuttings, dusty
	18			Fine cutting fragments of porphyritic basalt
	20			
	22			Porphyritic basalt, fine fragments <3mm
	24			Mediumgrained porphyritic basalt cuttings <5mm
	26			
	28			Fine cuttings of porphyritic basalt.
	30			Rapid drilling through 30m
	32			Porphyritic scoraceous basalt cuttings.
78,8	34			Sand and gravel
				Black tephra sand. Gravel pebbles of various origin.
76,3	36			Pebble size <2,5cm
				Bottom 36m
	38			
	40			
	42			
	44			
	46			
	48			

Depth m

Casing: 3" ODEX casing

WL=11.55 (14.09.06)
HD=36

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-30

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
30.08.2006	ÁÓT/MM
Drawing no.	

Coordinates: ISN93 X: 444935,00 Y: 394420,00 Elevation: 112

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
	0–4			Soil		3" ODEX casing
	4–6			Þjórsá-lava. Scoria.		
	6–32			Þjórsá-lava Holocene basalt with large plagioclase phenochrystals. Rapid drilling in 7-7,15m Porphyritic rock cuttings Porphyritic cuttings. Fragments <5mm. Porphyritic basalt. Fragments <1,5cm. More massive downwards Porphyritic rock cuttings		
	32–36			Black sand and gravel Mixture of Vesicular porphyritic basalt and tephra grains. Rounded gravel pebbles of various origin(10%). Pebble fragments <2cm and tephra sand.		
	36			Bottom 36m		

WL=11.74 (14.09.06)
HD=36

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-31

Contractor:	Drill:
RSFS	Langbráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
31.08.2006	MM
Drawing no.	

Coordinates: ISN93 X: 445084,49 Y: 394611,26 Elevation: 113,77 m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
	0–2			Soil		
110,3	2–4			Þjórsá-lava Scoria. Holocene basalt with large plagioclase phenochrystals.		
108,3	4–6			Porphyritic basalt cutting. Some vesicular fragments.		3" ODEX casing
106,8	6–8			Bottom 7m		

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Landsvirkjun

Hvammsvirkjun HEP
NL-32

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
31.08.2006	MM
Drawing no.	

Coordinates: ISN93 X: 445423,35 Y: 394788,51 Elevation: 112,65 m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
	0			Soil		
110,7	2			Þjórsá-lava Scoria		
110,4				Þjórsá-lava		
108,7	4			Holocene basalt with plagioclase phenochrysts.		
				Bottom 4m		
	6					
	8					
	10					
	12					
	14					
	16					
	18					
	20					
	22					
	24					
	26					
	28					
	30					
	32					
	34					
	36					
	38					
	40					
	42					
	44					
	46					
	48					

3" ODEX casing

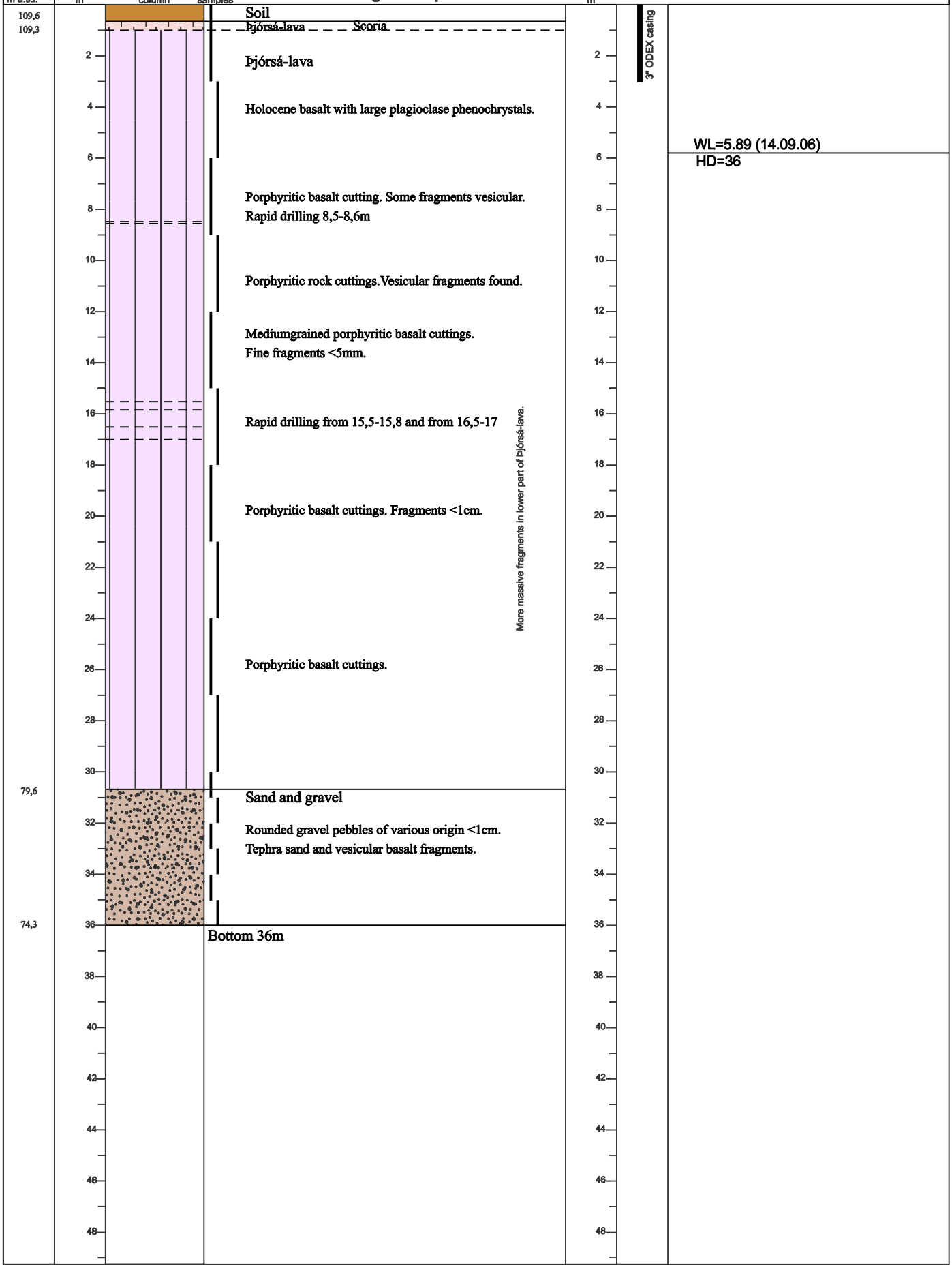
Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-33

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
31.08.2006	MM
Drawing no.	

Coordinates: ISN93 X: 445742,61 Y: 394947,60 Elevation: 110,25 m.a.s.l.



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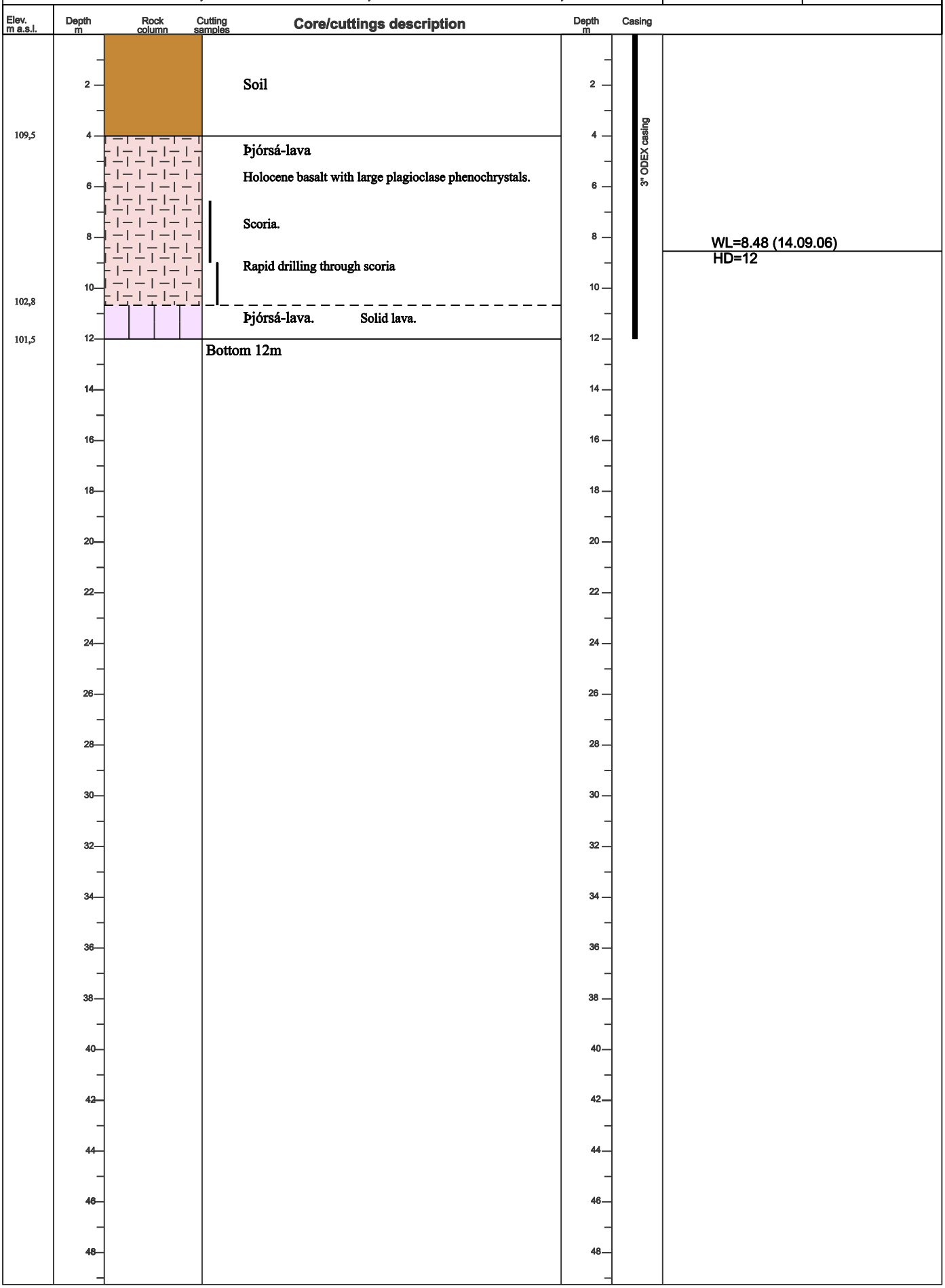
Landsvirkjun

Hvammsvirkjun HEP
NL-34

Contractor:	Drill:
RSFS	Langbráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
31.08.2006	MM
Drawing no.	

Coordinates: ISN93 X: 446042,54 Y: 395052,68 Elevation: 113,51 m.a.s.l.



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Landsvirkjun

Hvammsvirkjun HEP
NL-35

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
01.09.2006	MM
Drawing no.	

Coordinates: ISN93 X: 446331,05 Y: 395180 Elevation: 114,29 m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
	0–6			Soil		3" ODEX casing
108,8	6–10			Þjórsá-lava Holocene basalt with large plagioclase phenochrystals. Scoria.		
104,3	10–12			Þjórsá-lava Solid lava.		
102,3	12			Bottom 12m		

WL=8.20 (14.09.06)
HD=12

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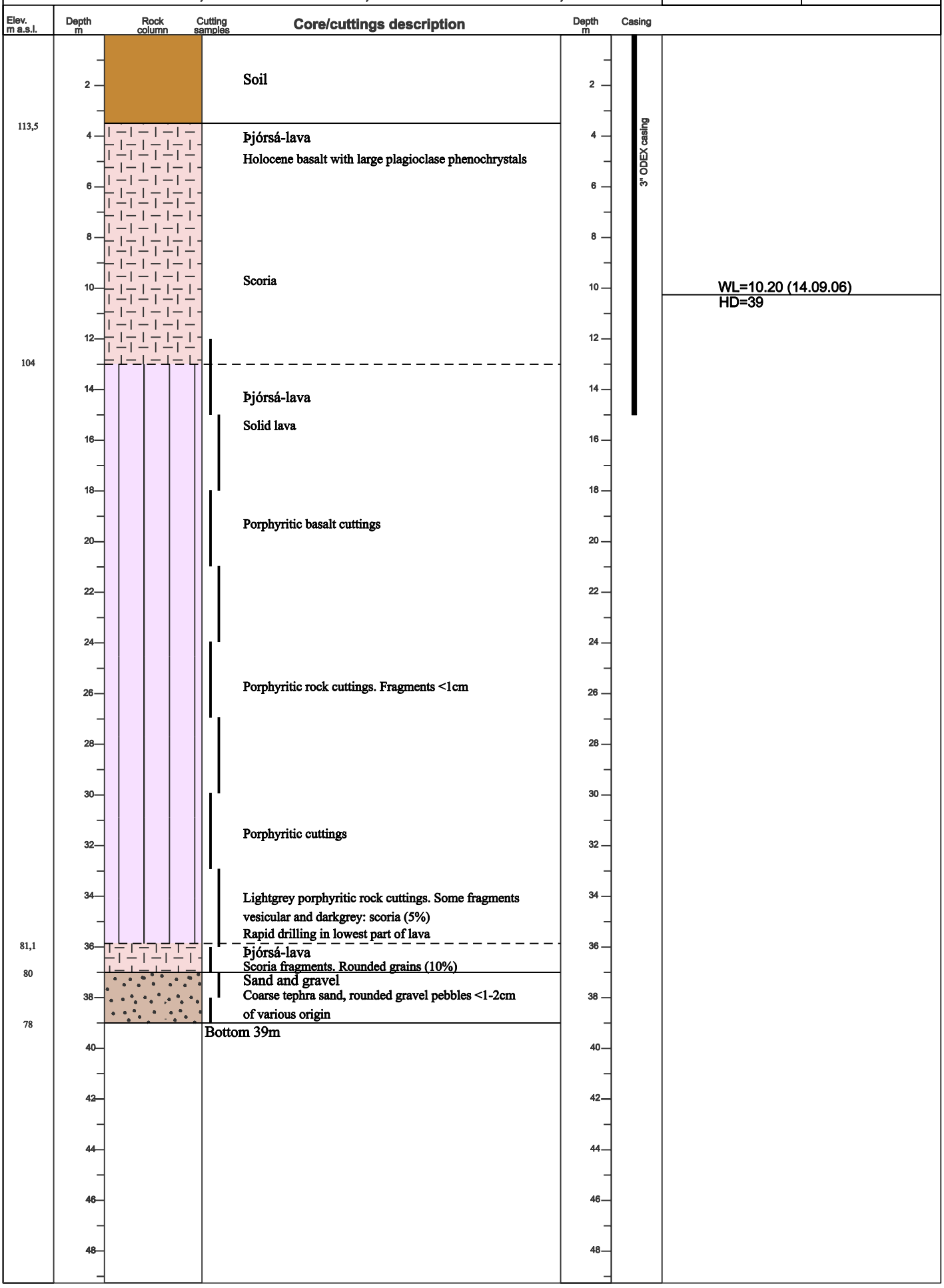
Landsvirkjun

Hvammsvirkjun HEP
NL-36

Contractor: RSBS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQ
Date of drilling: 01.09.2006	Drawn: MM
Drawing no.	

Coordinates: ISN93 X: 446645,13 Y: 395364,31 Elevation: 117,00 m.a.s.l.



Almenna Consulting Ltd.

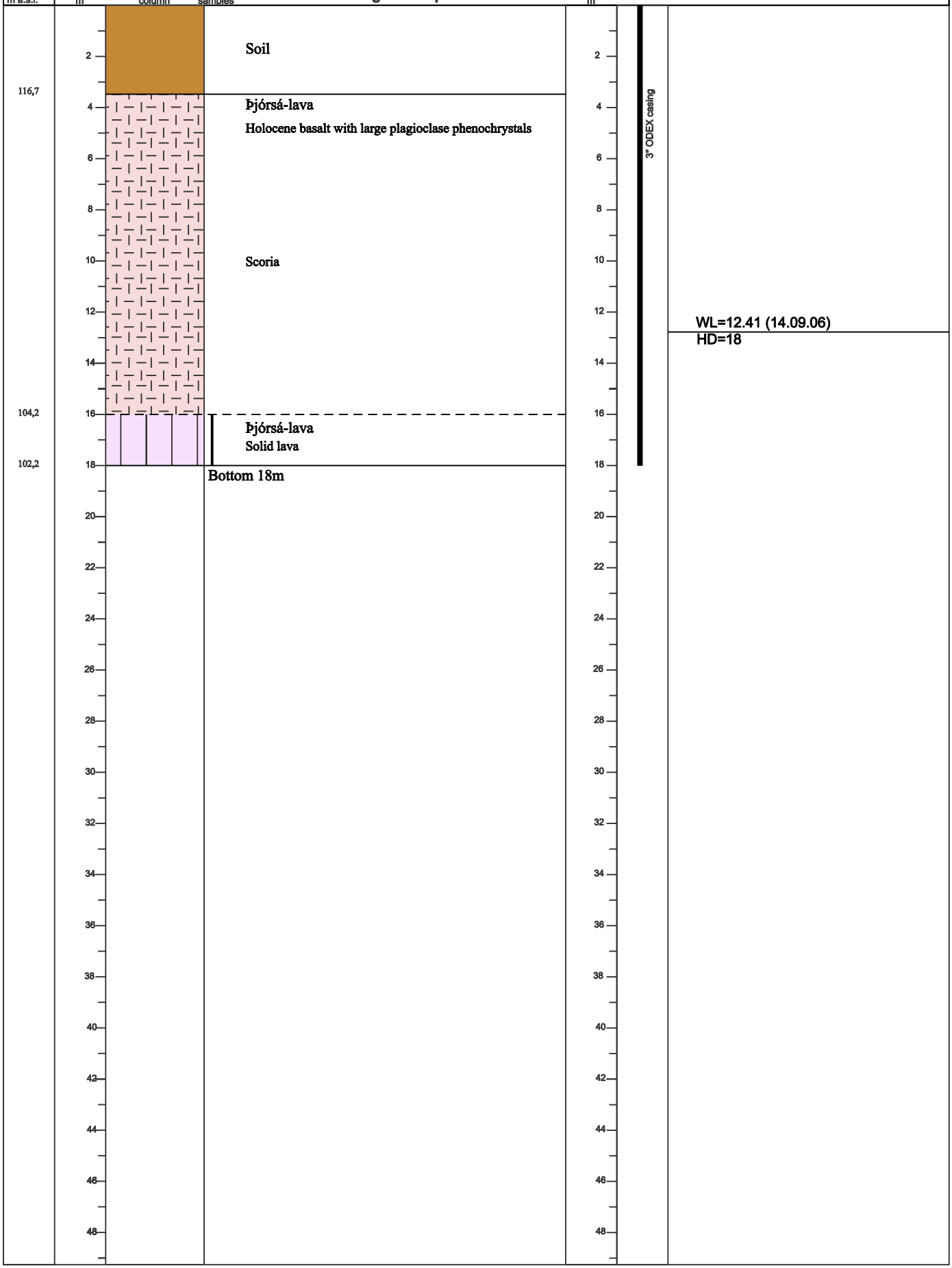
Landsvirkjun

Hvammsvirkjun HEP
NL-37

Contractor:	Drill:
RSFS	Langbráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
01.09.2006	MM

Coordinates: ISN93 X: 446864,55 Y: 395455,26 Elevation: 120,16 m.a.s.l.

Drawing no.



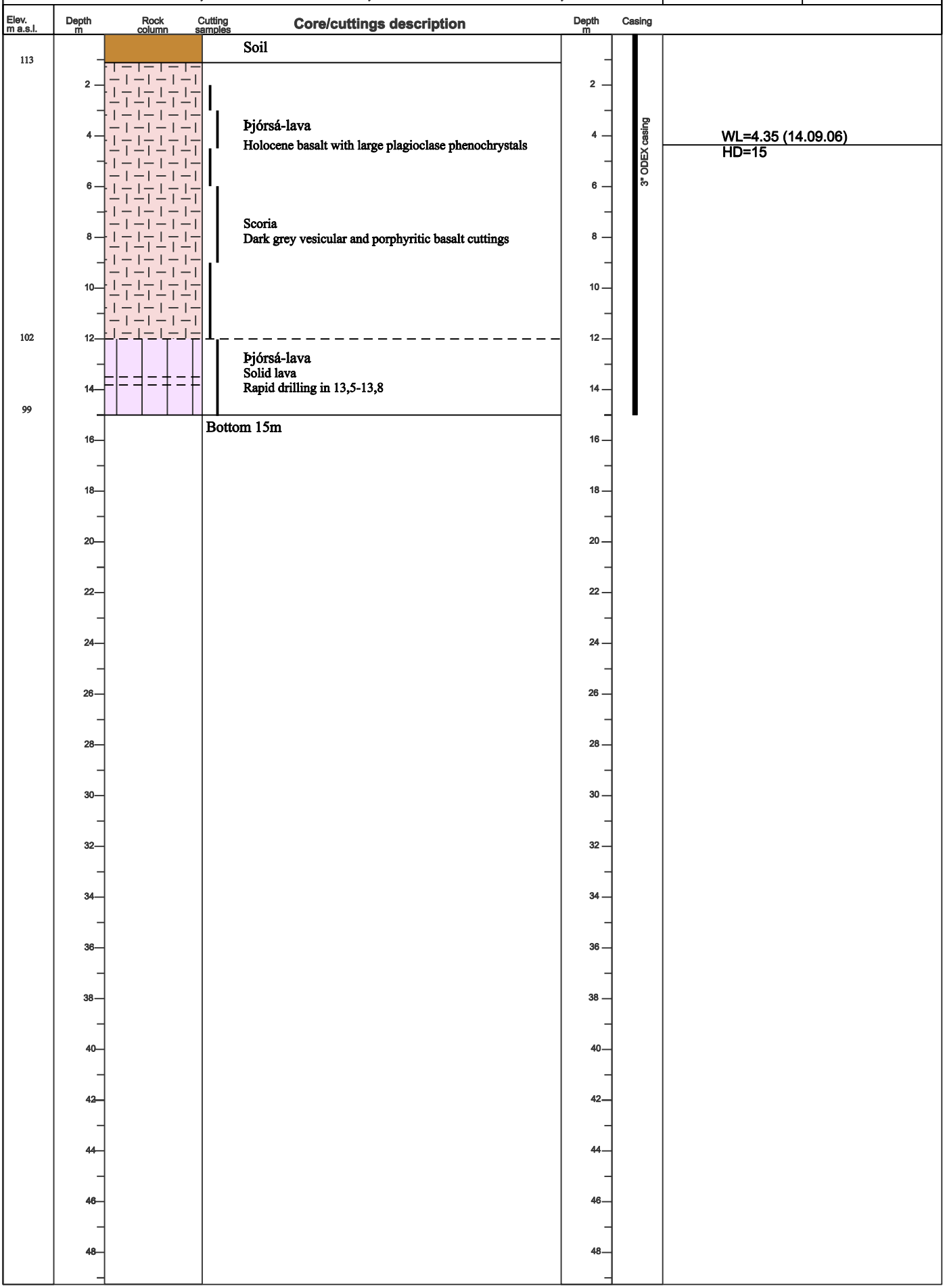
Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-38

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQ
Date of drilling: 04.09.2006	Drawn: MM
Drawing no.	

Coordinates: ISN93 X: 447151,32 Y: 395389,62 Elevation: 114,00 m.a.s.l.



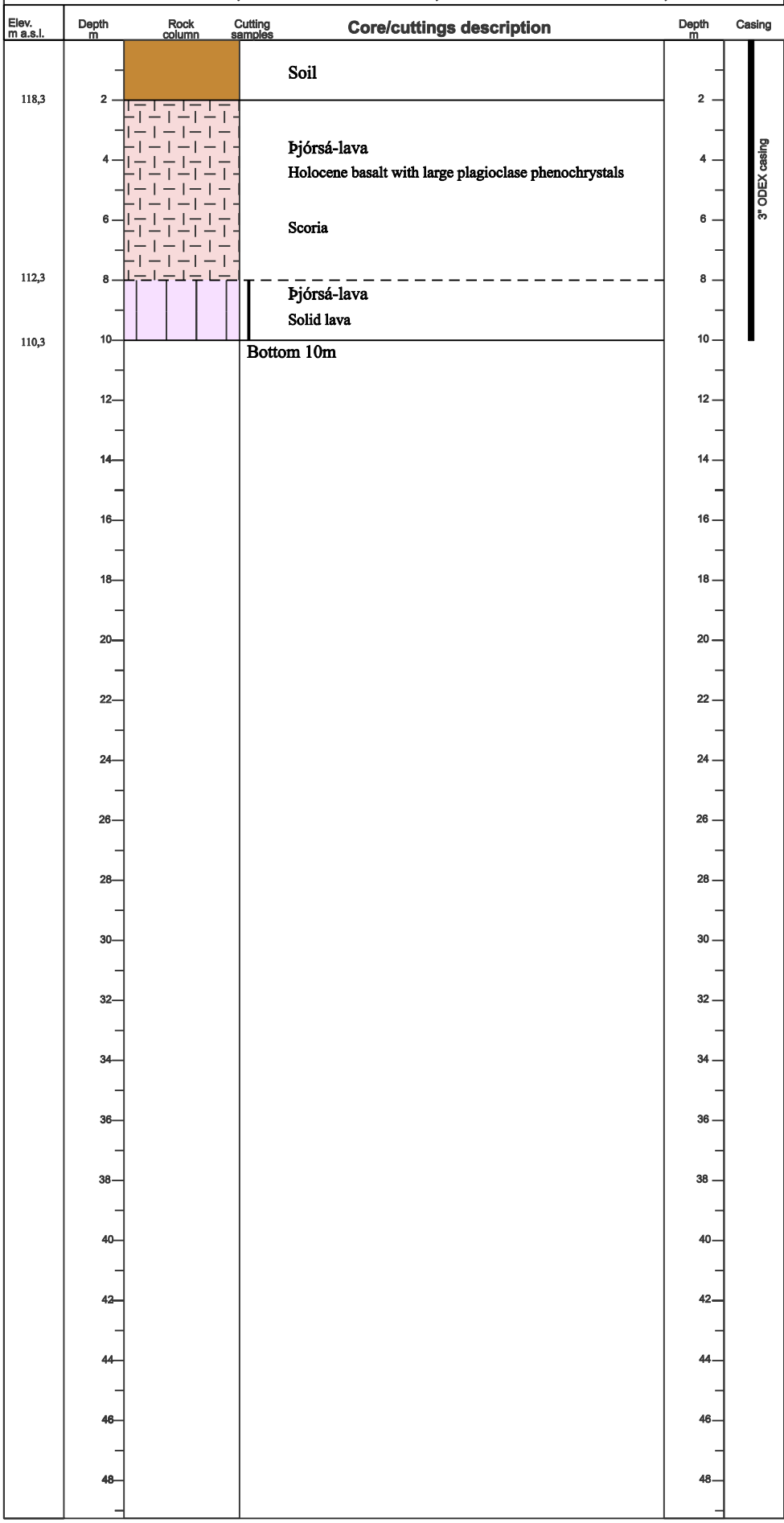
Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-39

Contractor:	Drill:
RSFS	Langbráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
05.09.2006	MM
Drawing no.	

Coordinates: ISN93 X: 447536,14 Y: 395301,80 Elevation: 120,29 m.a.s.l.



Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-40

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQ
Date of drilling: 05.09.2006	Drawn: MM
Drawing no.	

Coordinates: ISN93 X: 447915,60 Y: 395248,32 Elevation: 117,09 m.a.s.l.

Elev. m a.s.l.	Depth m	Core/cuttings description
116,1	0	Soil
	2	Þjórsá-lava Holocene basalt with large plagioclase phenochrystals Scoria
112,6	4	
	6	Þjórsá-lava Solid lava
	8	
	10	
	12	Porphyritic rock cuttings
	14	
	16	
	18	Porphyritic basalt cuttings. Fragments <5mm
	20	
	22	
	24	Porphyritic rock cuttings
	26	
	28	
	30	
	32	Vesicular dark grey rock cuttings
83,6	34	Sand and gravel Coarse tephra sand. Rounded gravel pebbles <2cm of various origin.
81,1	36	Bottom 36m
	38	
	40	
	42	
	44	
	46	
	48	

Casing: 3" ODEX casing

WL=7.47 (14.09.06)
HD=36

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-41

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
05.09.2006	MM
Drawing no.	

Coordinates: ISN93 X: 448347,52 N: 395165,38 Elevation: 114,55 m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description
113,1	0			Soil
	2			Þjórsá-lava Holocene basalt with large plagioclase phenochrysts. Scoria
110,6	4			Þjórsá-lava Solid lava
108,6	6			Bottom 6m

Depth m: 0, 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48

Casing: 3" ODEX casing

WL=4.24 (14.09.06)

HD=6

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-42

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
05.09.2006	MM
Drawing no.	

Coordinates: ISN93 X: 444934,00 Y: 394074,00 Elevation: xxx

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
x	0–12			Þjórsá-lava Holocene basalt with large plagioclase phenochrysts. Solid lava	0–12	3" ODEX casing
	12			Bottom 11,5m		

WL=x.xx

HD=

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-43

Contractor:	Drill:
RSFS	Langbráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
05.09.2006	MM
Drawing no.	

Coordinates: ISN93 X: 441815,68 N: 392821,38 Elevation: 91,18 m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
	0–2			Soil		
88,2	2–4					
	4–14			Þjórsá-lava - Scoria Large plagioclase phenochrystals. Scoria		3" ODEX casing
75,7	14–16			Bottom 15,5m		

WL=4.24 (14.09.06)
HD=6

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-44

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
05.09.2006	MM
Drawing no.	

Coordinates: ISN93 X: 441808,20 N: 392810,92 Elevation: 91,14 m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description
	0–4			Soil
87,1	4–18			Þjórsá-lava - scoria Holocene basalt with large plagioclase phenochrystals. Skoria fragments, volcanic glass fragments Scoria with large plagioclase phenochrystals Large scoria cuttings <2,5cm. Reddish surface on some frgm.
73,1	18			Bottom 18m

Depth m: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48

Casing: 3" ODEX casing

WL=4.24 (14.09.06)
HD=6

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-45

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
05.09.2006	MM
Drawing no.	

Coordinates: ISN93 X: 441839,05 N: 392839,29 Elevation: 92,14 m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description
	0–4			Soil
88,1	4–12			Þjórsá-lava - scoria Holocene basalt with large plagioclase phenochrystals. Scoria fragments. Fine scoria cuttings <5mm Vitreous scoria fragments. Lightbrown clay on surface.
80,1	12			Bottom 12m

Depth m: 2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24, 26, 28, 30, 32, 34, 36, 38, 40, 42, 44, 46, 48

Casing: 3" ODEX casing

WL=4.24 (14.09.06)
HD=6

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-47

Contractor: RSFS	Drill: Langbráður
Site: Núpur	Diameter: ODEX 3"/NQ
Date of drilling: 17.12.2006	Drawn: MM
Drawing no.	

Coordinates: ISN93 X: 444344 N: 394621 Elevation: x,x m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
x,x	0–12			Soil Peat with sandy lenses at the bottom	0–12	3" ODEX casing
	12–14			Basalt bedrock. Probably porphyritic basalt.	12–14	

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Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-48

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Núpur	ODEX 3"/NQ
Date of drilling:	Drawn:
17.12.2006	MM
Drawing no.	

Coordinates: ISN93 X: 444287 N: 394659 Elevation: x,x m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
x,x	0–14			Soil Peat with sandy lenses at the bottom		3" ODEX casing
	14			Basalt bedrock. Prob. porphyritic basalt		

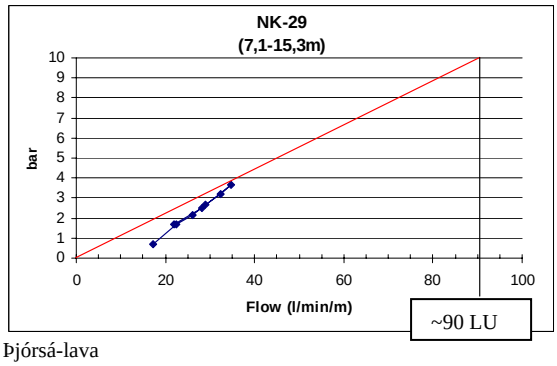
Hvammsvirkjun Hydroelectric Project

Lugeon tests and temperature readings

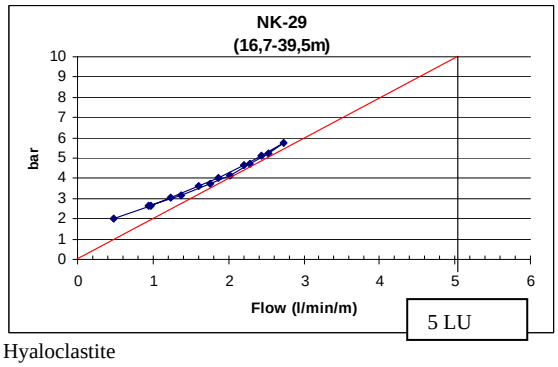
Lugeon test in holes NK-29 to NK-34 and NK-46 to NK-48

Temperature readings in holes NK-11 to NK-12, NK-18 to NK-21 and NK-27 to NK-31. Also in NL-1, NL-14 to NL-18, NL-20 to NL-22 and NL-24 to NL-25

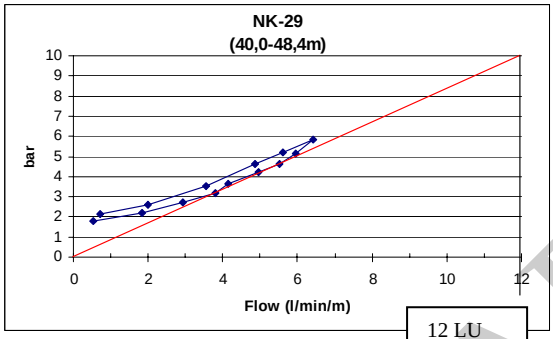
Permeability of NK-29



Þjórsá-lava



Hyaloclastite



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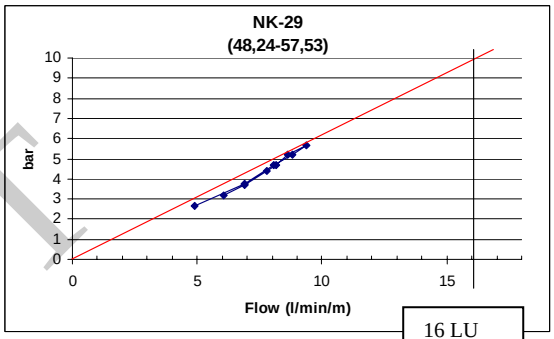

Hyaloclastite

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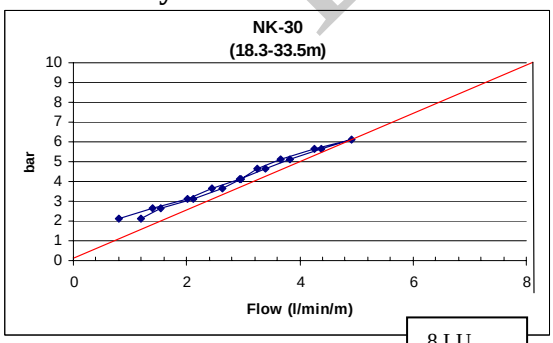
Permeability of NK-30



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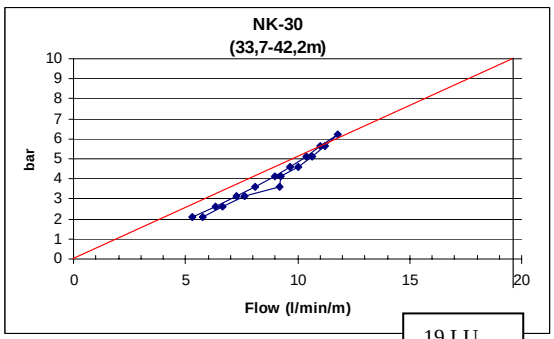

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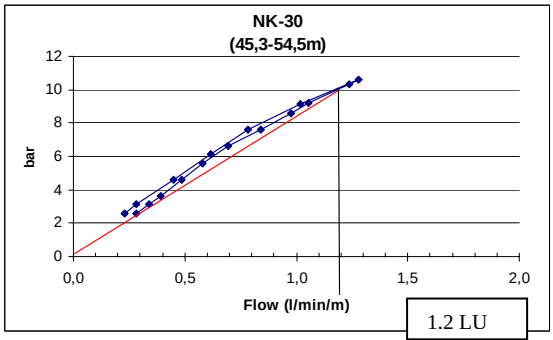

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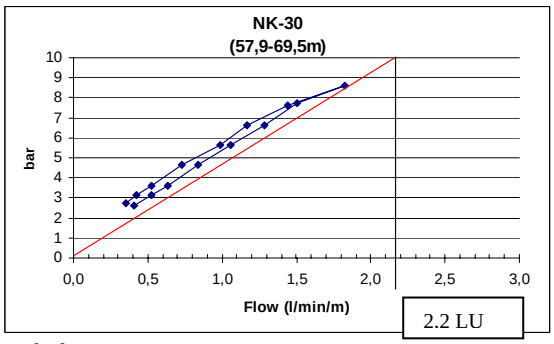
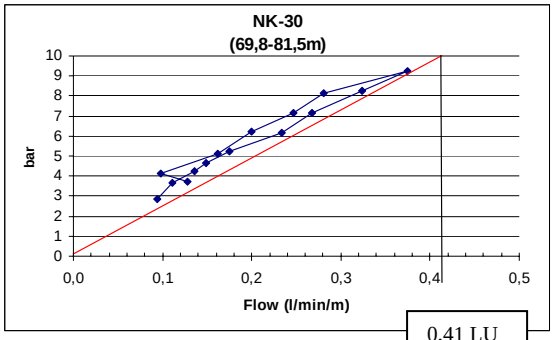


Hyaloclastite



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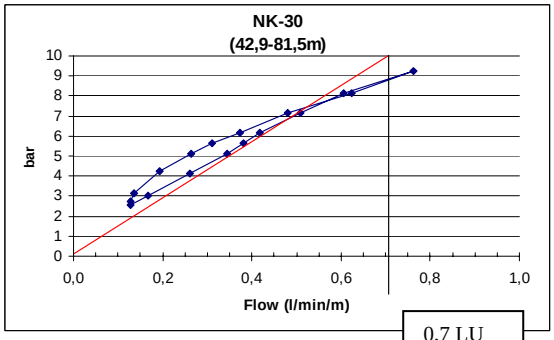
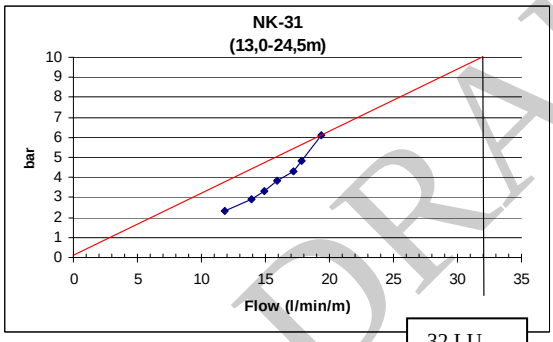
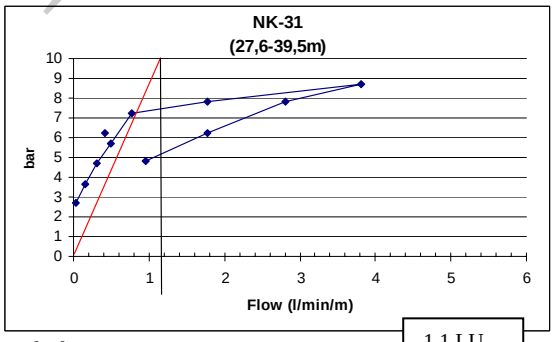


Hyaloclastite

Permeability of NK-31



Þjórsá-lava



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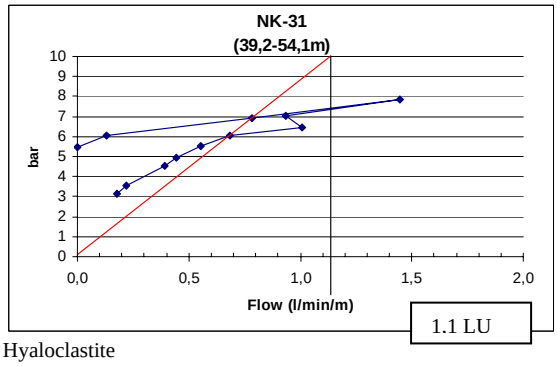

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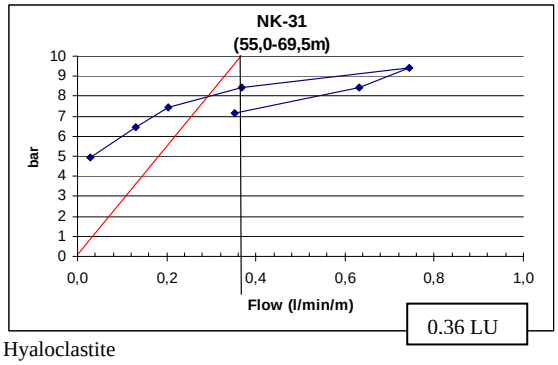
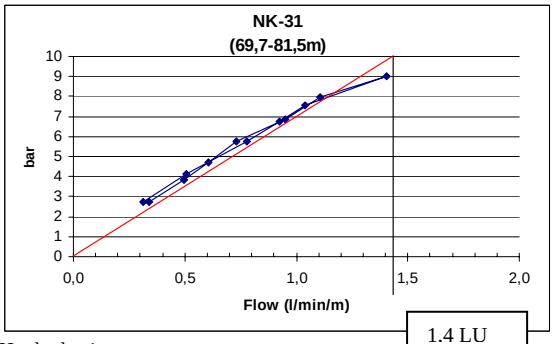


Hyaloclastite



Hyaloclastite

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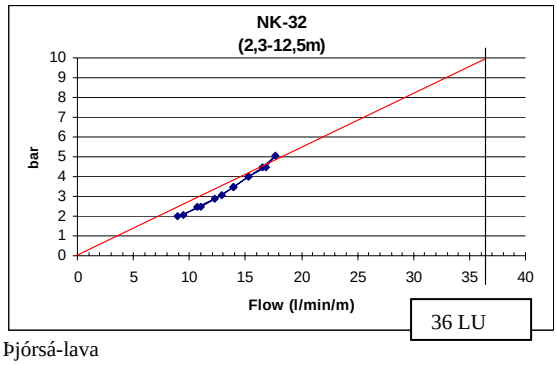
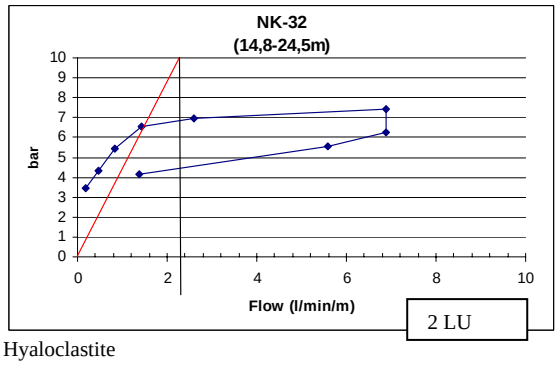
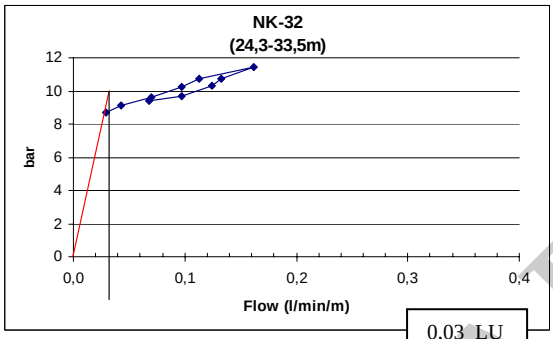
Permeability of NK-32



Þjórsá-lava



Hyaloclastite



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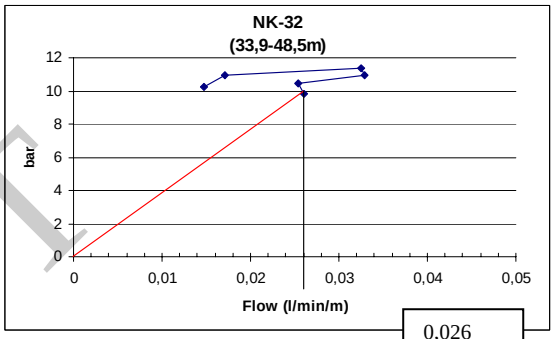
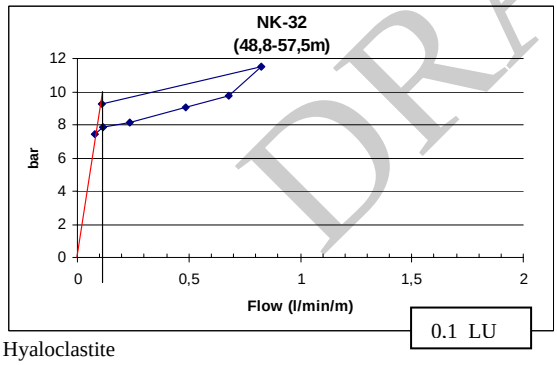
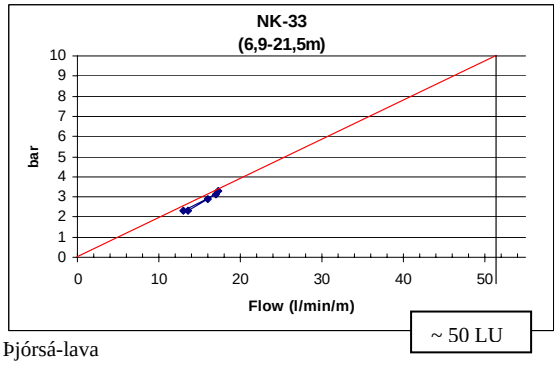


Hyaloclastite



Hyaloclastite

Permeability of NK-33



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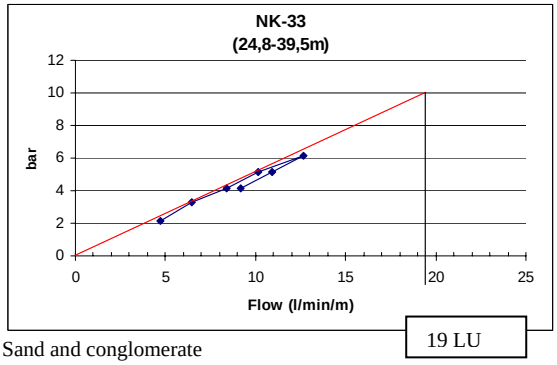

Sand and conglomerate

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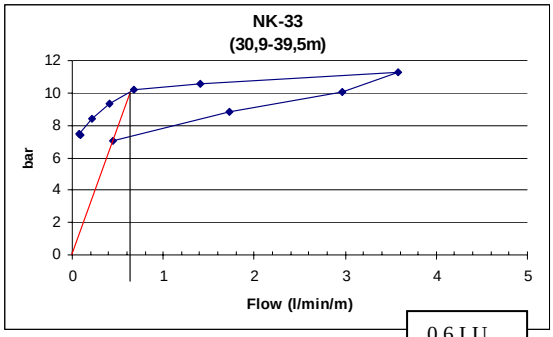
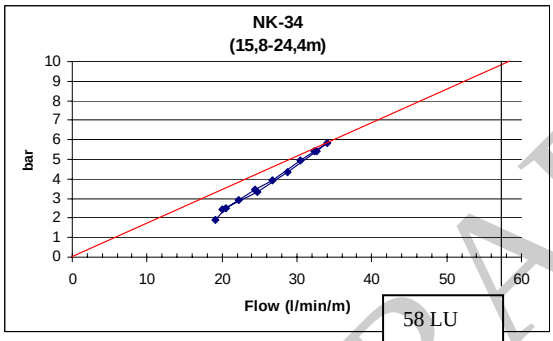


0.6 LU

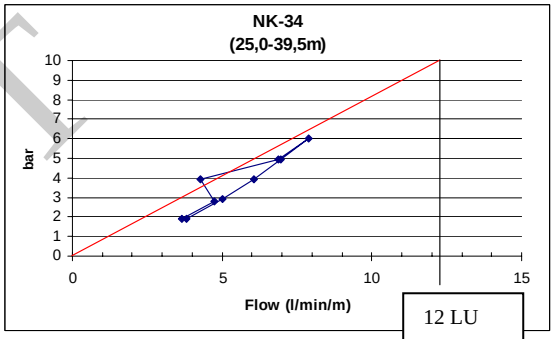
Conglomerate

Permeability of NK-34



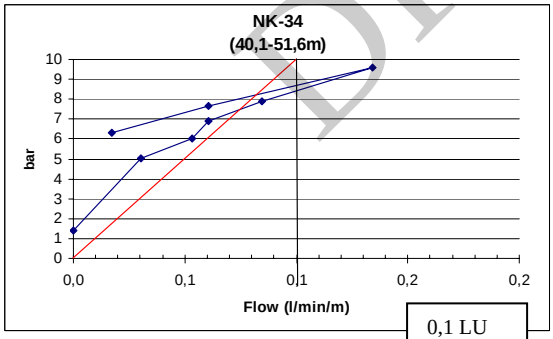
58 LU

Þjórsá-lava, sand and gravel



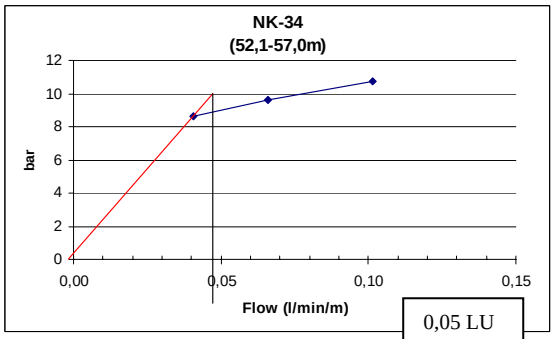
12 LU

Hyaloclastite



0,1 LU

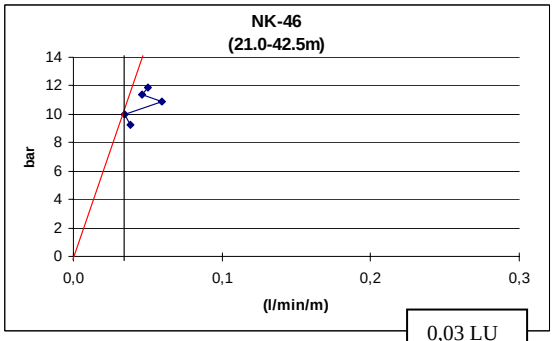
Hyaloclastite



0,05 LU

Hyaloclastite

Permeability of NK-46



0,03 LU

Hyaloclastite

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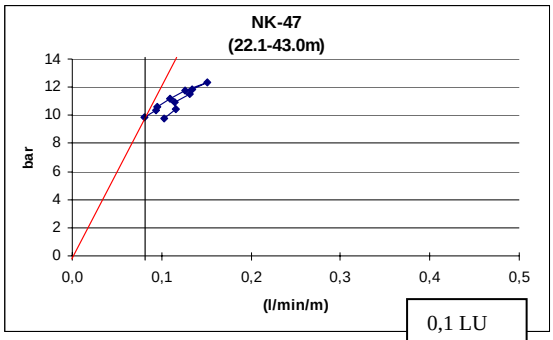
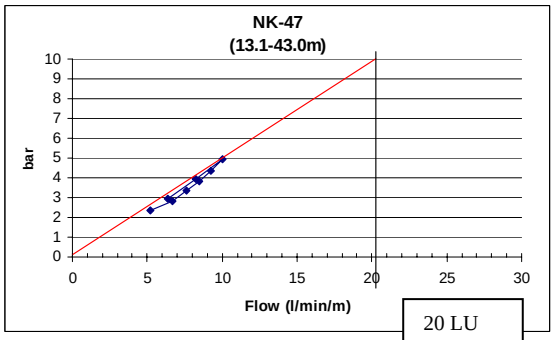
Permeability of NK-47

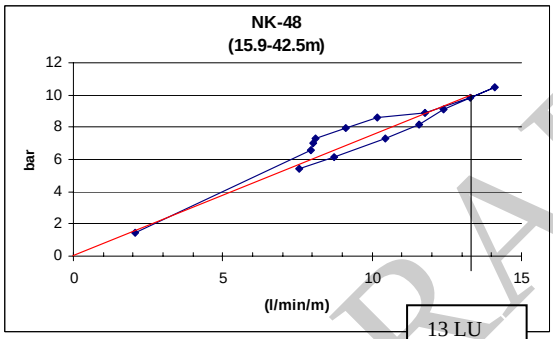


Hyaloclastite

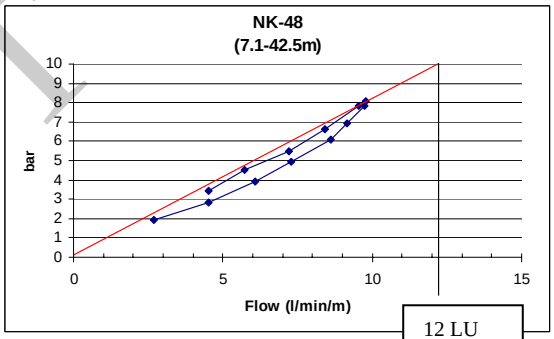


Þjórsá-lava, gravel and hyaloclastite

Permeability of NK-48



Porphyritic basalt



Porphyritic basalt

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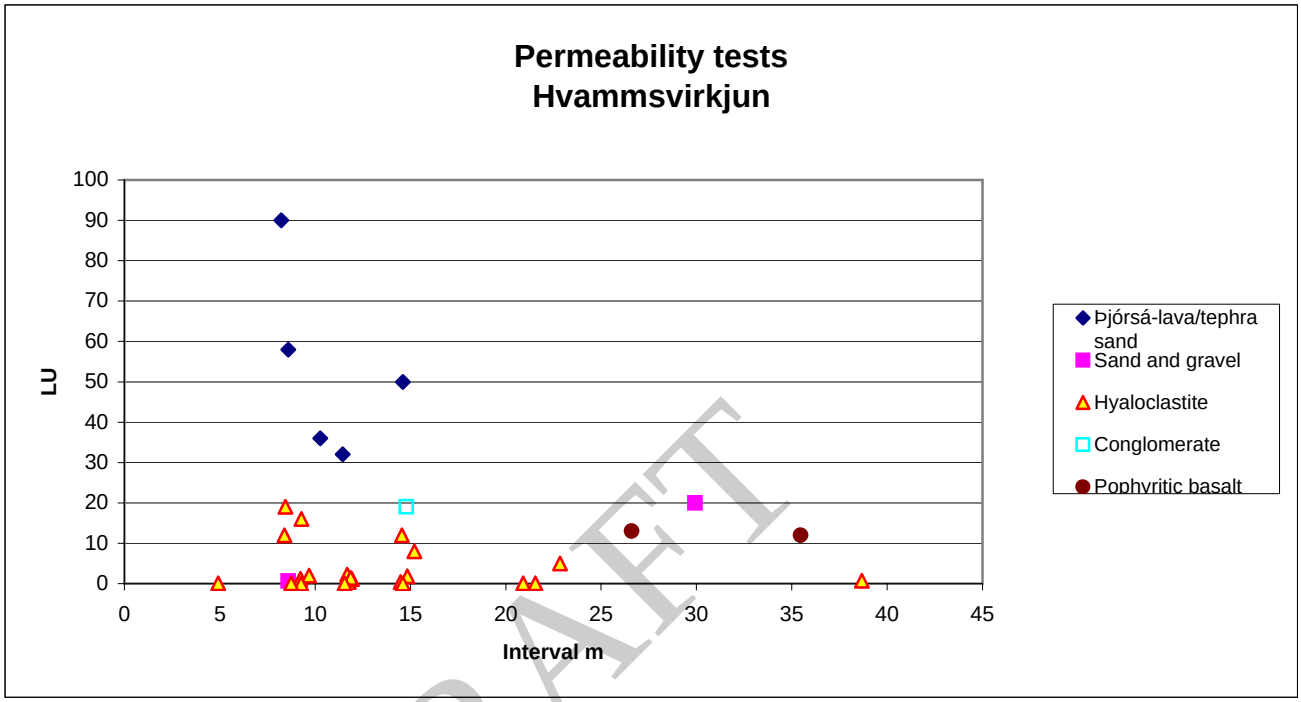
Permeability tests
Hvammsvirkjun
LU
Interval m
0
5
10
15
20
25
30
35
40
45
0
10
20
30
40
50
60
70
80
90
100
Þjórsá-lava/tephra sand
Sand and gravel
Hyaloclastite
Conglomerate
Pophyritic basalt

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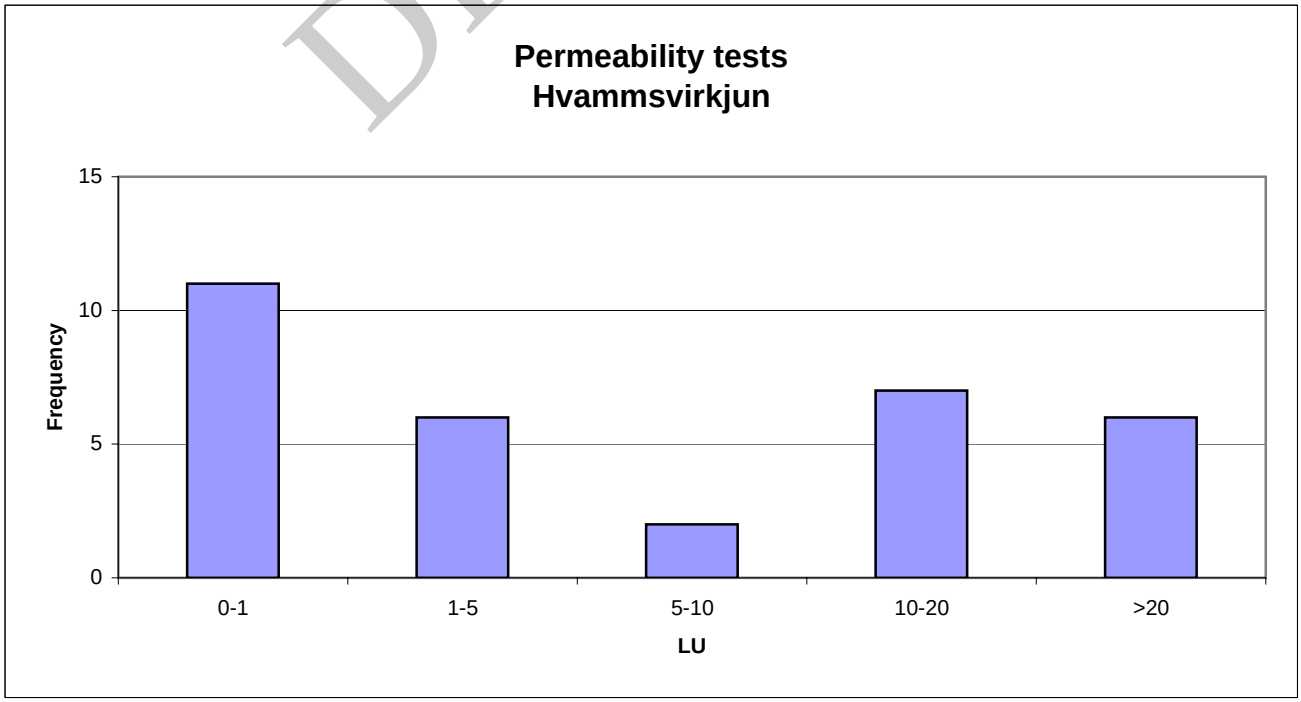
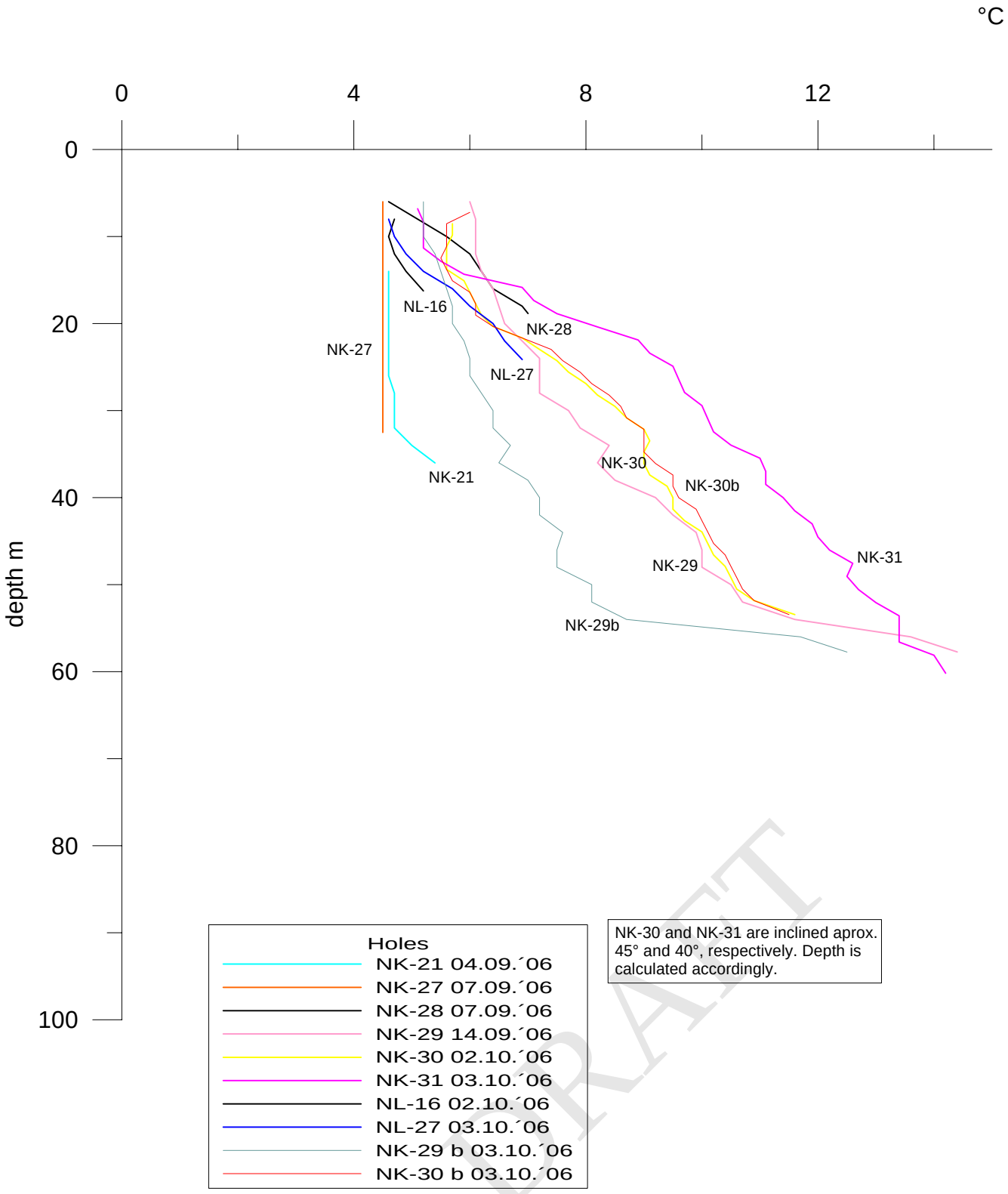

Permeability tests
Hvammsvirkjun
Frequency
LU
0
5
10
15
0-1
1-5
5-10
10-20
>20

Hvammsvirkjun hydroelectrical project
Temperature readings in boreholes

Powerhouse area



NK-30 and NK-31 are inclined aprox. 45° and 40°, respectively. Depth is calculated accordingly.

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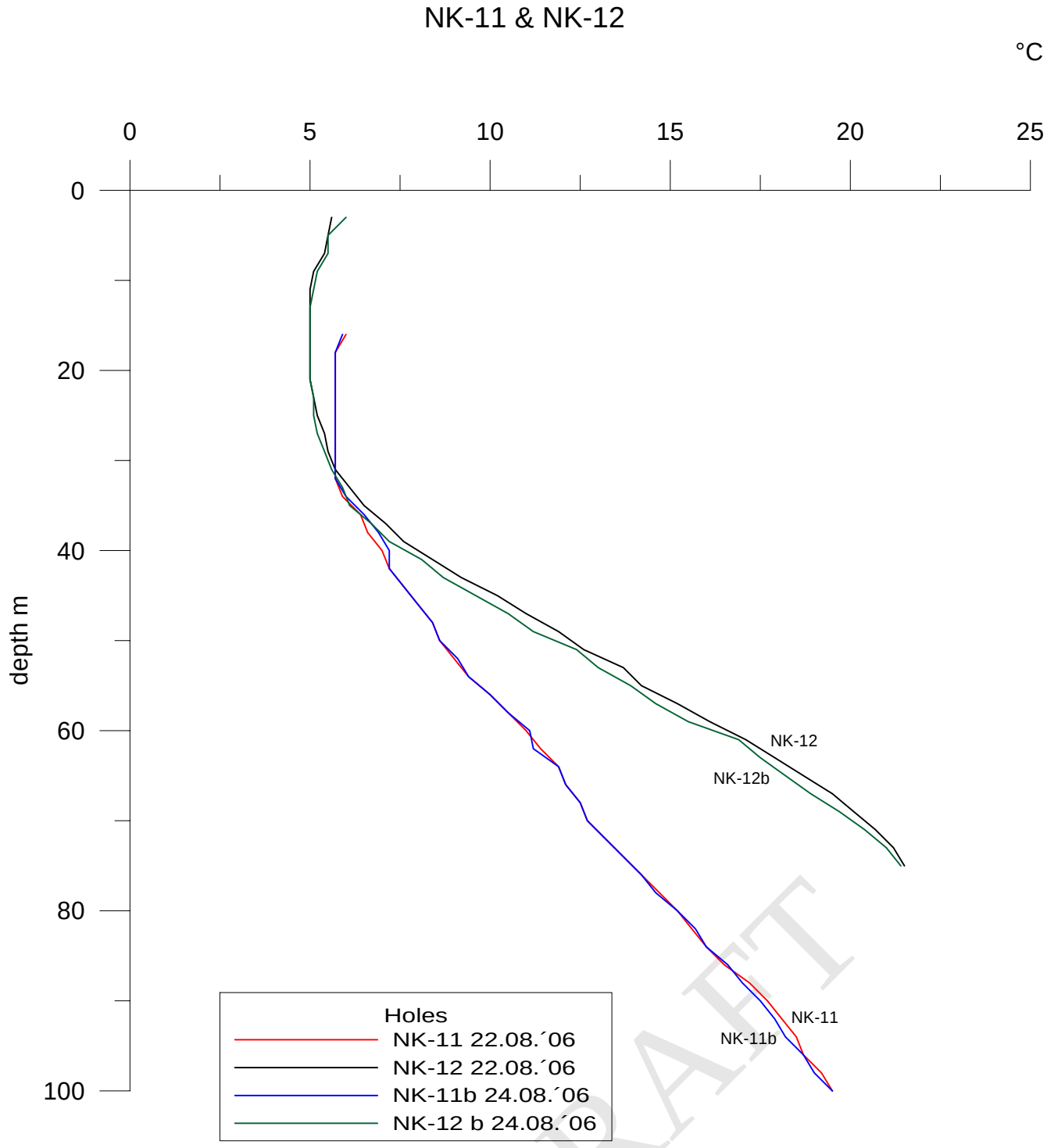
Hvammsvirkjun hydroelectrical project
Temperature readings in boreholes



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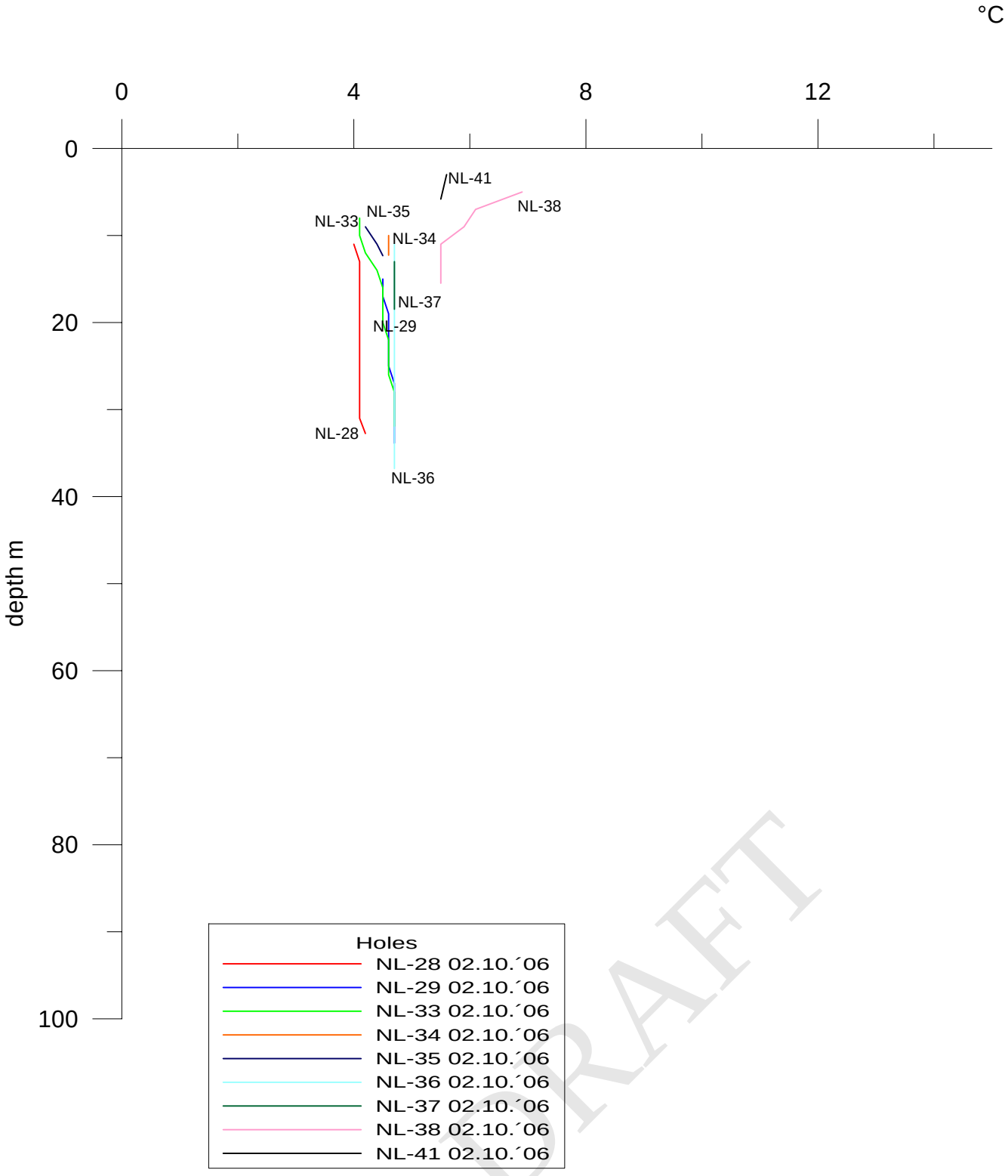
Hvammsvirkjun hydroelectrical project
Temperature readings in boreholes

Holes in Þjórsárlava at the damsite and along the weir



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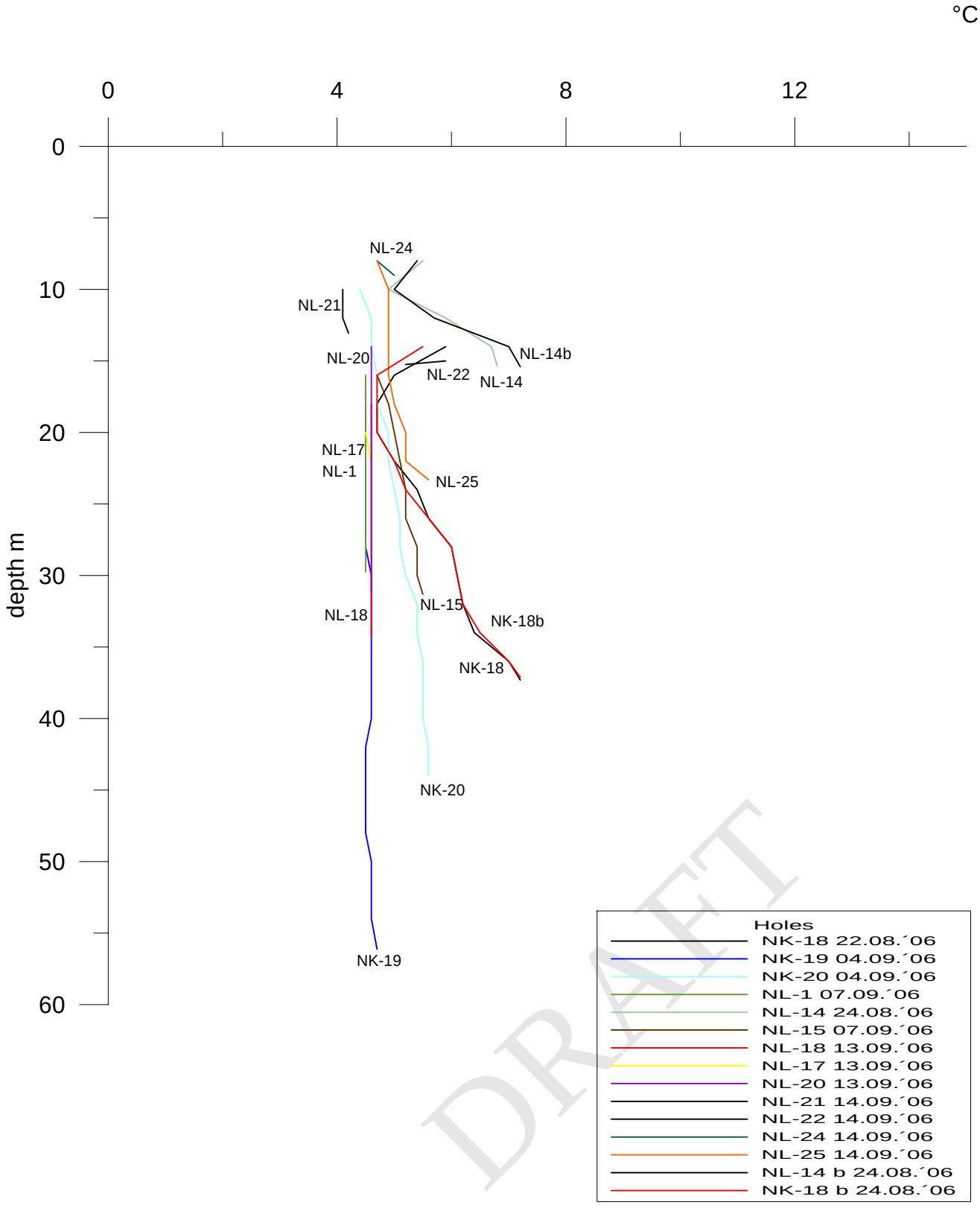
Hvammsvirkjun hydroelectrical project
Temperature readings in boreholes

Tailracetunnel and tailracecanal area



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Hvammsvirkjun Hydroelectric Project

Point load tests

Point load tests

NK-29

Depth (m)	Rock type	Number of tests	P (kN)	Point load strength (IS)	Is (50) (Mpa)	Apparent UCS (Mpa)
27,8	Hyaloclastite	10	4,5	2,2	2,1	33,5
38,0	Hyaloclastite	10	3,5	1,7	1,6	25,8
47,0	Hyaloclastite	7	2,1	1,0	1,0	15,2

NK-33

Depth (m)	Rock type	Number of tests	P (kN)	Point load strength (IS)	Is (50) (Mpa)	Apparent UCS (Mpa)
30,3	Conglomerate	8	5,3	2,6	2,5	71,5
31,5	Dyke	10	10,4	5,1	4,9	92,0
39,4	Conglomerate	10	2,7	1,3	1,3	36,6

NK-34

Depth (m)	Rock type	Number of tests	P (kN)	Point load strength (IS)	Is (50) (Mpa)	Apparent UCS (Mpa)
20,5	Hyaloclastite	10	3,3	1,6	1,5	24,3
37,5	Hyaloclastite	12	5,6	2,8	2,6	41,3

NK-48

Depth (m)	Rock type	Number of tests	P (kN)	Point load strength (IS)	Is (50) (Mpa)	Apparent UCS (Mpa)
20,0	Dyke	13	10,3	5,1	4,8	91,3
36,7	Porphyritic	8	6,8	3,4	3,2	60,8
40,4	Dyke	9	4,6	2,3	2,2	40,8
43,8	Porphyritic	11	5,1	2,5	2,4	45,5

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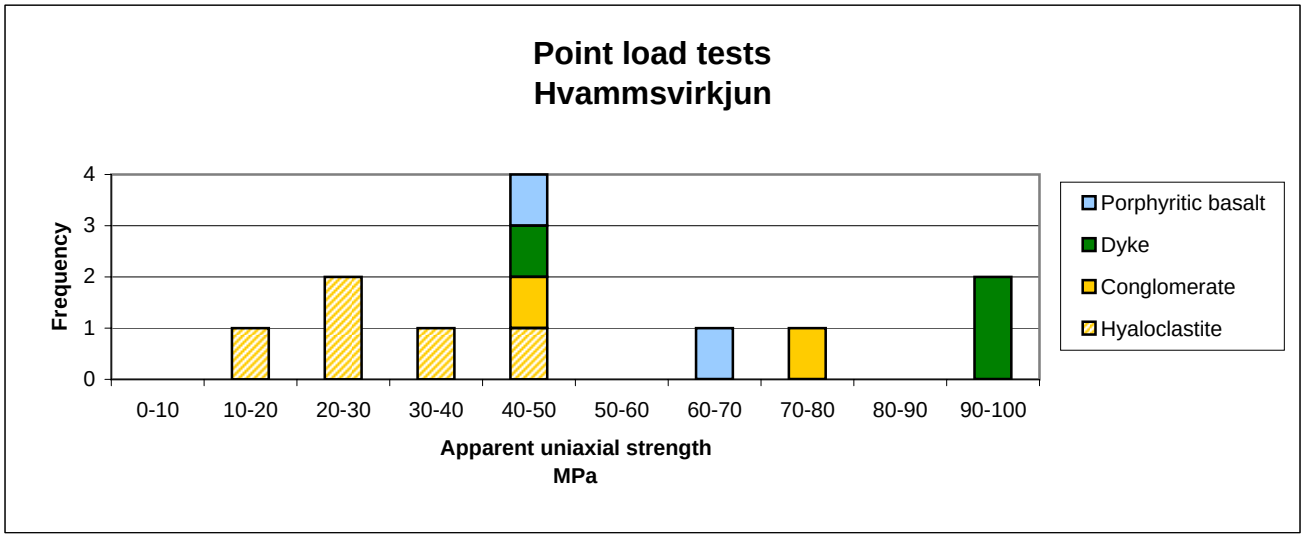


Hvammsvirkjun Hydroelectric Project

Pump test at Powerhouse site

Pumping test

Introduction

This report contains data from the drilling campaign of 2006, a pumping test at the proposed powerhouse site and seismic

The aim of the analysis at hand is to determine hydrogeological parameters which characterize the area. Hydrogeological parameters are important measures when estimating the need for dewatering at the site. Secondary objectives are to assess anisotropy in the aquifer.

The pumping site is located near Skarðsfjall mountain, approximately 2 km north of farm Hvammur and 750 m south of river Þjórsá.

The geology of the powerhouse area

The base of the site is formed by a well cemented and hydrothermally altered hyaloclastite. Outcrops of this formation can be seen to the southeast of the site where it dips under younger formations towards north and northwest. The permeability of the hyaoloclastite is low or very low. Lugeon tests indicate values of permeability in the order of: $K= 10^{-7} -10^{-8}$ m/s.

Deposited on top of the hyaloclastite is a layer of tephra-sand and fine grained gravel. This layer is some 2-3 m thick at the powerhouse site. It seems to be reasonably consistent there but it may be discontinuous towards west. This sandlayer appears to be consolidated but not cemented.

The Þjórsáhraun lava forms top of the geological sequence at the powerhouse site. It is 10-15 m thick at the very site but thickens considerably towards west and northwest.

The hydrological section of the Þjórárhraun lava is a classical one. It is composed of a thin layer of permeable scoria at the bottom overlain by a massive and relatively impermeable middle part of the lava. The upper part of the lava consists of very permeable scoria at the top and directly under the scoria the lava is porous and jointed but with lesser permeability. The groundwater table lies most often in this part of the lava. The hydrological parameters of the lava are shown in figure 2.

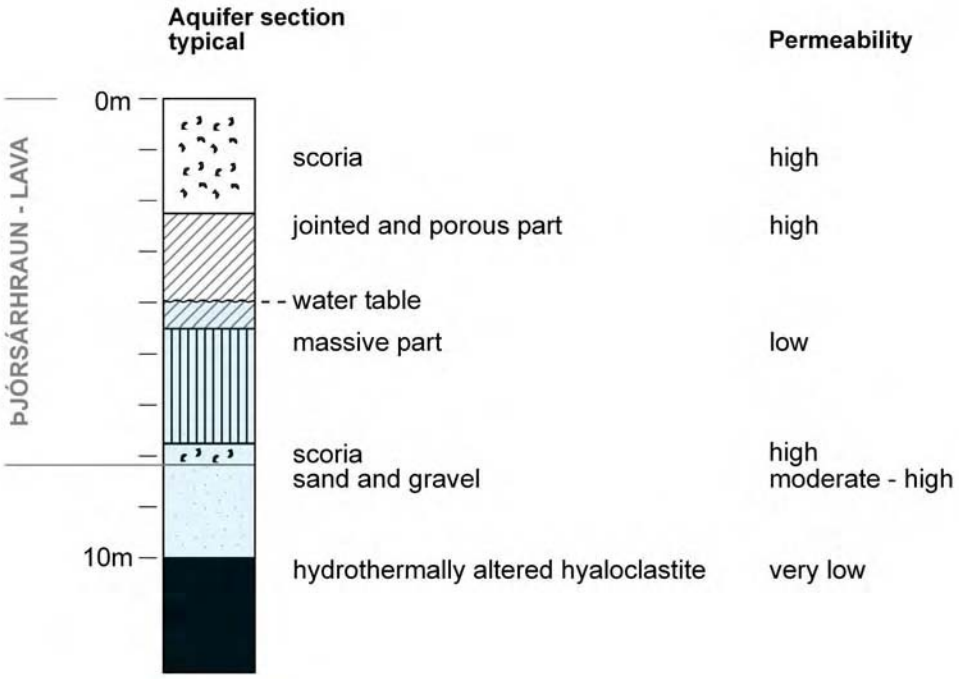


Figure 2. Typical aquifer section at the site.

The Aquifer tested is comprised of the Þjórsáhraun lava and the sand below it. The permeable bottom- scoria and the sand below the lava act as the main aquifer and the massive middle part act as an aquitard. When groundwater level is lowered due to e.g. pumping, the dense middle layer occupies a larger proportion of the total thickness of the aquifer and the ability of the aquifer to transmit water is reduced. In this case, the bottom part of the lava and sand layer become the primary flow medium. Lateral boundaries of the aquifer are found to the north where impermeable basalt layers and Hyaloclastite formations are present. Recharge to the aquifer is from the north and from infiltration of precipitated water.

Water level in Þjórsá river at the location under consideration is typically higher than the surrounding groundwater table; however the river bed is quite impermeable and recharge from the river to the aquifer is assumed to be very limited.

Pumping test theory

During a pumping test, hydraulic head in the aquifer is lowered and groundwater starts to flow towards the pumping well. The shape and extent of the cone of depression thus emerging depends on geologic parameters and pumping rate. Ideally, drawdown in a confined aquifer at any time and distance from the centre of the pumping well can be calculated using Theis' equation [Delleur, 1999]:

$$s(r,t) = \frac{Q}{4\pi \cdot T} \cdot \int_u^\infty \frac{e^{-y}}{y} dy = \frac{Q}{4\pi \cdot T} \cdot W(u) \qquad \text{in which} \quad u = \frac{r^2 \cdot S}{4T \cdot t}$$

In the equation, s [m] represents drawdown, r [m] radial distance from the centre of the pumping well, t [minutes] time and Q [l/s] pumped discharge. $W(u)$ represents Theis' well function. Transmissivity, T [m^2/s], is defined as the product of hydraulic conductivity and thickness of the aquifer and expresses the ability of the aquifer to convey groundwater. The storage coefficient, S [], represents the volume of water the aquifer takes into or releases from storage when hydraulic head is raised or lowered by one unit.

Utilisation of Theis' equation requires that the aquifer is of seemingly infinite extent, geologically homogeneous and of uniform thickness, the hydraulic head in the aquifer is initially horizontal, the wells penetrate the entire thickness of the aquifer, flow direction is horizontal, pumping rate is constant, water removed from storage is discharged instantaneously and the diameter of the pumping well is small. It is often possible to reformulate the problem or use corrections which make Theis' equation applicable in situations where the above assumptions are only approximately fulfilled or not fulfilled at all.

As mentioned above, the aquifer at Hvammur is composed of layers with different hydrogeological characteristics, which means that typical permeability and porosity is changing with depth in the aquifer. The conceptual model applied in the present analysis was to assume that the aquifer can be represented by a leaky confined aquifer. Drawdown is calculated according to a reformulation of Theis' equation attributed to Hantush and Jacob [Delleu, 1999]:

$$s(r,t) = \frac{Q}{4\pi \cdot T} \cdot \int_u^\infty \frac{e^{-y-\frac{r^2}{4L^2 y}}}{y} dy = \frac{Q}{4\pi \cdot T} \cdot W(u, r/L) \qquad \text{where} \quad L = \sqrt{Tc}$$

In this equation, L [m] denotes the leakage factor and c [minutes] is the characteristic hydraulic resistance of the aquitard. $W(u,r/L)$ is the well function.
The solution method which was applied in the analysis was to fit the Hantush-Jacob equation to the drawdown timeseries from each observation well.

Pumping

Setup of the pump, generator and discharge piping was completed on October 25, however, due to unfavourable weather forecast the pump was not started until October 30 at 13:28. Pumping rate was set at 38 l/s. Unfortunately, the generator broke down after about 9 hours of running, between 22:50 and 23:00 on October 30, and the pump stopped. Necessary repairs took place on October 31 and the pump was restarted on November 1 at 02:56 when it was believed that the aquifer had fully recovered. Pumping rate was set at 37 l/s during the second test. Drawdown in the observation wells appeared to have reached steady state conditions at around midnight on November 1 about 20 hours after pumping started. The generator was shut down and pumping stopped on November 6 at 13:32.

The pump which was used is a step pump, and pumping rate is set by means of a frequency regulator. The pump was operated at 100% of full power during the first test and 95% of full power during the second test. Care was taken to ensure that pumping rate was as constant as possible during the experiment. However, immediately after start, discharge from the pump is fluctuating, because of rapidly varying water level in the pumping well, inertia of stationary water in the pipes and increasing friction along the pipe. Notably in the second test, the discharge pipes were filled with water and therefore it was not possible to start the pump immediately with the required power. Instead, pumping rate was increased from zero to about 50% to 95% of full power during the first 3-4 minutes after start.

Discharge from the pump was measured using two independent methods, an inline flowmeter in the discharge pipe and a V- notch weir at the outlet of the pipe. The rate of pumping according to the measurements is shown in figure 2.

Discharge from the pump was conveyed in a 6” pipe about 300 m away from the pumping well and towards Þjórsá river, were the water was released to the ground surface. The water from the pump infiltrated the ground, and it is believed that this recharge source does not significantly affect the result of the pumping test.

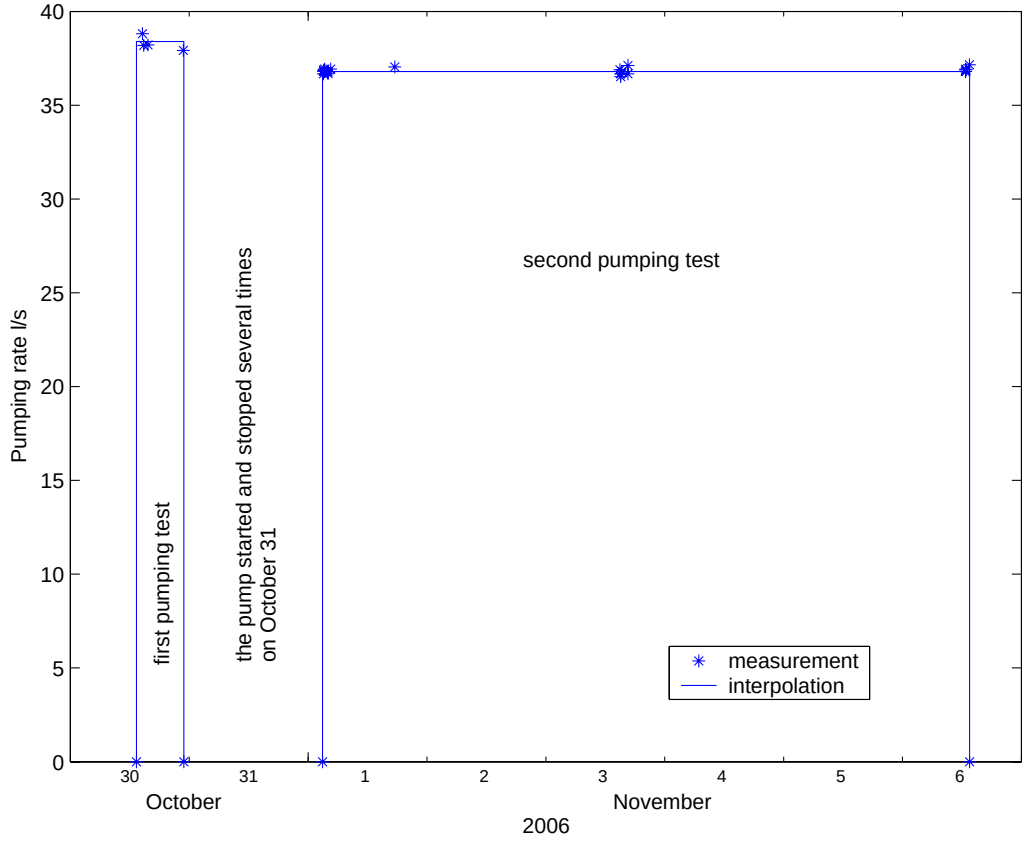


Figure 2. Pumping rate.

Observation wells

Drawdown was recorded in 10 wells and boreholes during the pumping test, cf. figure 1. Pressure transducers with dataloggers were installed in 6 wells, which registered water level automatically at specified time intervals during the course of the pumping test. In addition, Landsvirkjun operates a pressure transducer and datalogger in well NK10 approximately 500 m from the pumping well, and data from this station was used to evaluate groundwater conditions on a larger scale in the area during the pumping test. In the remaining four wells,

drawdown was measured by registering the distance from the top of the casing to the water surface in the wells manually with a tape. Also, readings on the pressure transducers were checked for consistency this way as often as possible.

Initial tests yielded high values of transmissivity in the aquifer ($T = O(10^{-1})$ m^2/s), and it was decided to place the dataloggers in wells which lie approximately 3 to 50 m from the pumping well to ensure that the dataloggers would record a strong drawdown signal. As can be seen in figure 1, the observation wells are located around the pumping well to the east – south – and west.

Weather conditions during the pumping test

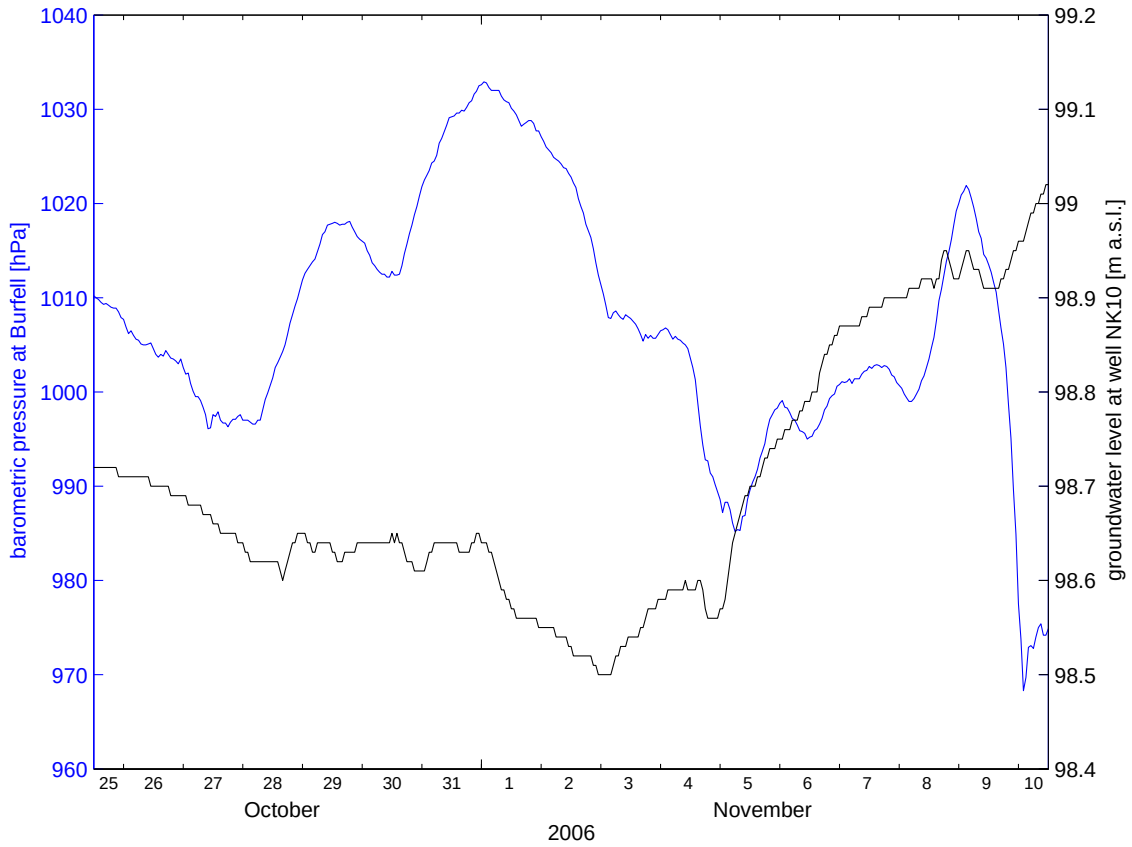


Figure 3. Barometric pressure variation at Búrfell [Icelandic Meteorological Office, 2006] and groundwater level variation at reference borehole NK10 [Landsvirkjun, 2006].

During the first test, barometric pressure increased approximately 20 hPa whereas water level at the reference well NK10 was relatively constant. During the second test, barometric pressure dropped in the period 1 – 3 November about 50 hPa, remained relatively constant until November 8 then increased rapidly on November 9. Groundwater level at NK10 dropped about 10 cm in the period November 1 – 3 but in the second half of the test groundwater level rose almost 50 cm, due to intense precipitation.

It was decided to correct observed groundwater level for variations in barometric pressure, according to the procedure described in Aquifer Test Pro User's Manual (2004). Further, it was assumed that corrections for regional ground water level variation would lead to inaccurate results, and thus was not applied.

Results

The overall result of the pumping test is listed in the table below:

	Transmisivity T [m^2/s]	Storativity S []
Pumping well	$1 \cdot 10^{-2}$	
NL42	$1 \cdot 10^{-2}$	
NL26	$1 \cdot 10^{-2}$	$5 \cdot 10^{-2}$
NL27	$2 \cdot 10^{-2}$	$4 \cdot 10^{-2}$
NK29	$3 \cdot 10^{-2}$	$3 \cdot 10^{-2}$
NL16	$8 \cdot 10^{-2}$	$7 \cdot 10^{-2}$

Table 1. Overall results of the pumping test.

According to the pumping test, transmissivity in the aquifer varies from about 1 to $8 \cdot 10^{-2}$ m/s, whereas storativity seems to be more constant. The result indicates that transmissivity is lower in the area closest to the pumping well. At well NK29, transmissivity is slightly higher and it is considerably higher at well NL16.

Pumping well and observation well NL42:

Residual drawdown in the second pumping test at the pumping well and observation well NL42 is shown in figure 5. The initial response of the aquifer to pumping (or residual pumping) is dominated by effects stemming from the hydraulic characteristics of the well, pump and discharge piping. The well is about 40 cm in diameter and contains significant amount of water in comparison to the pumping rate. When pumping started, water level in the pumping well dropped by more than 2 m corresponding to about 250 – 300 l within 10 to 15 seconds. Due to technical limitations of the drilling rig, the well casing was perforated near the bottom of the borehole mainly, where the geological formations are relatively softer than in the middle rocky layer. Because of this, significant vertical velocity components are present in the flow field closest to the pumping well, which introduces further bias into the initial drawdown in the observation well and well NL42. Therefore, data from the first 5 minutes of the pumping test were not utilised in the present analysis.

About 5 minutes after the pump started, the aquifer has recovered from the initial pressure shock and response to pumping is now controlled by the hydrogeological characteristics of the lower scoria zone of the lava and sandstone layer. Roughly 30 minutes after pumping started, recharge from the upper and middle sections of the lava causes a change in the slope of the drawdown profile. This response is like the response of an aquifer confined by leaky or semi permeable strata, and the solution of Hantush-Jacob can be used to predict drawdown in the aquifer. As drawdown increases, parts of the upper and middle lava are completely drained of water, therefore observed drawdown is more than predicted by the Hantush-Jacob solution at later times. An estimate of transmissivity and storativity of the lower part of the aquifer was obtained by fitting the Hantush-Jacob solution to the drawdown profile as indicated in the figure. The storativity coefficient for the pumping well and well NL42 are affected by the pumping and include head losses which are caused by flow friction in the pumping well.

	Transmisivity T [m^2/s]		Storativity S []	
	drawdown	recovery	drawdown	recovery
Pumping well	$1 \cdot 10^{-2}$	$1 \cdot 10^{-2}$	$1 \cdot 10^{-3}$	$1 \cdot 10^{-3}$
NL42	$1 \cdot 10^{-2}$	$1 \cdot 10^{-2}$	$1 \cdot 10^{-3}$	$1 \cdot 10^{-3}$

Table 2. Transmissivity and storativity in the pumping well and well NL42.

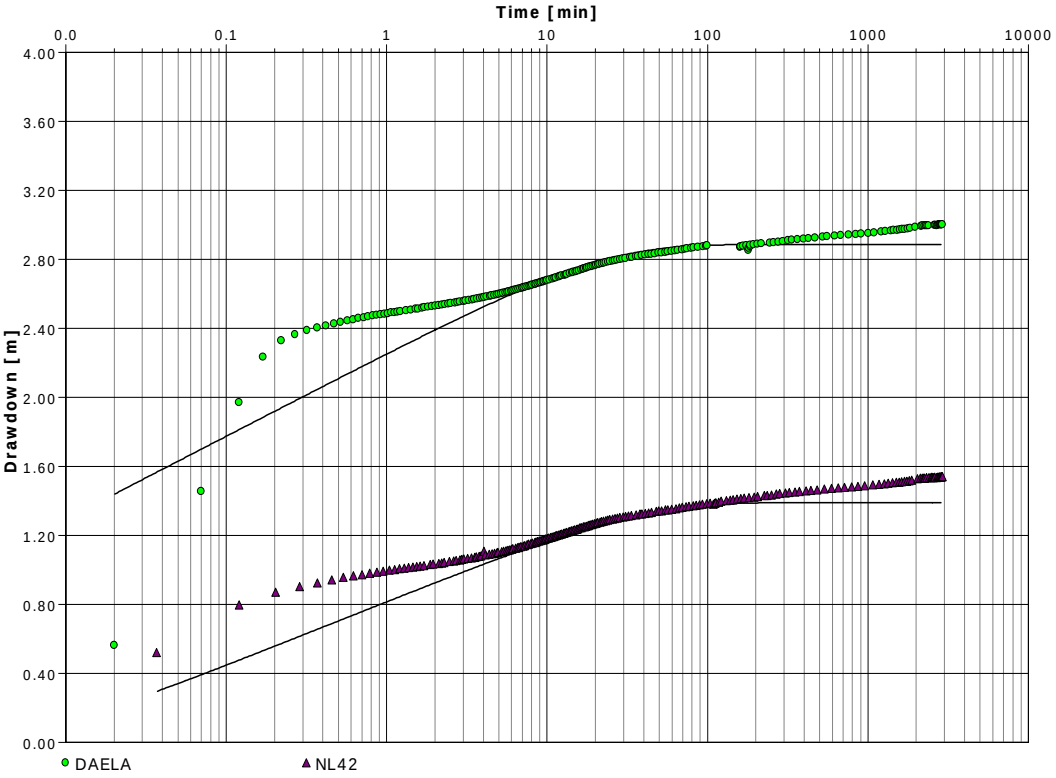


Figure 5. Residual drawdown at pumping well and observation well NL42. Second pumping test November 1 – 9 2006. Pumping rate was 37 l/s.

Observation wells NL26, NL27, NK29 and NL16

Figures 5 and 6 show observed drawdown and predicted drawdown according to the Hantush-Jacob solution during pumping and recovery in the test on November 1 - 10. As can be seen, the response of the aquifer is similar to the response of a leaky, confined aquifer. The Hantush-Jacob solution fits observed drawdown quite well, except for well NL26 at later times. The reason may be that the upper layers of the aquifer at well NL26 have drained completely of water which leads to increased drawdown as the cone of depression expands further outward. During early stages of pumping, the water released from storage originates from the bottom part of the aquifer, which is comprised of scoracious lava and sandstone. It was found that transmissivity is lower in the aquifer closest to the pumping well, and increases when one moves towards observation well NK29 and particularly towards well NL16.

	Transmisivity T [m^2/s]		Storativity S []	
	drawdown	recovery	drawdown	recovery
NL26	$1 \cdot 10^{-2}$	$1 \cdot 10^{-2}$	$6 \cdot 10^{-2}$	$3 \cdot 10^{-2}$
NL27	$2 \cdot 10^{-2}$	$2 \cdot 10^{-2}$	$3 \cdot 10^{-2}$	$3 \cdot 10^{-2}$
NK29	$3 \cdot 10^{-2}$	$3 \cdot 10^{-2}$	$4 \cdot 10^{-2}$	$3 \cdot 10^{-2}$
NL16	$7 \cdot 10^{-2}$	$6 \cdot 10^{-2}$	$7 \cdot 10^{-2}$	$7 \cdot 10^{-2}$

Table 3. Transmissivity and storativity in the pumping well and well NL42.

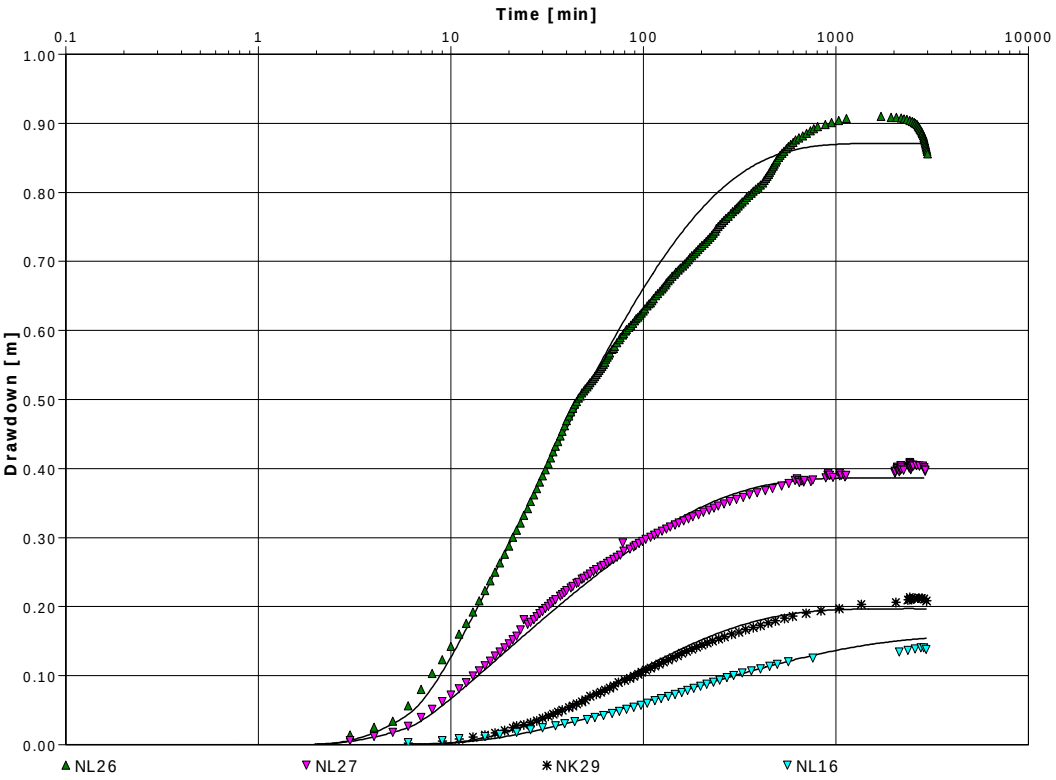


Figure 5. Drawdown during pumping at observation wells NL26, NL27, NK29 and NL16. Second pumping test November 1 – 9 2006. Pumping rate is 37 l/s.

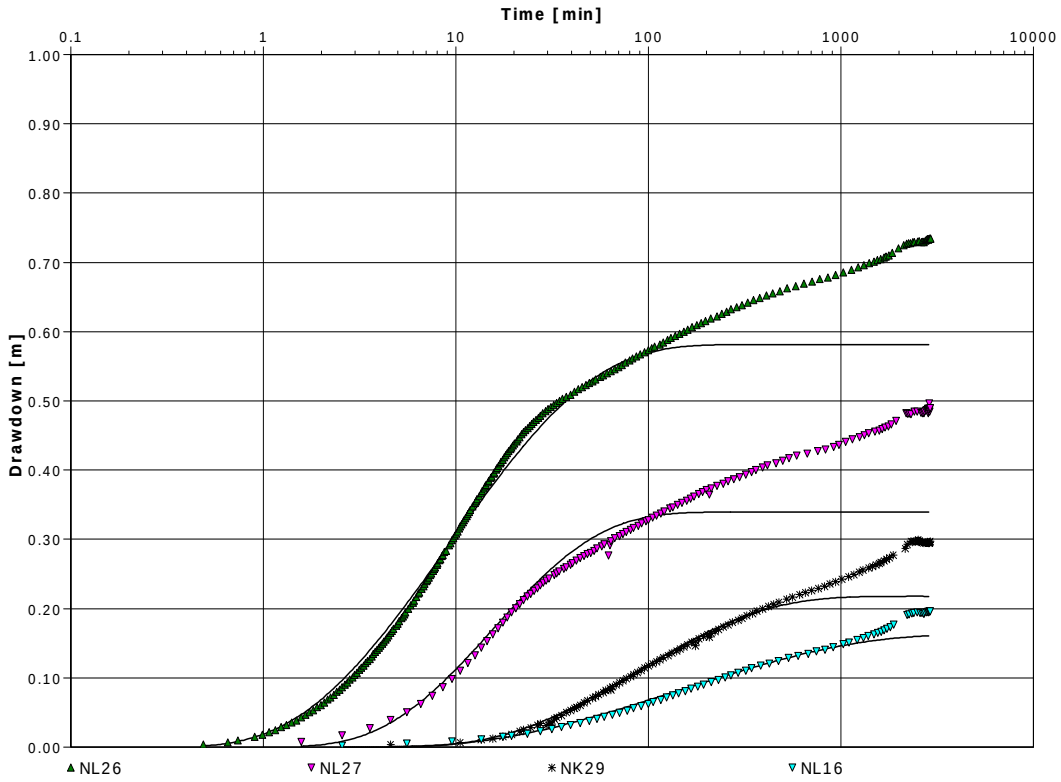


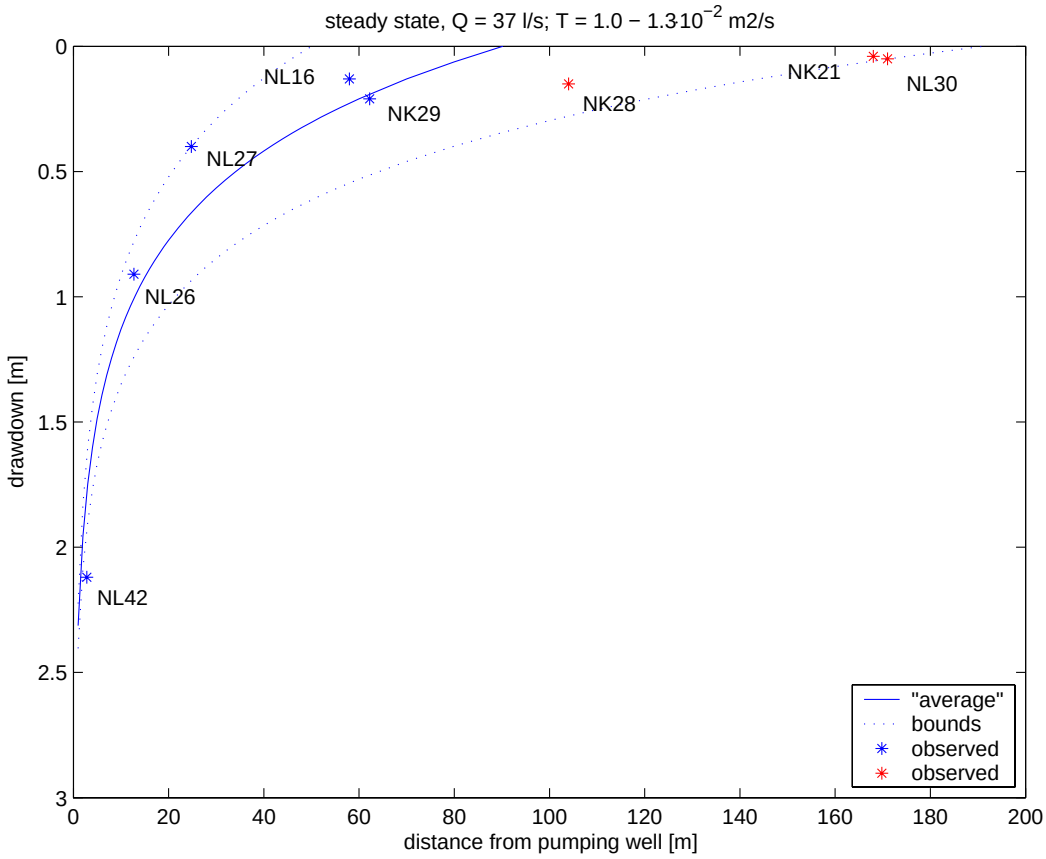
Figure 6. Recovery profiles at observation wells NL26, NL27, NK29 and NL16. Second pumping test November 1 – 9 2006. Pumping rate was 37 l/s.

Drawdown at other wells

Average transmissivity in the aquifer can be estimated from drawdown at steady state conditions. During the second pumping test, steady state drawdown appears to have been reached at around 00:00 on November 2, about 21 hour from pumping start. Drawdown at the observation wells is listed in table 2:

	Drawdown corrected for barometric pressure variation
	Drawdown at 00:00 November 2 2006 [m]
Pumping well	3,15
NL42	2,14
NL26	0,91
NL27	0,39
NK29	0,20
NL16	0,13
NK21	-0,01*
NK28	0,13*
NK34	0,05*
NL25	0,04*

Table 4. Drawdown at boreholes.


steady state, Q = 37 l/s; T = 1.0 − 1.3·10^−2 m2/s
drawdown [m]
distance from pumping well [m]
NL16
NK29
NK28
NK21
NL30
NL27
NL26
NL42
"average"
bounds
observed
observed

Summary

The results of the pumping test are estimates of transmissivity and conductivity of the aquifer. It was found that there is considerable variation in transmissivity in the area, which follows from differences in the geological formations present. Transmissivity is lower than was expected, by almost one order of magnitude. Water level fluctuation due to recharge from precipitation was considerable during the pumping test, and it proved to be difficult to interpret the response of the aquifer to long term pumping. According to the pumping test, a steady state drawdown was reached in the aquifer about 20 hours from the start of pumping on November 1, during a period when groundwater level was in recession at borehole NK10. On the other hand, when the pumping stopped on November 6, apparent steady state was reached only after about 48 hours, during a period when water level was rising at hole NK10. From these results it is possible to draw the conclusion that steady state drawdown during more placid hydrological conditions should be reached after about 30 hour from the start of pumping.

Also it should be noted that because of the rather strong vertical variation in geological characteristics of the aquifer, it is probable that values for transmissivity and storativity change, perhaps significantly, when groundwater level increases or decreases.

References

Delleur, J. W. (ed.) *The Handbook of Groundwater Engineering*., 1999.

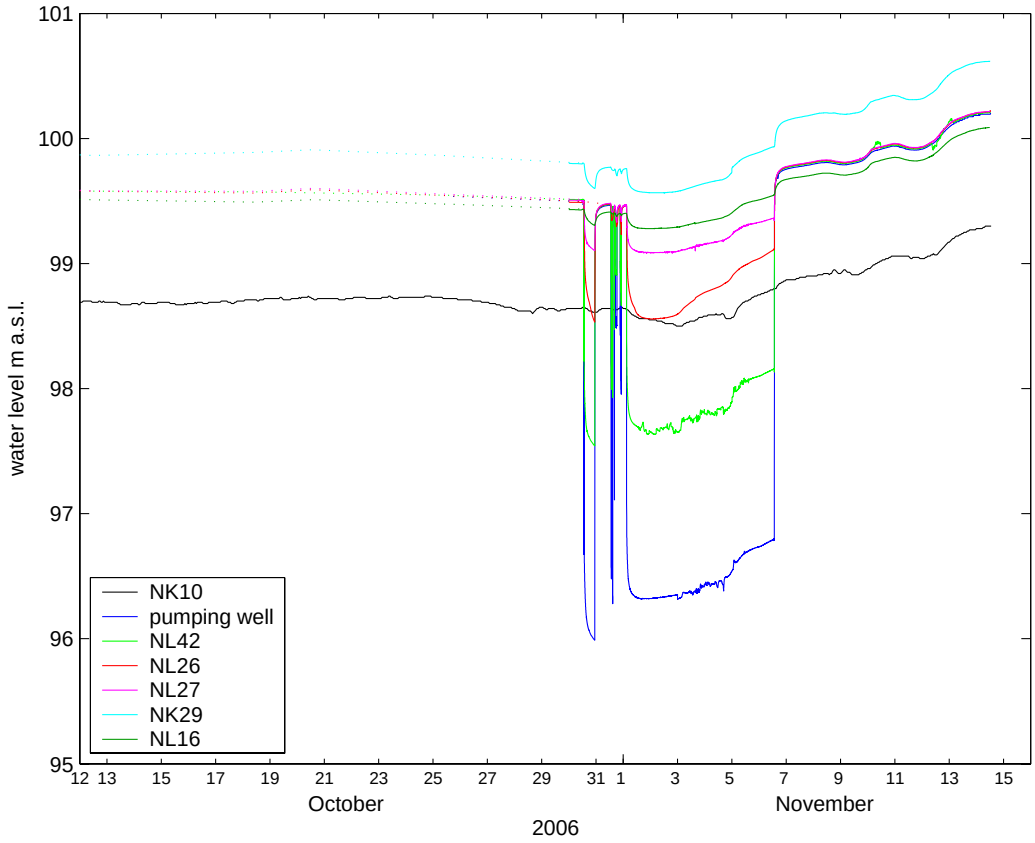
Icelandic Meteorological Office, email correspondence, 21.11.2006.

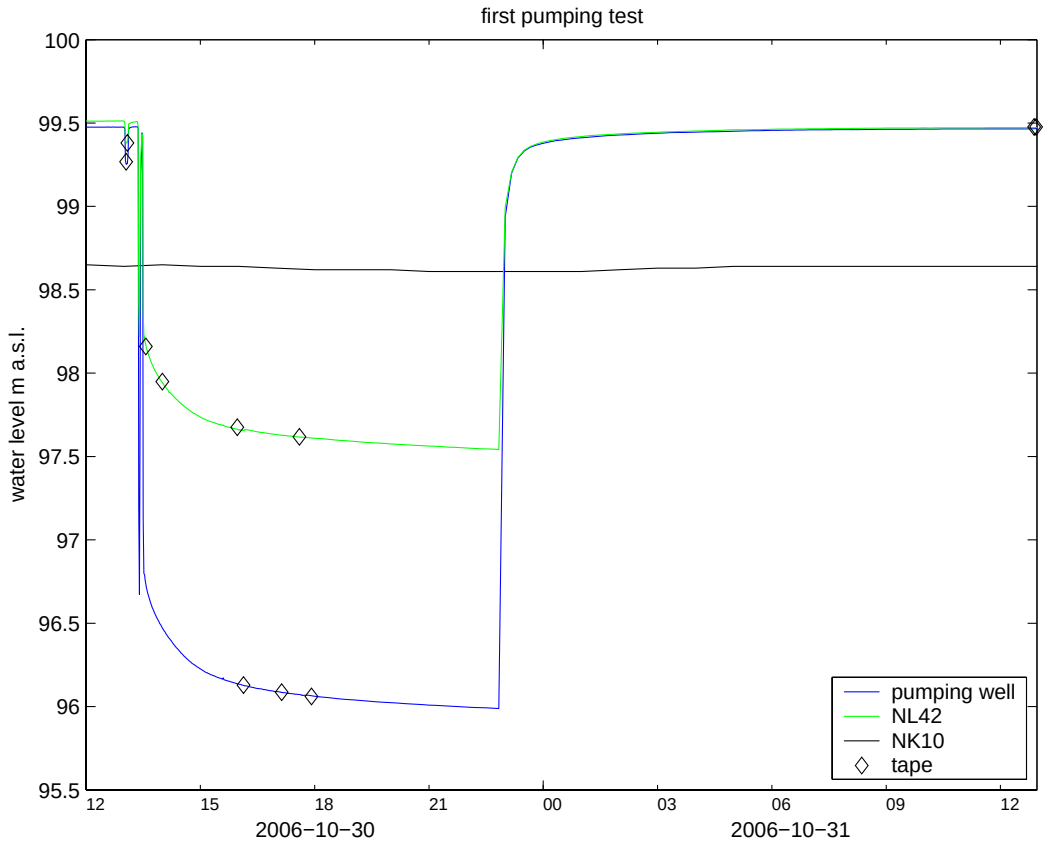
Landsvirkjun, email correspondence, 15.11.2006.

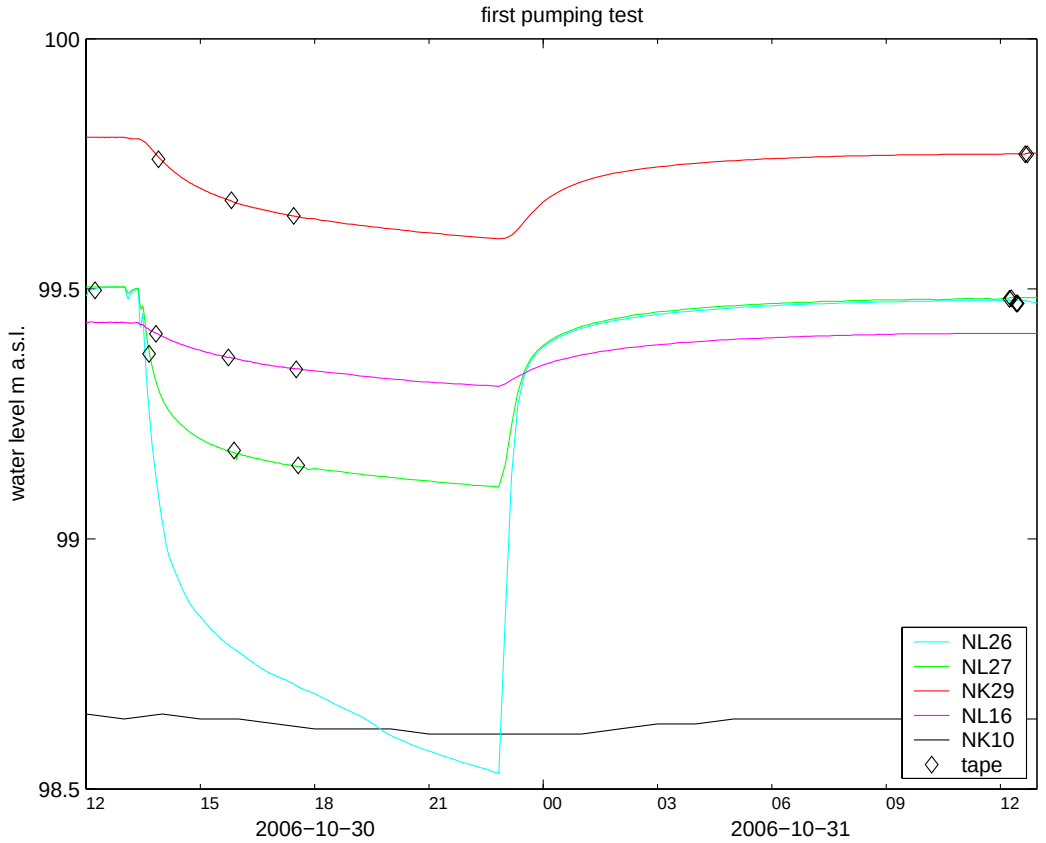
Waterloo Hydrogeologic, *Aquifer Test Pro User's Manual*, 2004.

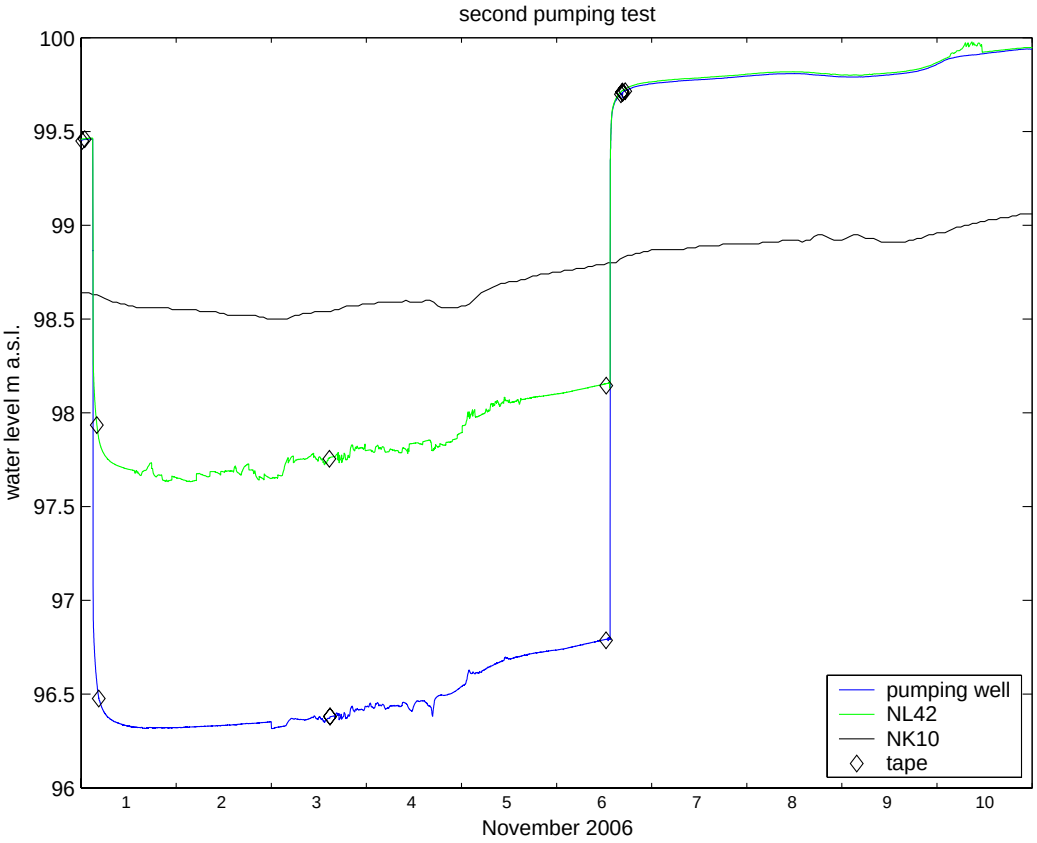
Appendix Core centre at borehole NK29

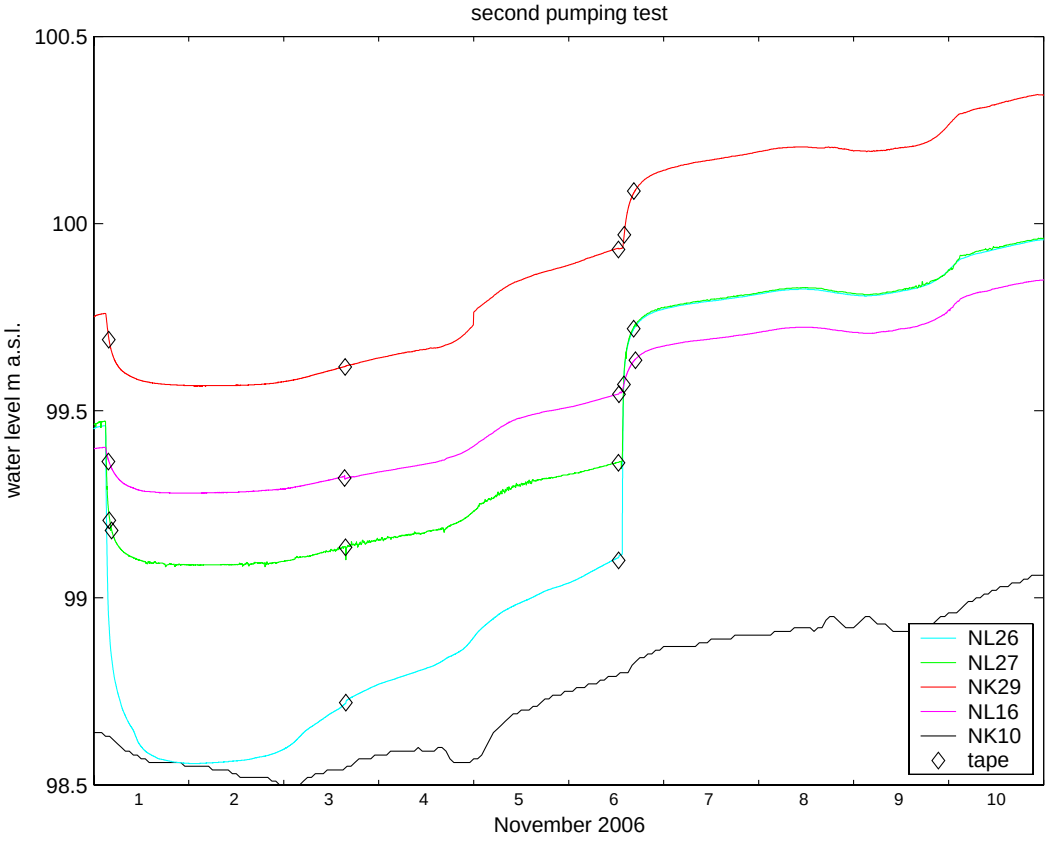
Appendix observed drawdown

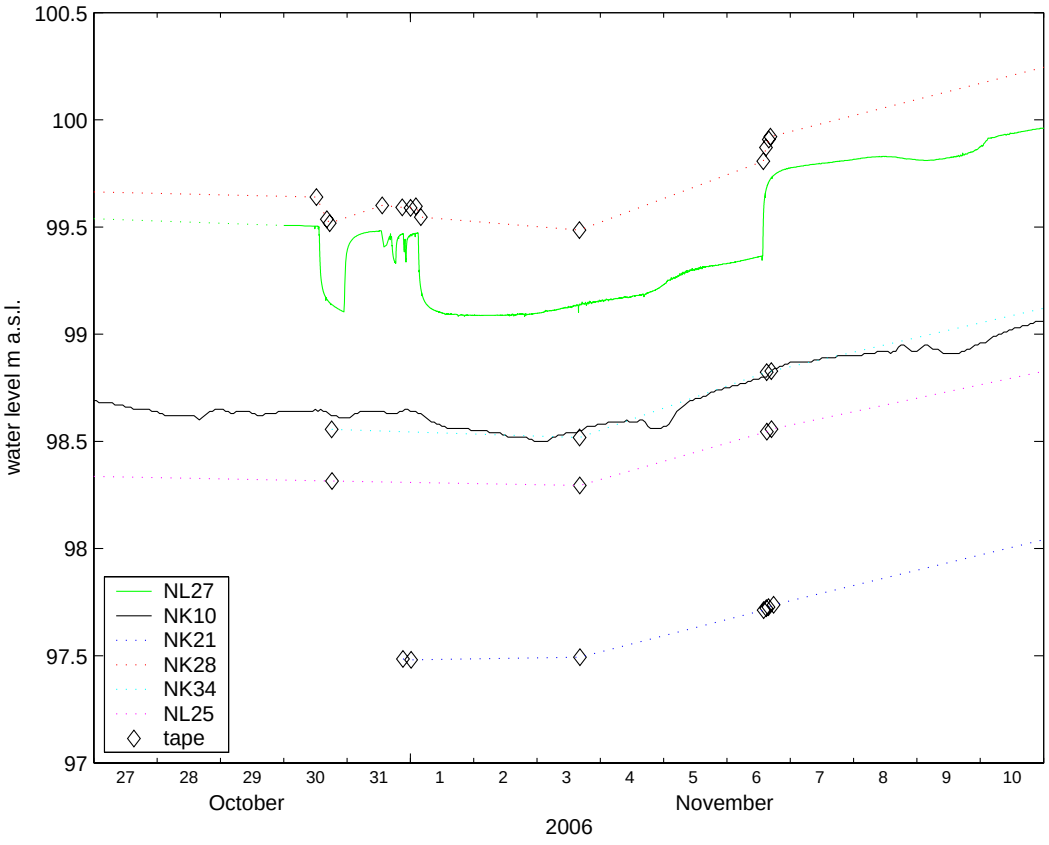



first pumping test
water level m a.s.l.
100
99.5
99
98.5
98
97.5
97
96.5
96
95.5
12
15
18
21
00
03
06
09
12
2006−10−30
2006−10−31
pumping well
NL42
NK10
tape


first pumping test
water level m a.s.l.
100
99.5
99
98.5
12
15
18
21
00
03
06
09
12
2006−10−30
2006−10−31
NL26
NL27
NK29
NL16
NK10
tape


second pumping test
water level m a.s.l.
November 2006
pumping well
NL42
NK10
tape


second pumping test
water level m a.s.l.
November 2006
NL26
NL27
NK29
NL16
NK10
tape


100.5
100
99.5
99
98.5
98
97.5
97
water level m a.s.l.
NL27
NK10
NK21
NK28
NK34
NL25
tape
27
28
29
30
31
1
2
3
4
5
6
7
8
9
10
October
November
2006

Fitting leaky aquifer formula

		T [m^2/s]	S []	c [minutes]
Pumping well	pumping 1	$0,9 – 1,0 \cdot 10^{-2}$	$0,6 – 1,2 \cdot 10^{-1}$	$1 – 2 \cdot 10^{4}$
	recovery 1			
	pumping 2	$0,9 – 1,7 \cdot 10^{-2}$	$10^{-4} – 10^{-1}$	$10^{2} – 10^{6}$
	recovery 2	$0,9 – 1,7 \cdot 10^{-2}$	$10^{-4} – 10^{-1}$	$10^{2} – 10^{6}$

		T [m^2/s]	S []	c [minutes]
observation well NL42	pumping 1	$1,0 – 1,8 \cdot 10^{-2}$	$1 \cdot 10^{-3} – 2 \cdot 10^{-2}$	$10^{3} – 10^{6}$
	recovery 1			
	pumping 2	$1,0 – 1,6 \cdot 10^{-2}$	$1 \cdot 10^{-3} – 1 \cdot 10^{-2}$	$10^{4} – 10^{6}$
	recovery 2	$1 – 2 \cdot 10^{-2}$	$1 \cdot 10^{-4} – 2 \cdot 10^{-2}$	$10^{3} – 10^{5}$

		T [m^2/s]	S []	c [minutes]
observation well NL26	pumping 1	$6 – 8 \cdot 10^{-3}$	$6 – 7 \cdot 10^{-2}$	$2 – 6 \cdot 10^{3}$
	recovery 1	$6 – 8 \cdot 10^{-3}$	$1 – 3 \cdot 10^{-2}$	$1 – 3 \cdot 10^{3}$
	pumping 2	$1,0 – 1,5 \cdot 10^{-2}$	$5 – 7 \cdot 10^{-2}$	$2 – 10 \cdot 10^{3}$
	recovery 2	$0,9 – 1,4 \cdot 10^{-2}$	$2 – 3 \cdot 10^{-2}$	$1 – 2 \cdot 10^{3}$

		T [m^2/s]	S []	c [minutes]
observation well NL27	pumping 1	$2 – 3 \cdot 10^{-2}$	$2 – 3 \cdot 10^{-2}$	$6 – 10 \cdot 10^{3}$
	recovery 1	$2 – 3 \cdot 10^{-2}$	$2 – 3 \cdot 10^{-2}$	$3 – 6 \cdot 10^{3}$
	pumping 2	$2 – 3 \cdot 10^{-2}$	$3 – 4 \cdot 10^{-2}$	$4 – 13 \cdot 10^{3}$
	recovery 2	$1,2 – 1,8 \cdot 10^{-2}$	$2 – 3 \cdot 10^{-2}$	$1 – 3 \cdot 10^{3}$

		T [m^2/s]	S []	c [minutes]
observation well NK29	pumping 1	$4 – 5 \cdot 10^{-2}$	$3 – 4 \cdot 10^{-2}$	$3 – 5 \cdot 10^{4}$
	recovery 1	$1 – 2 \cdot 10^{-2}$	$3 – 4 \cdot 10^{-2}$	$6 – 10 \cdot 10^{3}$
	pumping 2	$3 – 4 \cdot 10^{-2}$	$3 – 4 \cdot 10^{-2}$	$1 – 3 \cdot 10^{4}$
	recovery 2	$2 – 3 \cdot 10^{-2}$	$3 – 4 \cdot 10^{-2}$	$1 – 2 \cdot 10^{4}$

		T [m^2/s]	S []	c [minutes]
observation well NL16	pumping 1	$8 – 9 \cdot 10^{-2}$	$6 – 7 \cdot 10^{-2}$	10^{8}
	recovery 1	$5 – 7 \cdot 10^{-2}$	$7 – 10 \cdot 10^{-2}$	10^{8}
	pumping 2	$6 – 7 \cdot 10^{-2}$	$6 – 7 \cdot 10^{-2}$	$1 – 3 \cdot 10^{4}$
	recovery 2	$5 – 7 \cdot 10^{-2}$	$6 – 8 \cdot 10^{-2}$	$1 – 2 \cdot 10^{4}$

Hvammsvirkjun Hydroelectric Project

Seismic refraction survey at the tailrace tunnel site

Hvammsvirkjun

Landssveit

Bylgjubrotsmælingar til að meta stöðu og legu móbergslagsins sem liggur undir Þjórsárhrauni.

Á svæði væntanlegrar Hvammsvirkjunar norðan Skarðsfjalls framkvæmdi ÍSOR bylgjubrotsmælingar til þess að athuga hvort og með hvaða hætti megi kortleggja móbergsgrunn sem liggur undir Þjórsárhrauninu. Vandamálið felst í því að milli móbergsins og Þjórsárhraunsins er lausgerður sandur sem þannig myndar lághraðalag en það setur bylgjubrotsmælingunum skorður við kortlagningu móbergsins. Með því hins vegar að skjóta í borholum sem helzt ná niður í móbergið er hægt að koma af stað brotinni (refracted) bylgju í móberginu sem flytur upplýsingar um yfirborð móbergsins og hljóðhraðann í því til yfirborðs jarðar þar sem merkið er hlustað með hlóðnemakapli. Samt sem áður nást ekki upplýsingar um hljóðhraskiptingu í jarðlögunum ofan á móberginu.

Í niðurstöðum sem kynntar eru í þessari gagnaskýrzlu eru sett fram dýptar- og hraðasnið. Útreiknað dýpi niður á móbergið byggist á tvennu:

1. Áætluðu tímadýpi sem reiknað er út frá komutímum hljóðbylgna í mælistað (sérhver hljóðnemi) þegar skotið er báðu megin hljóðnemalagnar.
2. Dýpi niður á móbergið í kjarna- og loftboruðum holum.

Meðalhraðinn fyrir hvert snið er sá hraði sem setur tímadýpið næst borholunum í rétta landfræðilega hæð móbergsyfirborðsins.

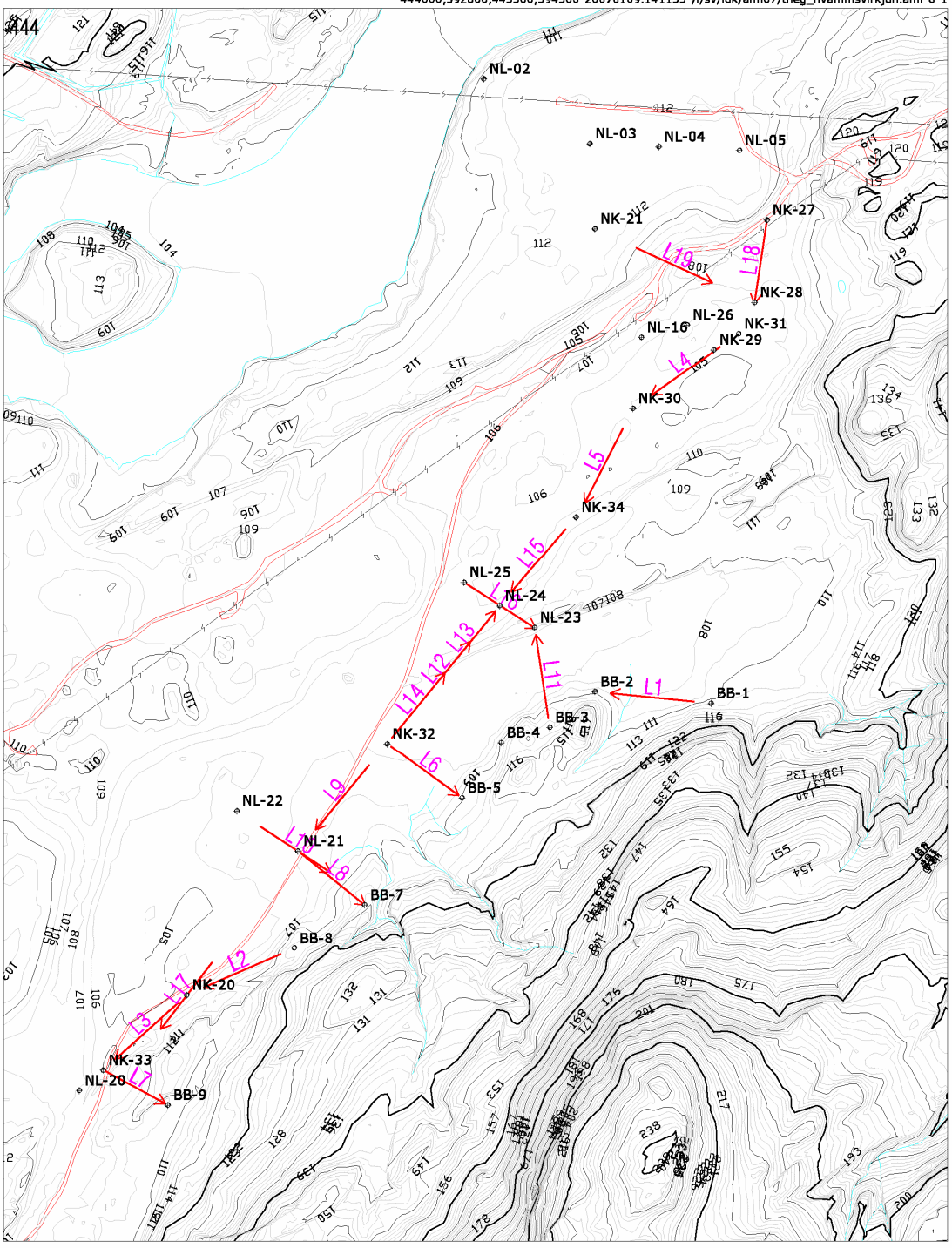
Ef ekki er um að ræða mikla óreglu í jarðlögunum ofan á móberginu þá gefur sniðið góða mynd af útlínum móbergsins. Með því er sagt að þær ójöfnur sem koma fram í dýptarsniðinu eiga uppruna sinn í móberginu.
Á kortinu sem fylgir eru mælilínurnar sýndar með þeim númerum sem þær hafa í upptalningunni hér að neðan. Örin er til merkis um hvernig lesið skuli af línuritum þ.a. hún bendir í átt hækkandi gildis fyrir staðsetningar á hljóðnemalínu.

Við úrvinnslu gagnanna er notast við s.k. GRM aðferð (Generalized Reciprocal Method) til að hraða- og tímagreina gögnin en aðferðin byggir á að skoða ferðatímaferla sem koma frá skotum báðu megin frá inn á hljóðnemakapalinn.
Í tilrauninni var notað 24 rása skráningartæki og bil milli hljóðnema var sett 5m sem þýðir að hvert snið sem tekið er nær yfir 115 m. Undantekning var gerð við línu L7 þar sem hljóðnemabilið var sett 4 m þ.a. sú lögn er 92 m löng.

Þorsteinn Egilson

(444000,394500) (445300,394500)

444000,392800,445300,394500 20070109.141155 /i/sv/luk/aml07/theg_hvammsvirkjun.aml 8 1



(444000,392800) (445300,392800)

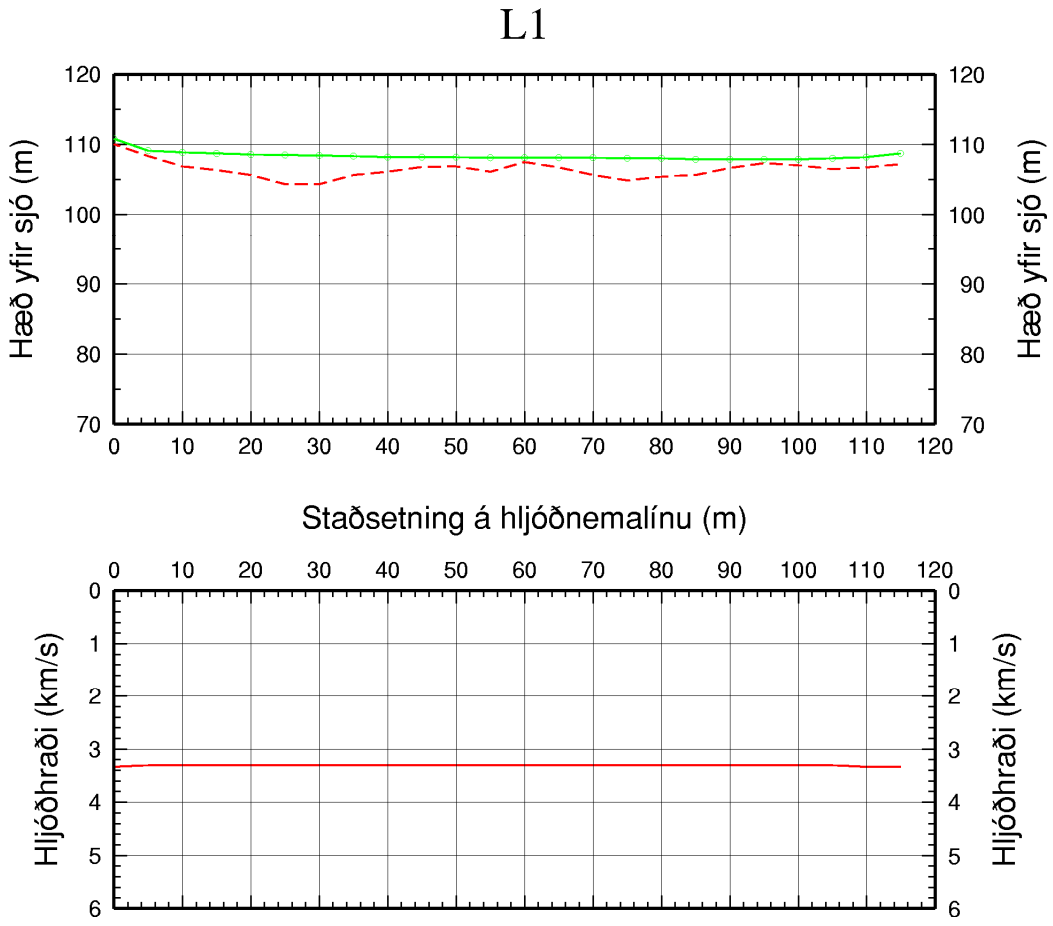
ÍSOR SV
20070109

0 0.5 km

ÍSOR

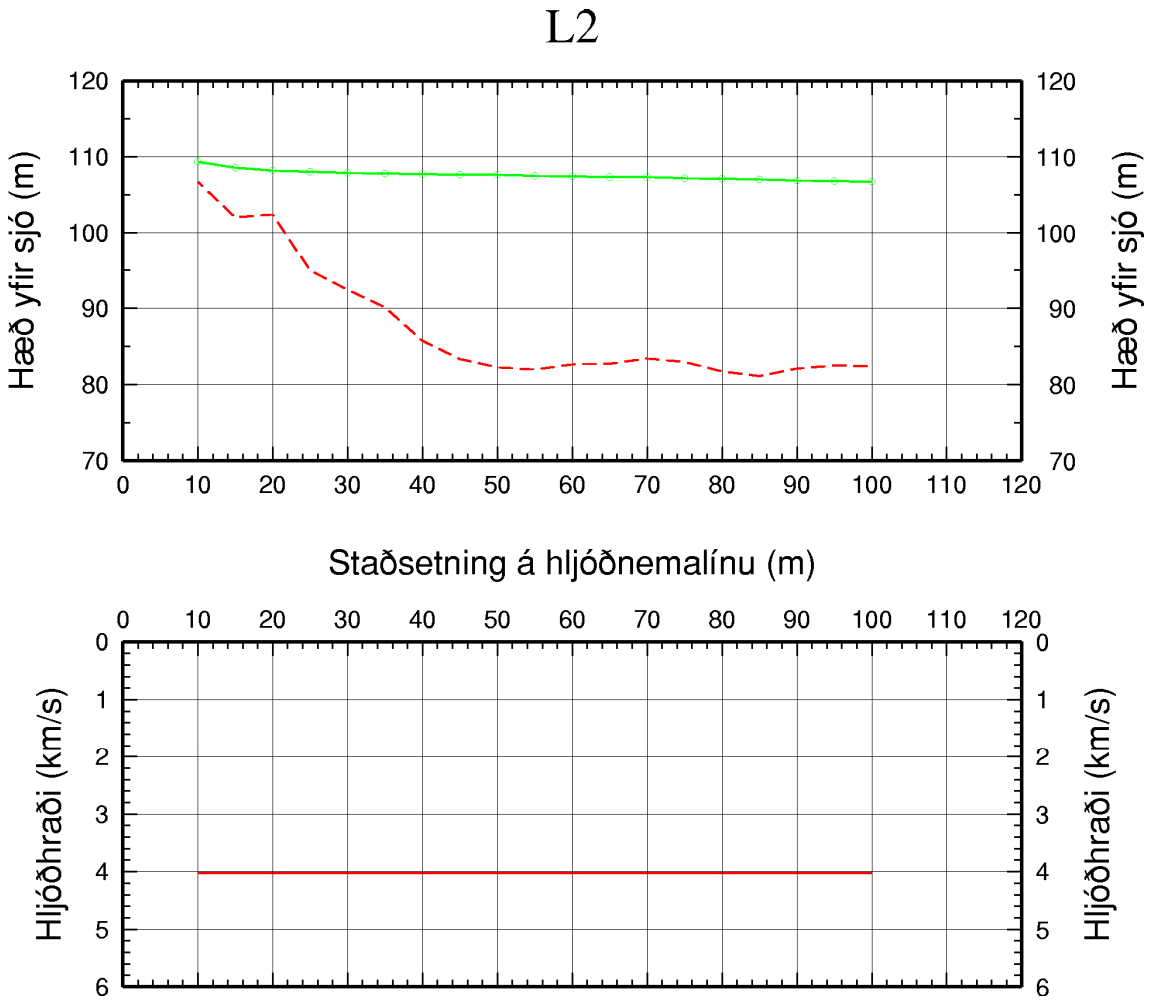
Lína L1 milli holna BB1 og BB2

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444951.1	393543.3	0	710	3341.3	110.8	110	0.8
444946.1	393543.8	5	710	3311.2	109.1	108.3	0.8
444941.2	393544.3	10	710	3311.2	108.9	106.9	2.0
444936.2	393544.8	15	710	3311.2	108.7	106.3	2.4
444931.2	393545.3	20	710	3311.2	108.6	105.6	3.0
444926.2	393545.8	25	710	3311.2	108.5	104.3	4.2
444921.2	393546.3	30	710	3311.2	108.4	104.3	4.1
444916.3	393546.8	35	710	3311.2	108.3	105.6	2.7
444911.3	393547.3	40	710	3311.2	108.2	106.1	2.1
444906.3	393547.8	45	710	3311.2	108.2	106.8	1.4
444901.3	393548.3	50	710	3311.2	108.2	106.9	1.3
444896.4	393548.8	55	710	3311.2	108.1	106.1	2.0
444891.4	393549.3	60	710	3311.2	108.1	107.5	0.6
444886.4	393549.8	65	710	3311.2	108.1	106.7	1.4
444881.4	393550.2	70	710	3311.2	108.1	105.6	2.5
444876.5	393550.8	75	710	3311.2	108	104.9	3.1
444871.5	393551.2	80	710	3311.2	108	105.4	2.6
444866.5	393551.8	85	710	3311.2	107.9	105.6	2.3
444861.5	393552.2	90	710	3311.2	107.9	106.6	1.3
444856.6	393552.8	95	710	3311.2	107.9	107.3	0.6
444851.6	393553.2	100	710	3311.2	107.9	107	0.9
444846.6	393553.8	105	710	3311.2	108	106.5	1.5
444841.6	393554.2	110	710	3341.3	108.2	106.7	1.5
444836.7	393554.7	115	710	3341.3	108.7	107.2	1.5



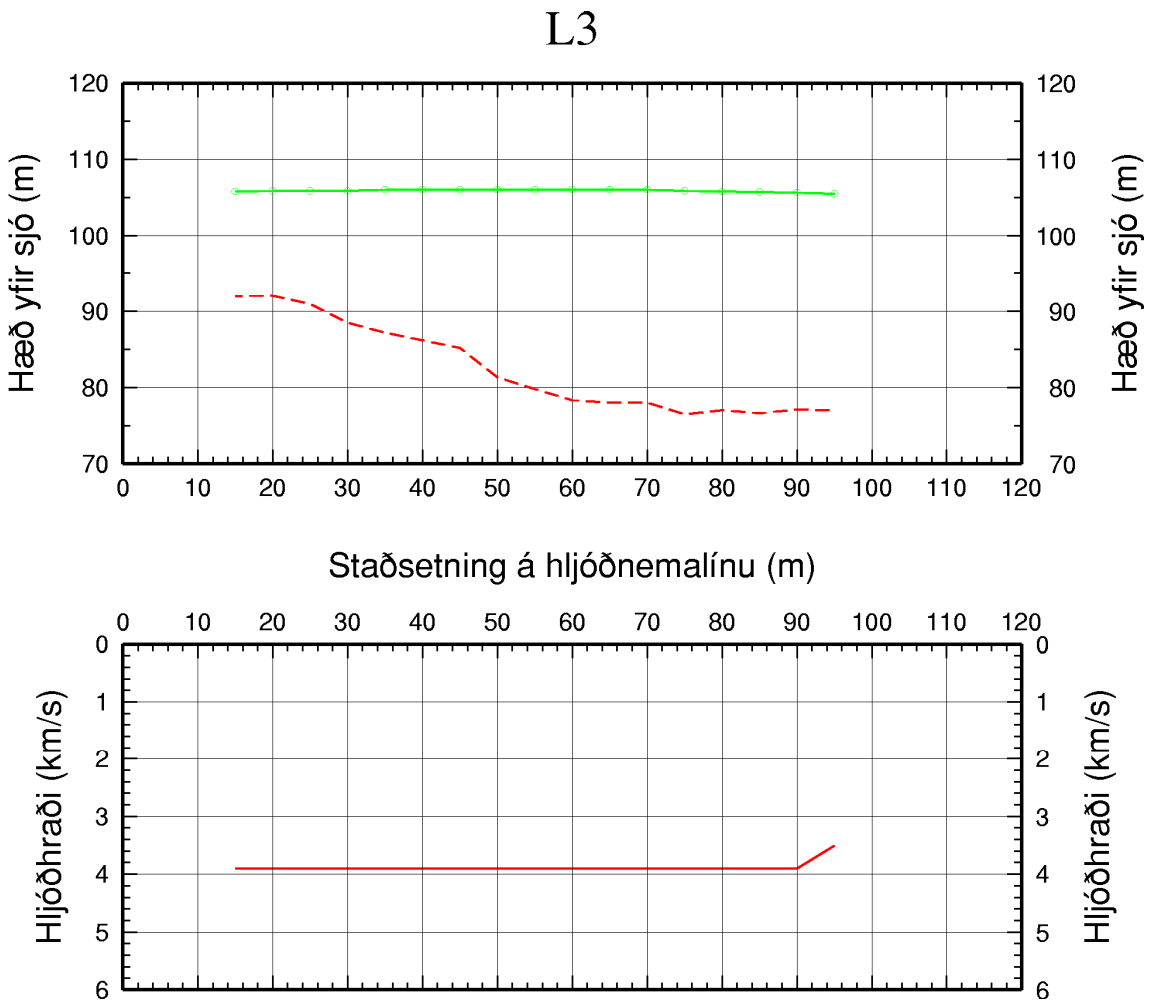
Lína L2 milli holna BB8 og NK-20

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444372.4	393190.9	10	1050	4030	109.3	103.8	5.5
444367.9	393188.9	15	1050	4030	108.6	102.0	6.6
444363.3	393186.9	20	1050	4030	108.2	102.4	5.8
444358.7	393184.8	25	1050	4030	108.0	94.9	13.1
444354.1	393182.8	30	1050	4030	107.9	92.4	15.5
444349.6	393180.8	35	1050	4030	107.8	90.1	17.7
444345.0	393178.8	40	1050	4030	107.7	85.7	22.1
444340.4	393176.8	45	1050	4030	107.6	83.3	24.3
444335.8	393174.8	50	1050	4030	107.6	82.2	25.4
444331.2	393172.8	55	1050	4030	107.5	81.9	25.6
444326.7	393170.8	60	1050	4030	107.4	82.6	24.8
444322.1	393168.8	65	1050	4030	107.3	82.7	24.6
444317.5	393166.8	70	1050	4030	107.3	83.4	23.9
444312.9	393164.8	75	1050	4030	107.2	82.9	24.3
444308.3	393162.8	80	1050	4030	107.1	81.7	25.4
444303.8	393160.7	85	1050	4030	107.0	81.1	25.9
444299.2	393158.7	90	1050	4030	106.9	82.1	24.8
444294.6	393156.7	95	1050	4030	106.8	82.5	24.3
444290.0	393154.7	100	1050	4030	106.7	82.4	24.3



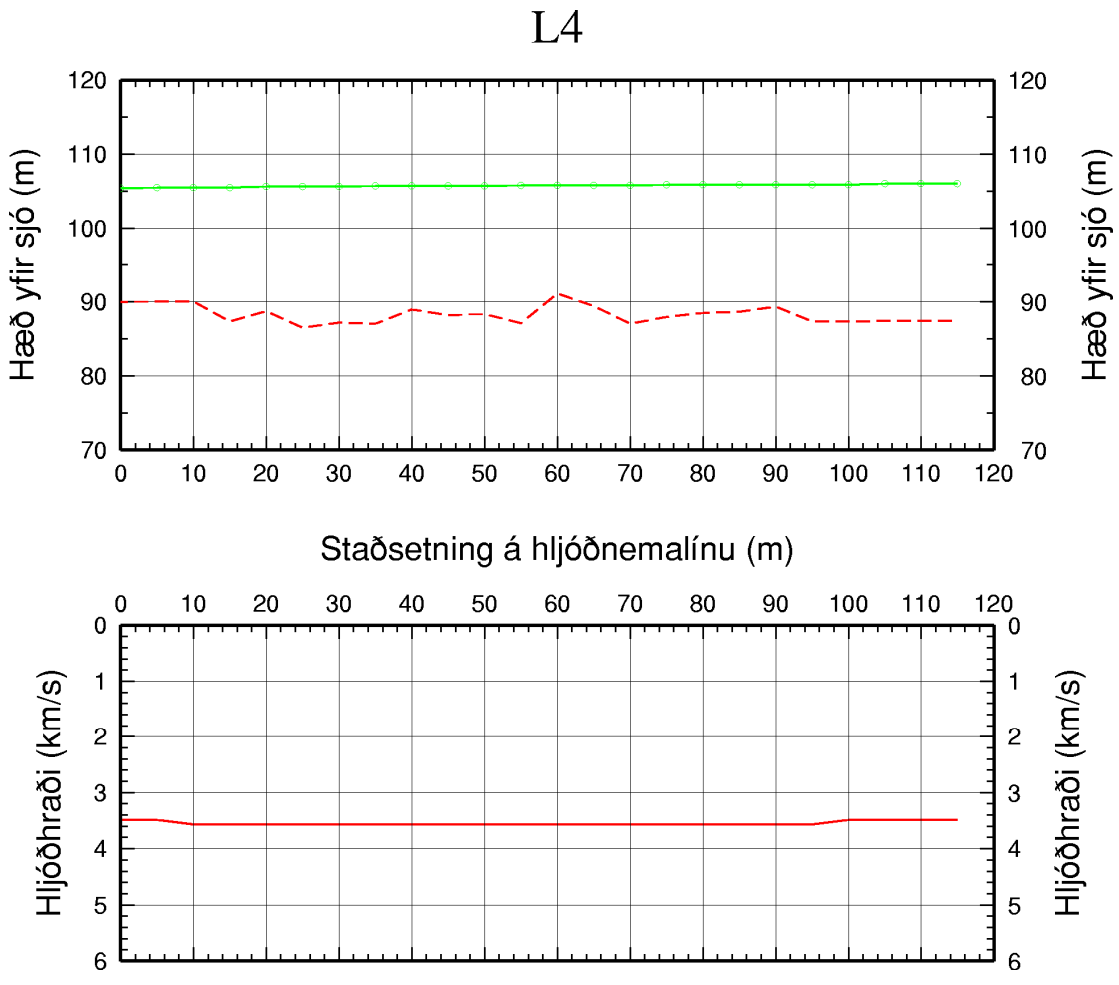
Lína L3 milli holna NK-20 og NK-33

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444228.9	393117.3	15	850	3909	105.8	91.9	13.9
444225.2	393114.0	20	850	3909	105.9	92.0	13.9
444221.5	393110.6	25	850	3909	105.9	90.9	15.0
444217.8	393107.3	30	850	3909	105.9	88.5	17.4
444214.0	393104.0	35	850	3909	106.0	87.2	18.8
444210.3	393100.6	40	850	3909	106.0	86.2	19.8
444206.6	393097.3	45	850	3909	106.0	85.2	20.8
444202.8	393093.9	50	850	3909	106.0	81.3	24.6
444199.1	393090.6	55	850	3909	106.0	79.8	26.2
444195.4	393087.3	60	850	3909	106.0	78.3	27.7
444191.7	393083.9	65	850	3909	106.0	78.0	28.1
444187.9	393080.6	70	850	3909	106.0	78.0	28.0
444184.2	393077.3	75	850	3909	105.9	76.5	29.4
444180.5	393073.9	80	850	3909	105.8	77.0	28.8
444176.8	393070.6	85	850	3909	105.7	76.6	29.1
444173.1	393067.2	90	850	3909	105.6	77.1	28.5
444169.3	393063.9	95	850	3511	105.5	77.0	28.5



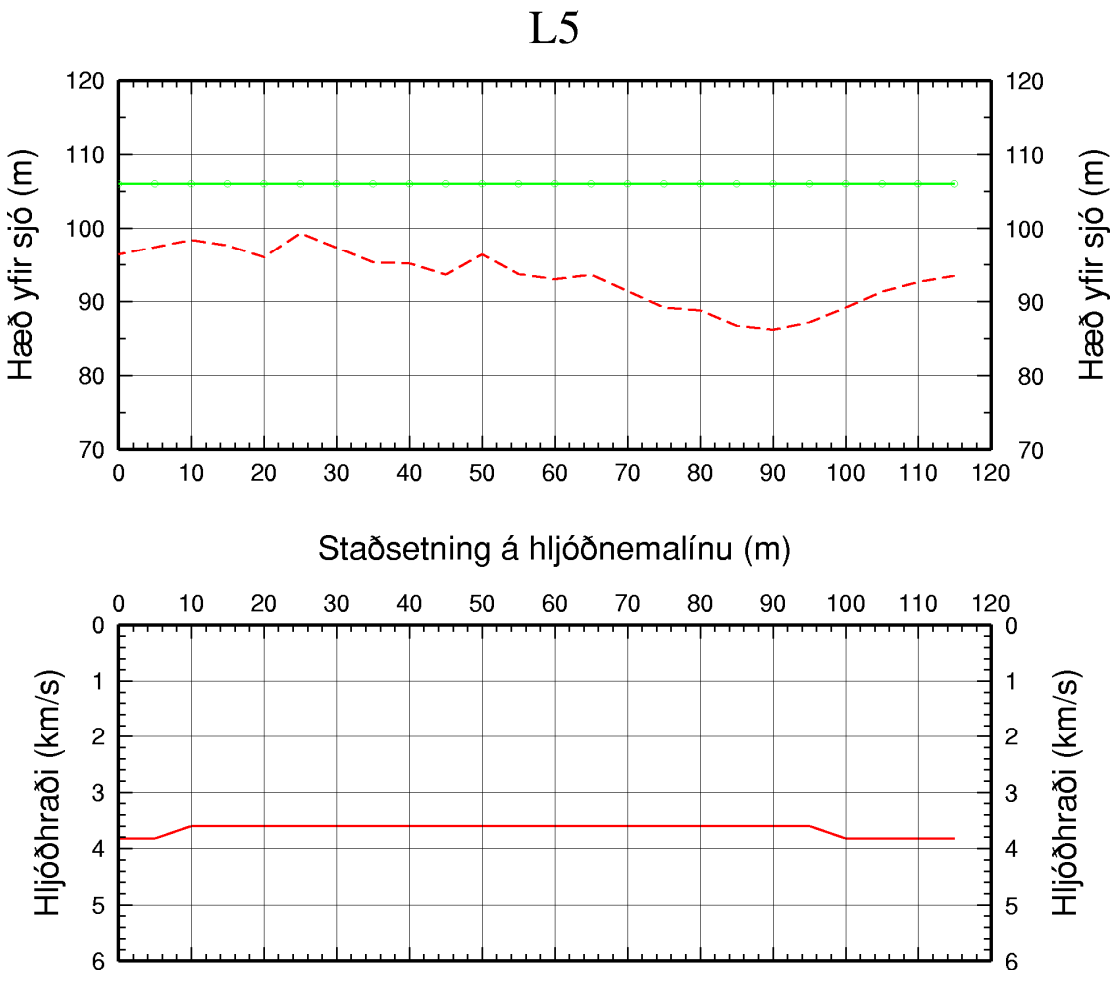
Lína L4 á milli holna NK-31 og NK-30

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444986.5	394033.8	0	1160	3489	105.4	89.9	15.5
444982.4	394030.9	5	1160	3489	105.5	90.0	15.5
444978.4	394028.0	10	1160	3567	105.5	90.0	15.5
444974.3	394025.1	15	1160	3567	105.5	87.3	18.2
444970.2	394022.2	20	1160	3567	105.6	88.7	16.9
444966.2	394019.3	25	1160	3567	105.6	86.5	19.1
444962.1	394016.4	30	1160	3567	105.6	87.2	18.4
444958.0	394013.5	35	1160	3567	105.7	87.0	18.7
444953.9	394010.6	40	1160	3567	105.7	88.9	16.8
444949.9	394007.7	45	1160	3567	105.7	88.2	17.5
444945.8	394004.8	50	1160	3567	105.7	88.3	17.4
444941.8	394001.8	55	1160	3567	105.8	87.1	18.7
444937.7	393998.9	60	1160	3567	105.8	91.1	14.7
444933.6	393996.0	65	1160	3567	105.8	89.4	16.4
444929.5	393993.1	70	1160	3567	105.8	87.0	18.8
444925.5	393990.2	75	1160	3567	105.9	87.9	18.0
444921.4	393987.3	80	1160	3567	105.9	88.5	17.4
444917.3	393984.4	85	1160	3567	105.9	88.6	17.3
444913.3	393981.5	90	1160	3567	105.9	89.3	16.6
444909.2	393978.6	95	1160	3567	105.9	87.3	18.6
444905.1	393975.7	100	1160	3489	105.9	87.3	18.6
444901.1	393972.8	105	1160	3489	106.0	87.4	18.6
444897.0	393969.9	110	1160	3489	106.0	87.4	18.6
444892.9	393967.0	115	1160	3489	106.0	87.4	18.6



Lína L5 á milli holna NK-30 og NK-34

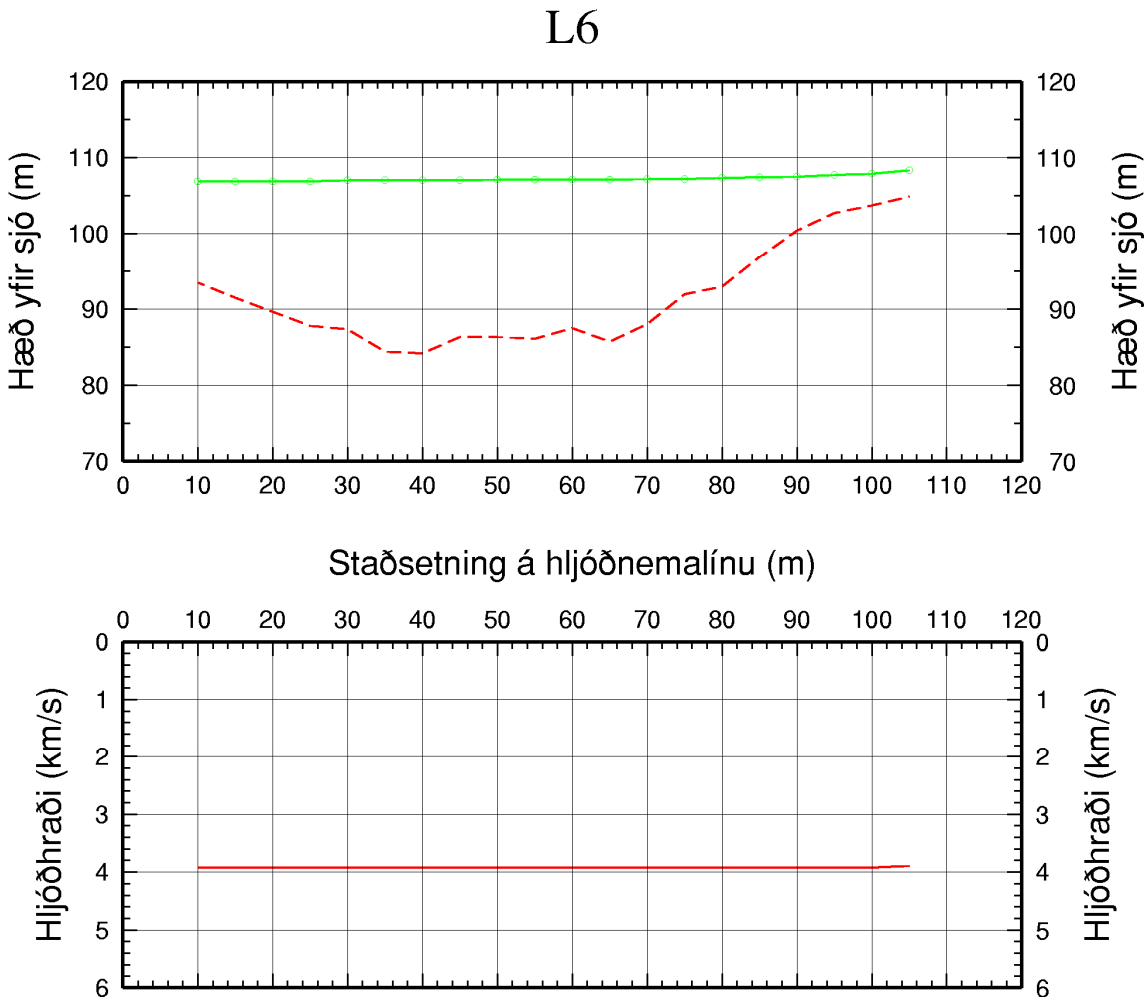
Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444852.8	393921.3	0	960	3826.0	106.0	96.4	9.6
444850.5	393916.8	5	960	3826.0	106.0	97.4	8.6
444848.3	393912.4	10	960	3597.8	106.0	98.4	7.6
444846.0	393907.9	15	960	3597.8	106.0	97.6	8.4
444843.7	393903.5	20	960	3597.8	106.0	96.0	10.0
444841.5	393899.0	25	960	3597.8	106.0	99.3	6.7
444839.2	393894.6	30	960	3597.8	106.0	97.3	8.7
444836.9	393890.1	35	960	3597.8	106.0	95.3	10.7
444834.7	393885.7	40	960	3597.8	106.0	95.2	10.8
444832.4	393881.2	45	960	3597.8	106.0	93.6	12.4
444830.1	393876.8	50	960	3597.8	106.0	96.4	9.6
444827.8	393872.3	55	960	3597.8	106.0	93.7	12.3
444825.6	393867.8	60	960	3597.8	106.0	93.0	13.0
444823.3	393863.4	65	960	3597.8	106.0	93.6	12.4
444821.0	393858.9	70	960	3597.8	106.0	91.4	14.6
444818.8	393854.5	75	960	3597.8	106.0	89.2	16.8
444816.5	393850.0	80	960	3597.8	106.0	88.8	17.2
444814.2	393845.6	85	960	3597.8	106.0	86.7	19.3
444812.0	393841.1	90	960	3597.8	106.0	86.2	19.8
444809.7	393836.7	95	960	3597.8	106.0	87.2	18.8
444807.4	393832.2	100	960	3826.0	106.0	89.2	16.8
444805.2	393827.8	105	960	3826.0	106.0	91.3	14.7
444802.9	393823.3	110	960	3826.0	106.0	92.6	13.4
444800.6	393818.8	115	960	3826.0	106.0	93.5	12.5



ÍSOR

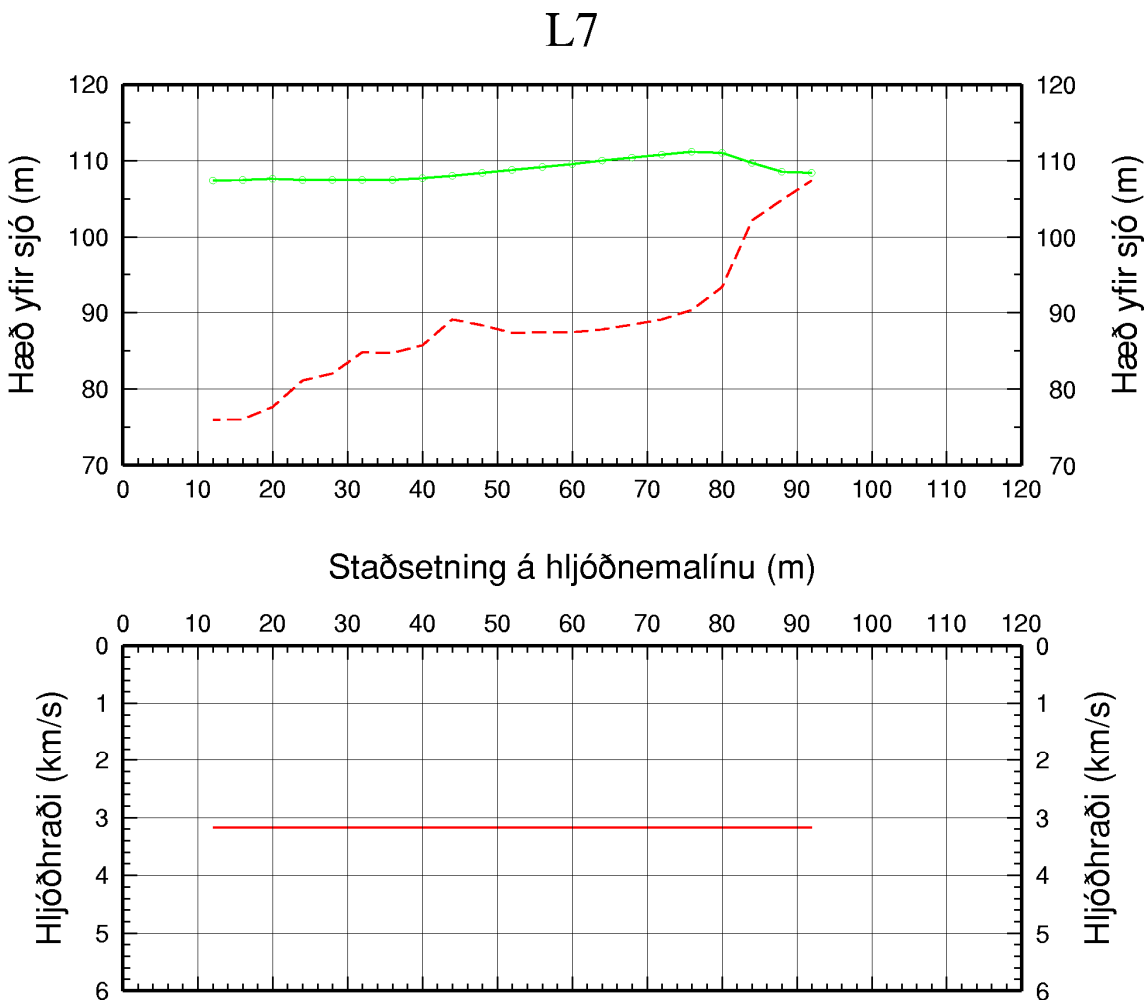
Lína L6 milli holna NK-32 og BB-5

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444540.9	393475.6	10	1050	3925.4	106.9	93.5	13.4
444545.0	393472.6	15	1050	3925.4	106.9	91.5	15.4
444549.0	393469.7	20	1050	3925.4	106.9	89.6	17.3
444553.1	393466.8	25	1050	3925.4	106.9	87.8	19.1
444557.1	393463.8	30	1050	3925.4	107.0	87.3	19.7
444561.1	393460.9	35	1050	3925.4	107.0	84.4	22.6
444565.2	393457.9	40	1050	3925.4	107.0	84.2	22.8
444569.2	393455.0	45	1050	3925.4	107.0	86.3	20.7
444573.2	393452.0	50	1050	3925.4	107.1	86.3	20.8
444577.3	393449.1	55	1050	3925.4	107.1	86.1	21.0
444581.3	393446.2	60	1050	3925.4	107.1	87.5	19.6
444585.4	393443.2	65	1050	3925.4	107.1	85.7	21.4
444589.4	393440.2	70	1050	3925.4	107.2	88.0	19.2
444593.5	393437.3	75	1050	3925.4	107.2	91.9	15.3
444597.5	393434.4	80	1050	3925.4	107.3	92.9	14.4
444601.6	393431.4	85	1050	3925.4	107.4	96.9	10.5
444605.6	393428.5	90	1050	3925.4	107.5	100.4	7.1
444609.7	393425.6	95	1050	3925.4	107.7	102.7	5.0
444613.7	393422.6	100	1050	3925.0	107.9	103.7	4.2
444617.7	393419.7	105	1050	3900.0	108.3	104.9	3.4



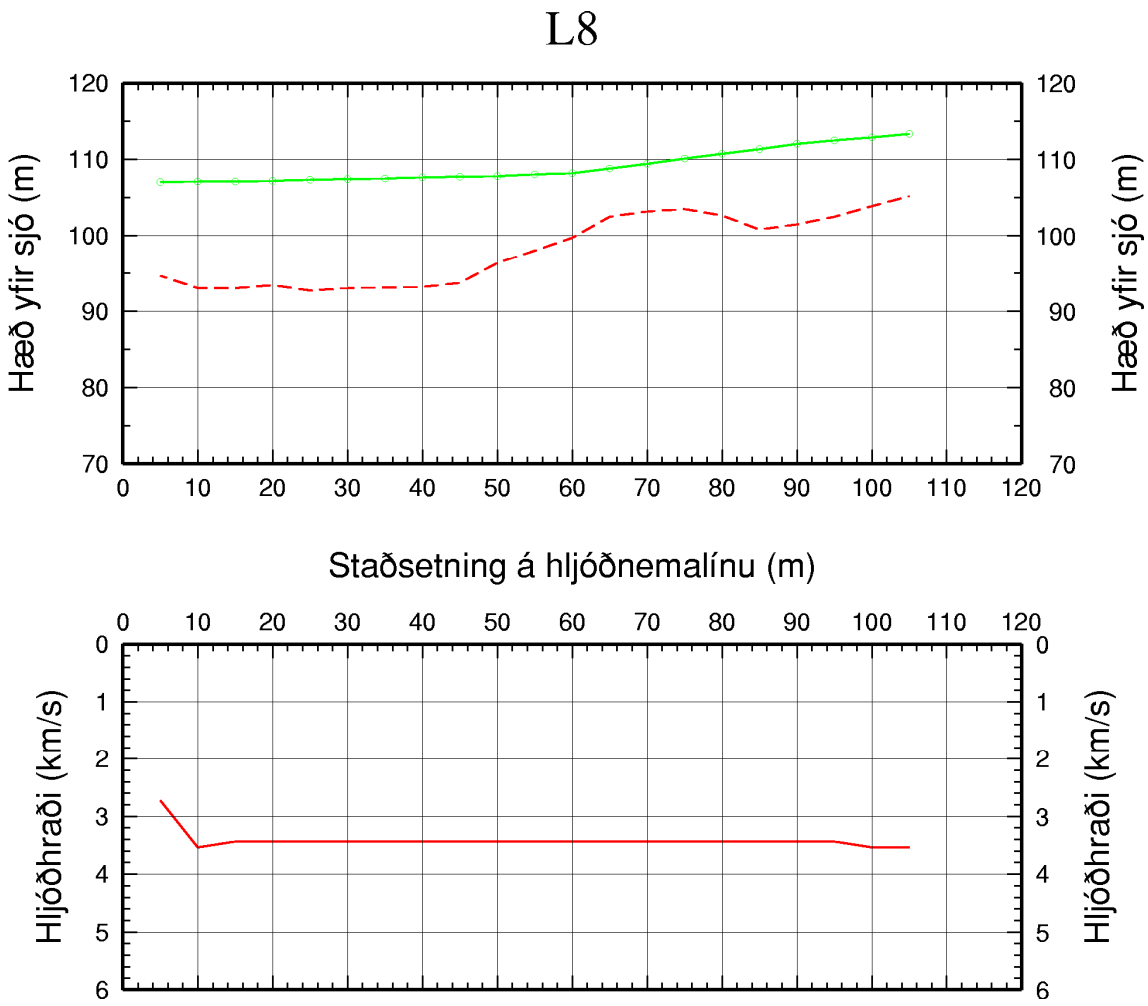
Lína L7 milli hona NK-33 og BB-9

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444151.1	393027.4	12	1050	3171	107.4	75.9	31.5
444154.6	393025.5	16	1050	3171	107.5	76.0	31.5
444158.1	393023.6	20	1050	3171	107.6	77.6	30.0
444161.6	393021.7	24	1050	3171	107.5	81.1	26.4
444165.2	393019.8	28	1050	3171	107.5	82.0	25.5
444168.7	393017.9	32	1050	3171	107.5	84.8	22.7
444172.2	393016.0	36	1050	3171	107.5	84.7	22.8
444175.7	393014.1	40	1050	3171	107.7	85.7	22.1
444179.2	393012.2	44	1050	3171	108.0	89.1	18.9
444182.8	393010.3	48	1050	3171	108.4	88.3	20.1
444186.3	393008.4	52	1050	3171	108.8	87.3	21.5
444189.8	393006.5	56	1050	3171	109.2	87.4	21.8
444193.3	393004.7	60	1050	3171	109.6	87.4	22.2
444196.8	393002.8	64	1050	3171	110.0	87.8	22.2
444200.4	393000.8	68	1050	3171	110.4	88.4	22.1
444203.9	392999.0	72	1050	3171	110.8	89.1	21.7
444207.4	392997.1	76	1050	3171	111.2	90.3	20.9
444210.9	392995.2	80	1050	3171	111.0	93.3	17.7
444214.5	392993.3	84	1050	3171	109.7	102.2	7.5
444218.0	392991.4	88	1050	3171	108.6	104.9	3.7
444221.5	392989.5	92	1050	3171	108.4	107.4	1.1



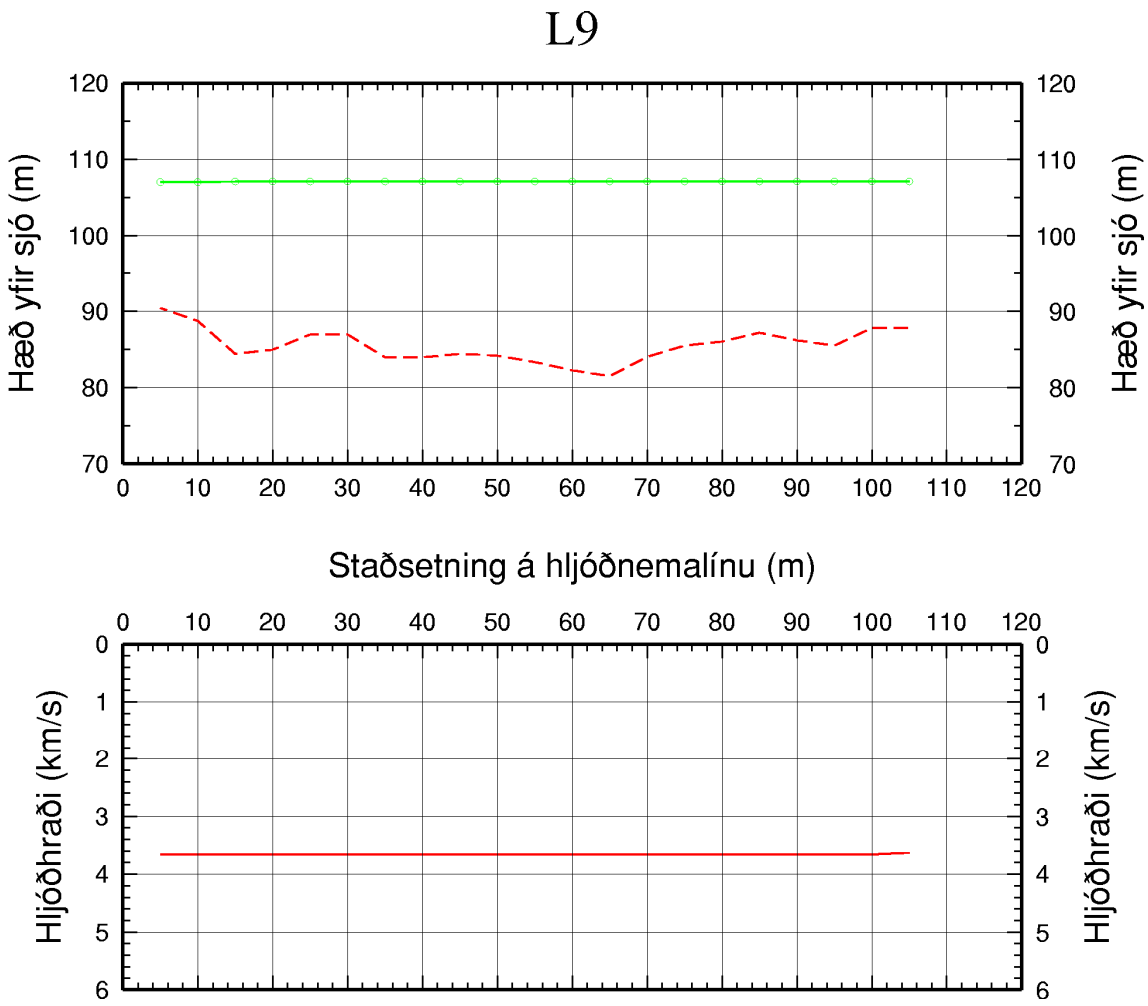
Lína L8 milli holna NL-21 og BB-7

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444410.8	393332.3	5	620	2731	107.0	94.6	12.4
444414.7	393329.1	10	620	3544	107.1	93.0	14.1
444418.6	393326.0	15	620	3443	107.1	93.0	14.1
444422.5	393322.9	20	620	3443	107.2	93.4	13.8
444426.4	393319.8	25	620	3443	107.3	92.7	14.6
444430.3	393316.6	30	620	3443	107.4	93.0	14.4
444434.2	393313.5	35	620	3443	107.5	93.1	14.4
444438.1	393310.3	40	620	3443	107.6	93.2	14.4
444442.0	393307.2	45	620	3443	107.7	93.7	14.0
444445.9	393304.1	50	620	3443	107.8	96.3	11.5
444449.8	393300.9	55	620	3443	108.0	98.0	10.0
444453.7	393297.8	60	620	3443	108.2	99.7	8.5
444457.6	393294.7	65	620	3443	108.8	102.5	6.3
444461.4	393291.5	70	620	3443	109.4	103.2	6.2
444465.3	393288.4	75	620	3443	110.1	103.5	6.6
444469.2	393285.3	80	620	3443	110.7	102.6	8.1
444473.2	393282.1	85	620	3443	111.3	100.8	10.5
444477.0	393279.0	90	620	3443	112.0	101.5	10.5
444480.9	393275.9	95	620	3443	112.5	102.5	10.0
444484.8	393272.7	100	620	3544	112.9	103.9	9.0
444488.7	393269.6	105	620	3544	113.3	105.2	8.1



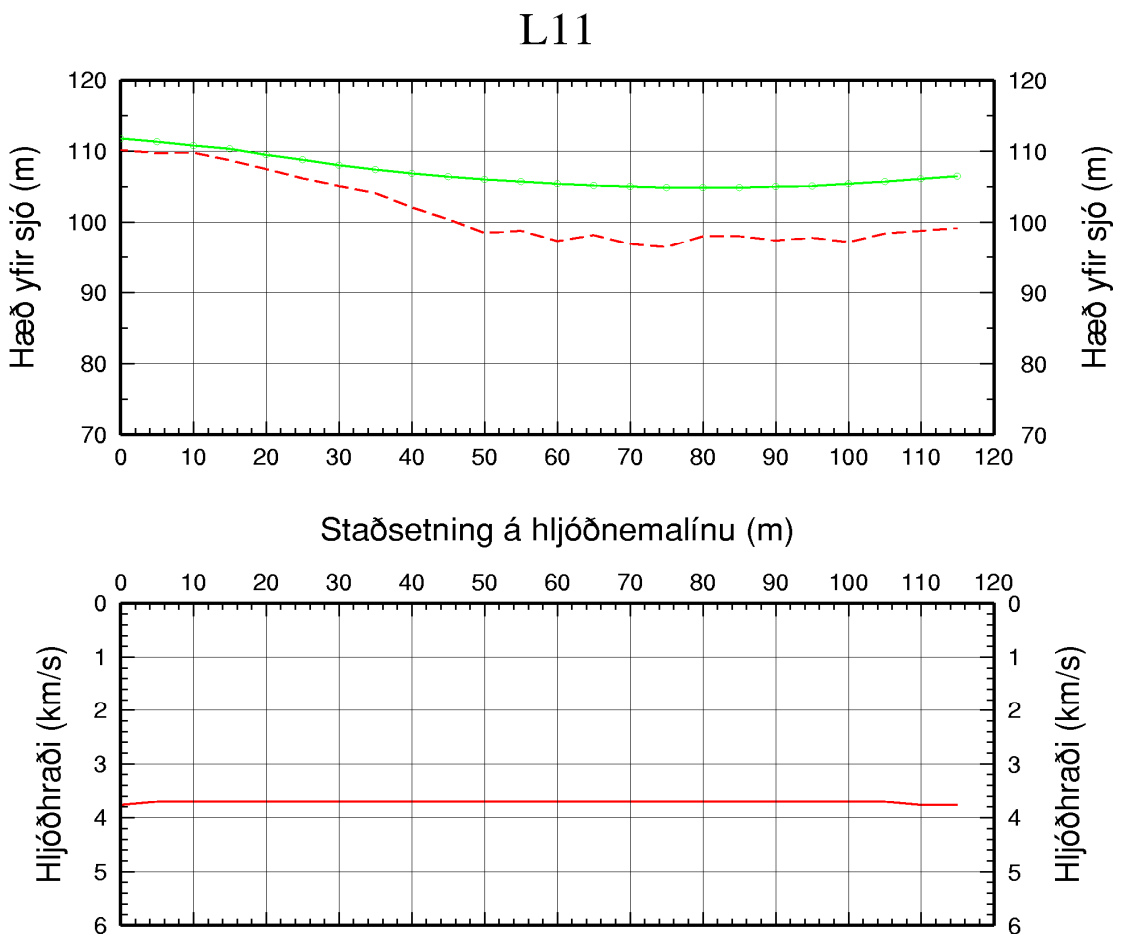
Lína L9 milli holna NK-32 og NL-21

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444500.5	393452.0	5	1100	3667	107.0	90.4	16.6
444497.3	393448.1	10	1100	3667	107.0	88.7	18.3
444494.1	393444.3	15	1100	3667	107.1	84.4	22.7
444490.9	393440.4	20	1100	3667	107.1	84.9	22.2
444487.7	393436.6	25	1100	3667	107.1	86.9	20.2
444484.5	393432.8	30	1100	3667	107.1	86.9	20.2
444481.3	393428.9	35	1100	3667	107.1	83.9	23.2
444478.1	393425.1	40	1100	3667	107.1	83.9	23.2
444474.9	393421.2	45	1100	3667	107.1	84.4	22.7
444471.7	393417.3	50	1100	3667	107.1	84.2	22.9
444468.5	393413.5	55	1100	3667	107.1	83.3	23.8
444465.3	393409.7	60	1100	3667	107.1	82.2	24.9
444462.2	393405.8	65	1100	3667	107.1	81.5	25.6
444458.9	393402.0	70	1100	3667	107.1	84.0	23.1
444455.8	393398.1	75	1100	3667	107.1	85.5	21.6
444452.6	393394.3	80	1100	3667	107.1	86.0	21.1
444449.3	393390.4	85	1100	3667	107.1	87.2	19.9
444446.2	393386.6	90	1100	3667	107.1	86.2	20.9
444443.0	393382.8	95	1100	3667	107.1	85.5	21.6
444439.8	393378.9	100	1100	3667	107.1	87.8	19.2
444436.6	393375.1	105	1100	3629	107.1	87.8	19.2



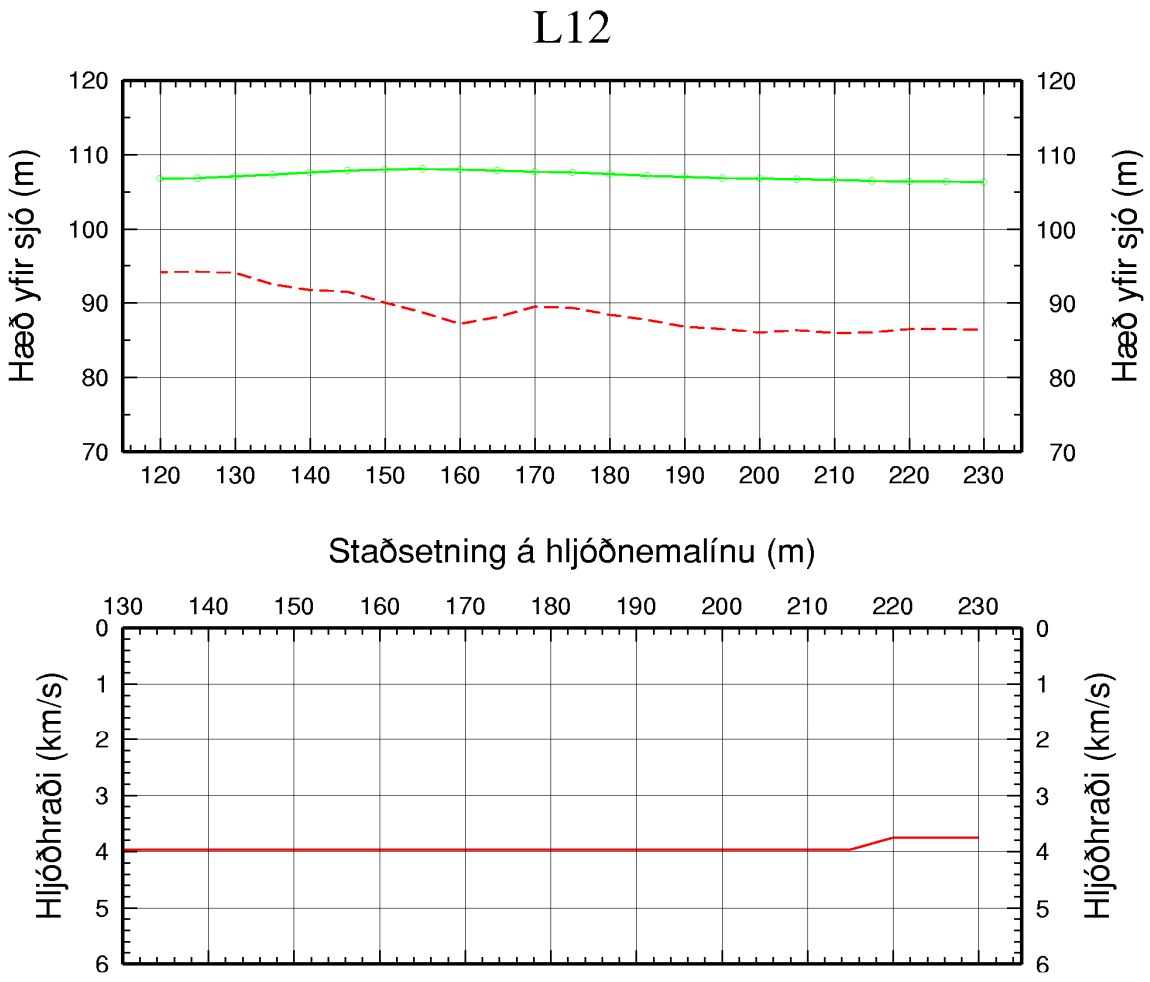
Lína 11 milli holna BB-3 og NL-23

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444750.2	393519.9	0	610	3764	111.8	110.2	1.6
444749.4	393524.8	5	610	3706	111.3	109.7	1.6
444748.7	393529.8	10	610	3706	110.8	109.8	1.0
444747.9	393534.7	15	610	3706	110.3	108.7	1.6
444747.2	393539.7	20	610	3706	109.5	107.5	2.0
444746.4	393544.6	25	610	3706	108.8	106.2	2.6
444745.7	393549.6	30	610	3706	108.0	105.1	2.9
444744.9	393554.5	35	610	3706	107.4	104.1	3.3
444744.1	393559.4	40	610	3706	106.9	102.1	4.8
444743.4	393564.4	45	610	3706	106.4	100.4	6.0
444742.6	393569.3	50	610	3706	106.0	98.5	7.5
444741.8	393574.3	55	610	3706	105.7	98.8	6.9
444741.1	393579.2	60	610	3706	105.4	97.3	8.1
444740.3	393584.2	65	610	3706	105.2	98.2	7.0
444739.6	393589.1	70	610	3706	105.0	96.9	8.1
444738.8	393594.0	75	610	3706	104.9	96.4	8.5
444738.1	393599.0	80	610	3706	104.9	98.0	6.9
444737.3	393603.9	85	610	3706	104.9	98.0	6.9
444736.6	393608.9	90	610	3706	105.0	97.4	7.6
444735.8	393613.8	95	610	3706	105.1	97.8	7.3
444735.0	393618.8	100	610	3706	105.4	97.2	8.2
444734.3	393623.7	105	610	3706	105.7	98.4	7.3
444733.5	393628.6	110	610	3764	106.1	98.8	7.3
444732.8	393633.6	115	610	3764	106.5	99.2	7.3



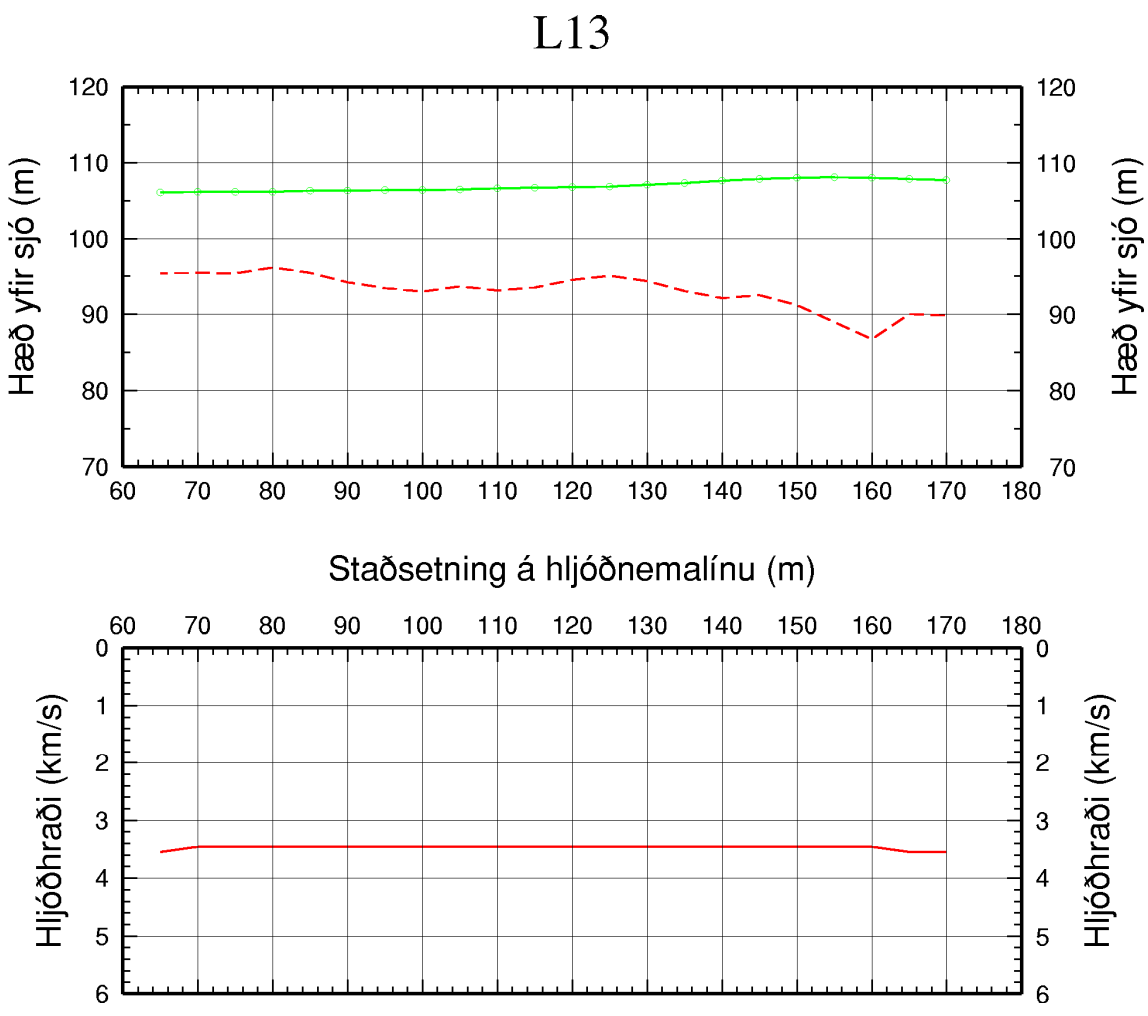
Lína L12 á milli holna NK-32 og NL-24

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg(m)
444603.9	393578.0	120	663	3759	106.8	94.1	12.7
444607.0	393581.8	125	663	3972	106.9	94.2	12.7
444610.2	393585.7	130	663	3972	107.1	94.0	13.1
444613.3	393589.6	135	663	3972	107.3	92.5	14.8
444616.5	393593.5	140	663	3972	107.6	91.7	15.9
444619.7	393597.3	145	663	3972	107.9	91.5	16.4
444622.8	393601.2	150	663	3972	108.0	90.0	18.0
444626.0	393605.1	155	663	3972	108.1	88.7	19.4
444629.2	393609.0	160	663	3972	108.0	87.2	20.8
444632.3	393612.8	165	663	3972	107.9	88.1	19.8
444635.5	393616.7	170	663	3972	107.7	89.5	18.2
444638.6	393620.6	175	663	3972	107.6	89.3	18.3
444641.8	393624.5	180	663	3972	107.4	88.4	19.0
444644.9	393628.3	185	663	3972	107.2	87.7	19.5
444648.1	393632.2	190	663	3972	107.0	86.8	20.2
444651.3	393636.1	195	663	3972	106.9	86.5	20.4
444654.4	393640.0	200	663	3972	106.8	86.0	20.8
444657.6	393643.8	205	663	3972	106.7	86.3	20.4
444660.8	393647.7	210	663	3972	106.6	85.9	20.7
444663.9	393651.6	215	663	3972	106.5	86.0	20.5
444667.1	393655.5	220	663	3759	106.4	86.5	19.9
444670.2	393659.3	225	663	3759	106.4	86.5	19.9
444673.4	393663.2	230	663	3759	106.3	86.4	19.9



Lína L13 á milli holna NK-32 og NL-24

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444569.1	393535.4	65	663	3546	106.1	95.3	10.8
444572.2	393539.2	70	663	3465	106.2	95.4	10.8
444575.4	393543.1	75	663	3465	106.2	95.3	10.9
444578.6	393547.0	80	663	3465	106.2	96.1	10.1
444581.7	393550.9	85	663	3465	106.3	95.4	10.9
444584.9	393554.8	90	663	3465	106.3	94.2	12.1
444588.1	393558.6	95	663	3465	106.4	93.4	13.0
444591.2	393562.5	100	663	3465	106.4	92.9	13.5
444594.4	393566.3	105	663	3465	106.5	93.6	12.9
444597.5	393570.2	110	663	3465	106.6	93.1	13.5
444600.7	393574.1	115	663	3465	106.7	93.5	13.2
444603.9	393578.0	120	663	3465	106.8	94.5	12.3
444607.0	393581.8	125	663	3465	106.9	95.0	11.9
444610.2	393585.7	130	663	3465	107.1	94.3	12.8
444613.3	393589.6	135	663	3465	107.3	93.0	14.3
444616.5	393593.5	140	663	3465	107.6	92.1	15.5
444619.7	393597.3	145	663	3465	107.9	92.5	15.4
444622.8	393601.2	150	663	3465	108.0	91.2	16.8
444626.0	393605.1	155	663	3465	108.1	88.9	19.2
444629.2	393609.0	160	663	3465	108.0	86.7	21.3
444632.3	393612.8	165	663	3546	107.9	90.0	17.9
444635.5	393616.7	170	663	3546	107.7	89.8	17.9



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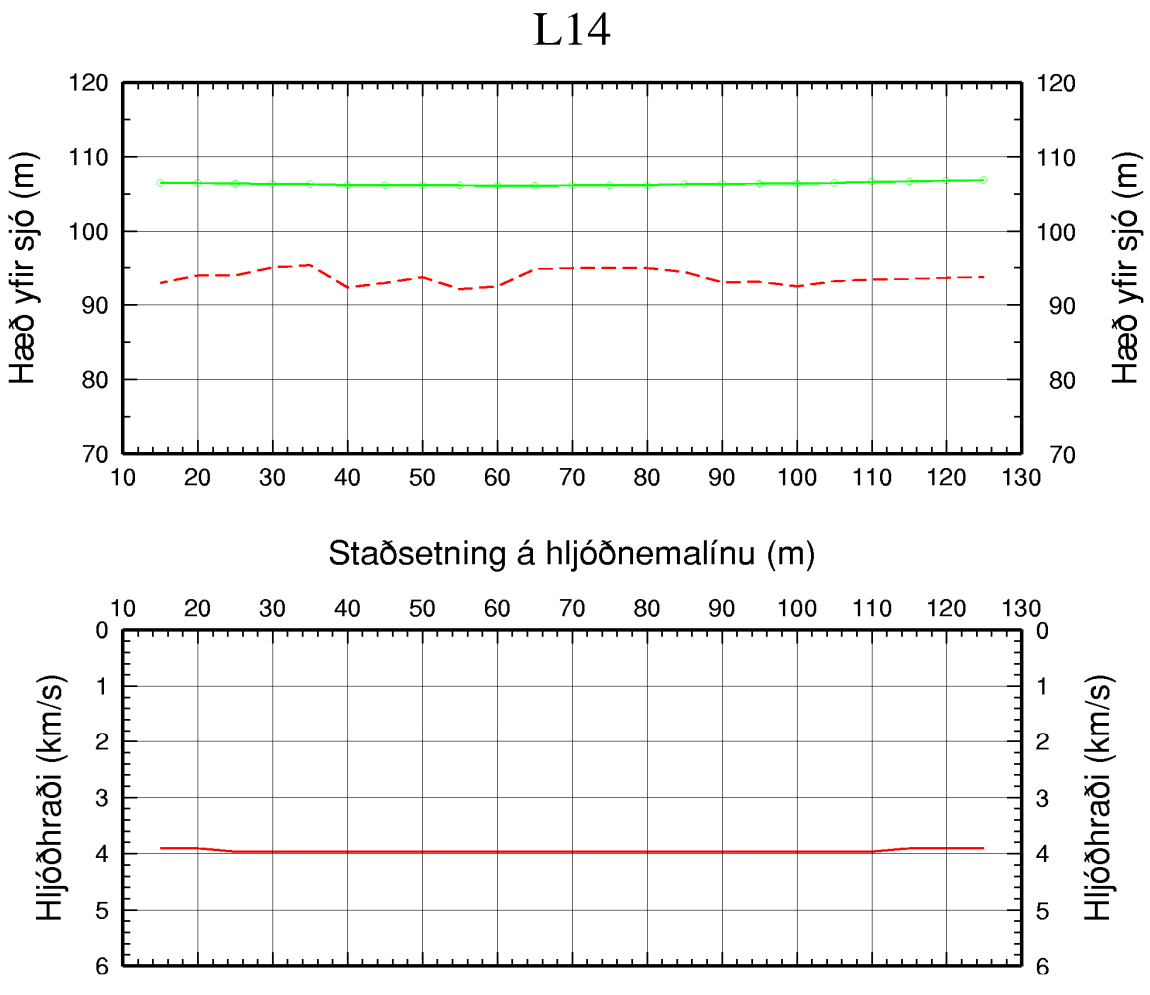
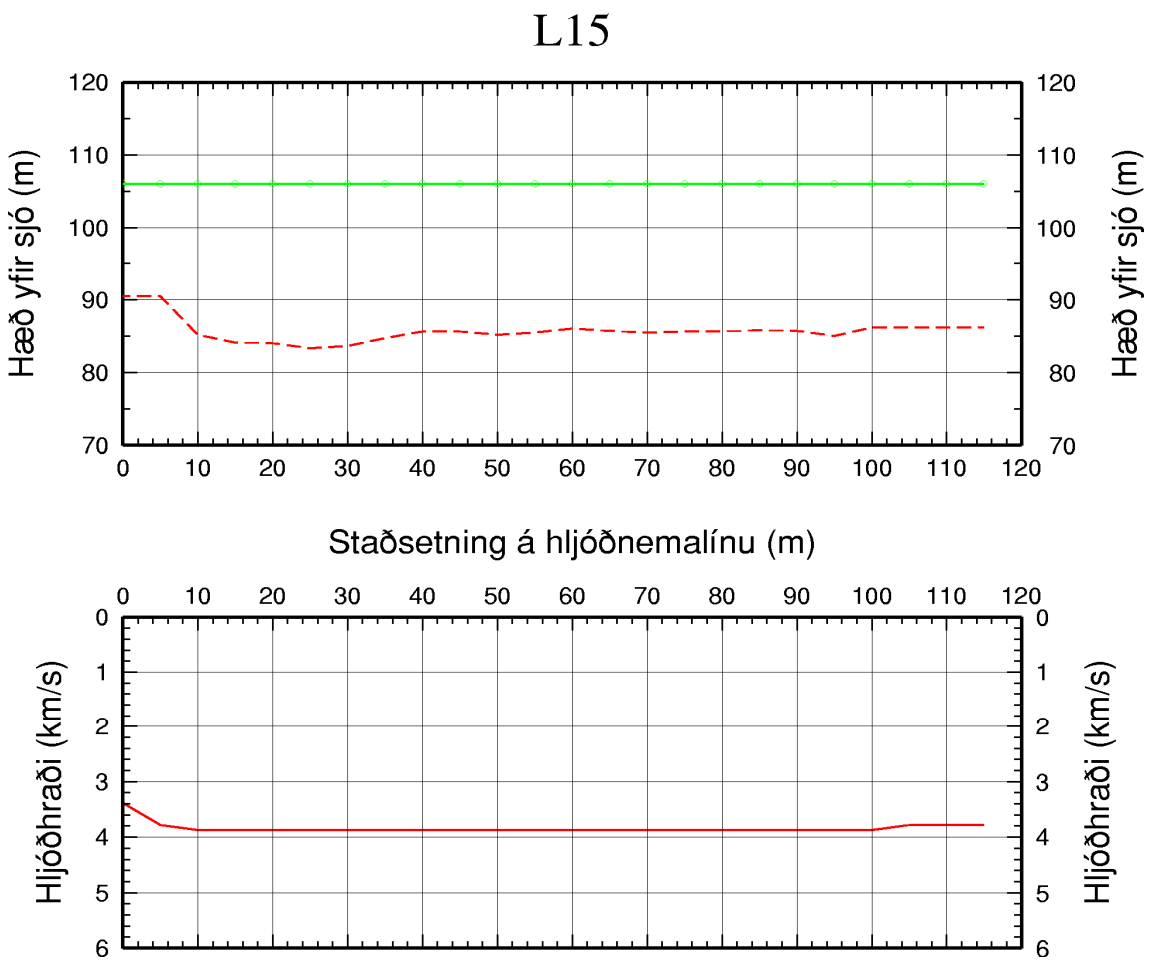
Lína L14 á milli holna NK-32 og NL-24

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444537.5	393496.6	15	663	3905	106.5	92.9	13.6
444540.7	393500.5	20	663	3905	106.5	93.9	12.6
444543.8	393504.4	25	663	3972	106.4	93.9	12.5
444547.0	393508.2	30	663	3972	106.3	95.0	11.3
444550.1	393512.1	35	663	3972	106.3	95.3	11.0
444553.3	393516.0	40	663	3972	106.2	92.3	13.9
444556.4	393519.9	45	663	3972	106.2	92.9	13.3
444559.6	393523.8	50	663	3972	106.2	93.7	12.5
444562.8	393527.6	55	663	3972	106.2	92.1	14.1
444565.9	393531.5	60	663	3972	106.1	92.5	13.6
444569.1	393535.4	65	663	3972	106.1	94.8	11.3
444572.2	393539.2	70	663	3972	106.2	94.9	11.3
444575.4	393543.1	75	663	3972	106.2	94.9	11.3
444578.6	393547.0	80	663	3972	106.2	94.9	11.3
444581.7	393550.9	85	663	3972	106.3	94.4	11.9
444584.9	393554.8	90	663	3972	106.3	93.0	13.3
444588.1	393558.6	95	663	3972	106.4	93.1	13.3
444591.2	393562.5	100	663	3972	106.4	92.5	13.9
444594.4	393566.3	105	663	3972	106.5	93.2	13.3
444597.5	393570.2	110	663	3972	106.6	93.4	13.2
444600.7	393574.1	115	663	3905	106.7	93.5	13.2
444603.9	393578.0	120	663	3905	106.8	93.6	13.2
444607.0	393581.8	125	663	3905	106.9	93.7	13.2



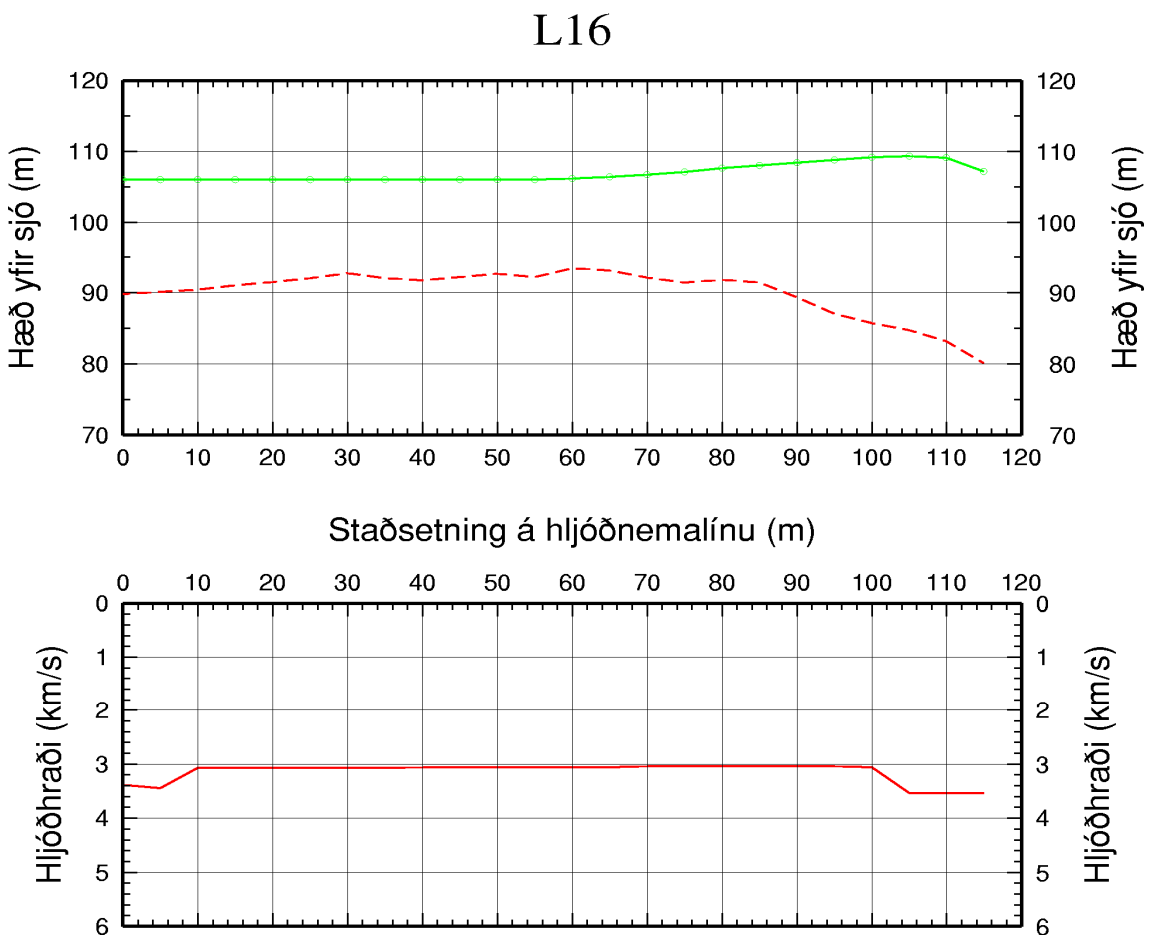
Lína 15 milli holna NL-24 og NK-34 (ath röð)

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444774	393782	0	907	3384	106	91	16
444771	393779	5	907	3781	106	91	16
444768	393775	10	907	3877	106	85	21
444765	393771	15	907	3877	106	84	22
444761	393767	20	907	3877	106	84	22
444758	393763	25	907	3877	106	83	23
444755	393760	30	907	3877	106	84	22
444752	393756	35	907	3877	106	85	21
444748	393752	40	907	3877	106	86	20
444745	393748	45	907	3877	106	86	20
444742	393744	50	907	3877	106	85	21
444739	393741	55	907	3877	106	86	21
444735	393737	60	907	3877	106	86	20
444732	393733	65	907	3877	106	86	20
444729	393729	70	907	3877	106	86	21
444726	393725	75	907	3877	106	86	20
444722	393722	80	907	3877	106	86	20
444719	393718	85	907	3877	106	86	20
444716	393714	90	907	3877	106	86	20
444713	393710	95	907	3877	106	85	21
444709	393706	100	907	3877	106	86	20
444706	393703	105	907	3781	106	86	20
444703	393699	110	907	3781	106	86	20
444700	393695	115	907	3781	106	86	20



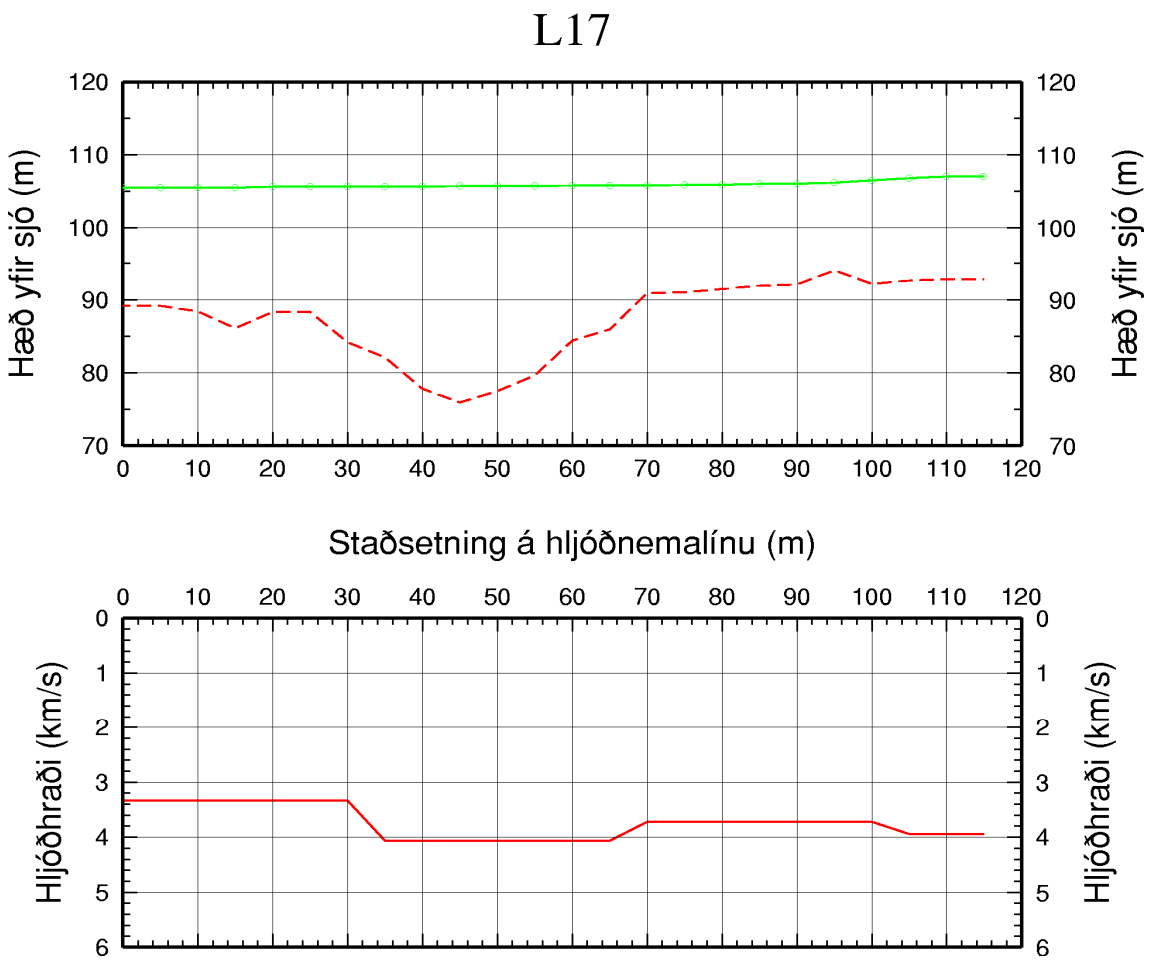
Lína L16 milli holna NL-25 og NL-23

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444634.9	393706.4	0	621	3384	106.0	89.8	16.2
444639.1	393703.7	5	608	3448	106.0	90.1	15.9
444643.3	393701.0	10	595	3073	106.0	90.4	15.6
444647.5	393698.3	15	583	3073	106.0	91.0	15.0
444651.8	393695.6	20	570	3073	106.0	91.5	14.5
444656.0	393692.9	25	557	3073	106.0	92.0	14.0
444660.2	393690.2	30	544	3073	106.0	92.7	13.3
444664.4	393687.6	35	531	3073	106.0	92.0	14.0
444668.6	393684.9	40	518	3063	106.0	91.7	14.3
444672.8	393682.2	45	506	3063	106.0	92.2	13.8
444677.0	393679.5	50	493	3063	106.0	92.6	13.4
444681.2	393676.8	55	480	3063	106.0	92.2	13.8
444685.5	393674.1	60	480	3063	106.2	93.4	12.8
444689.7	393671.4	65	527	3063	106.4	93.1	13.3
444693.9	393668.7	70	573	3041	106.7	92.1	14.7
444698.1	393666.0	75	620	3041	107.1	91.4	15.7
444702.3	393663.3	80	666	3041	107.6	91.8	15.8
444706.5	393660.6	85	713	3041	108.0	91.4	16.6
444710.8	393657.9	90	760	3041	108.4	89.3	19.2
444714.9	393655.2	95	806	3041	108.8	87.0	21.9
444719.2	393652.5	100	853	3063	109.2	85.7	23.5
444723.4	393649.8	105	899	3545	109.3	84.7	24.6
444727.6	393647.2	110	946	3545	109.1	83.2	26.0
444731.8	393644.5	115	992	3545	107.2	80.1	27.1



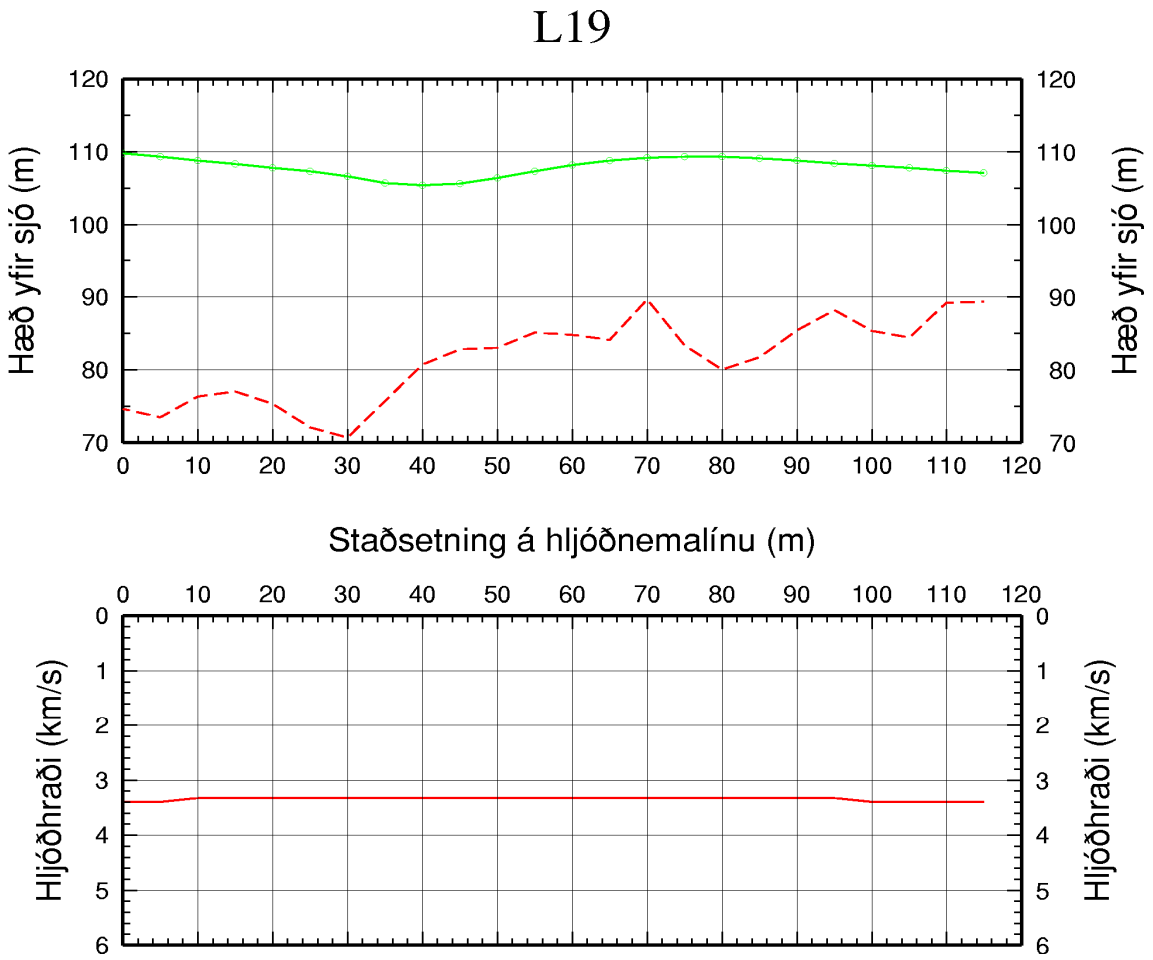
Lína L17 milli holna NL-20 og NL-21

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444287.0	393183.5	0	1240	3342	105.5	89.2	16.3
444283.9	393179.5	5	1240	3342	105.5	89.2	16.3
444280.9	393175.6	10	1240	3342	105.5	88.4	17.2
444277.8	393171.6	15	1240	3342	105.5	86.1	19.4
444274.8	393167.7	20	1240	3342	105.6	88.3	17.3
444271.8	393163.7	25	1240	3342	105.6	88.3	17.3
444268.7	393159.7	30	1240	3342	105.6	84.2	21.4
444265.7	393155.8	35	1240	4070	105.6	82.1	23.6
444262.6	393151.8	40	1240	4070	105.6	77.8	27.9
444259.6	393147.8	45	1240	4070	105.7	75.9	29.7
444256.5	393143.8	50	1240	4070	105.7	77.5	28.2
444253.5	393139.9	55	1240	4070	105.7	79.6	26.1
444250.4	393135.9	60	1240	4070	105.8	84.4	21.3
444247.4	393132.0	65	1240	4070	105.8	85.9	19.9
444244.3	393128.0	70	1240	3727	105.8	90.9	14.9
444241.3	393124.0	75	1240	3727	105.9	91.0	14.9
444238.2	393120.1	80	1240	3727	105.9	91.5	14.4
444235.2	393116.1	85	1240	3727	106.0	91.9	14.0
444232.2	393112.2	90	1240	3727	106.0	92.1	14.0
444229.1	393108.2	95	1240	3727	106.2	94.0	12.2
444226.1	393104.2	100	1240	3727	106.5	92.2	14.3
444223.0	393100.2	105	1240	3946	106.8	92.6	14.2
444220.0	393096.3	110	1240	3946	107.0	92.8	14.2
444216.9	393092.3	115	1240	3946	107.0	92.8	14.2



Lína L19 milli holna NK-21 og NK-28

Austur (m)	Norður (m)	Mælistaður (m)	Yfirb.hraði (m/s)	Móbergshraði (m/s)	Mælihæð (m)	Móbergshæð (m)	Dýpi á móberg (m)
444870.3	394170.1	0	1200	3398	109.8	78.6	31.2
444874.8	394168.0	5	1200	3398	109.3	78.1	31.2
444879.4	394165.9	10	1200	3329	108.8	77.6	31.2
444883.9	394163.8	15	1200	3329	108.3	75.9	32.4
444888.5	394161.8	20	1200	3329	107.8	74.9	32.9
444893.0	394159.7	25	1200	3329	107.3	76.6	30.7
444897.6	394157.6	30	1200	3329	106.6	77.4	29.2
444902.1	394155.5	35	1200	3329	105.7	79.1	26.6
444906.7	394153.4	40	1200	3329	105.4	78.3	27.1
444911.2	394151.3	45	1200	3329	105.6	83.8	21.8
444915.8	394149.2	50	1200	3329	106.4	85.9	20.5
444920.3	394147.2	55	1200	3329	107.3	88.3	19.0
444924.8	394145.1	60	1200	3329	108.2	87.7	20.5
444929.4	394143.0	65	1200	3329	108.8	89.1	19.7
444933.9	394140.9	70	1200	3329	109.2	84.6	24.6
444938.5	394138.8	75	1200	3329	109.3	86.7	22.6
444943.0	394136.7	80	1200	3329	109.3	89.3	20.0
444947.6	394134.6	85	1200	3329	109.1	87.4	21.7
444952.1	394132.5	90	1200	3329	108.8	85.3	23.5
444956.7	394130.5	95	1200	3329	108.4	85.6	22.8
444961.2	394128.4	100	1200	3398	108.1	85.3	22.8
444965.8	394126.3	105	1200	3398	107.8	85.0	22.8
444970.3	394124.2	110	1200	3398	107.4	84.6	22.8
444974.8	394122.1	115	1200	3398	107.1	84.3	22.8



Holtavirkjun Hydroelectric Project

Maps

Cross sections

Core hole logs

Photos of core

Percussion hole logs

Lugeon tests and temperature readings

Point load tests

Holtavirkjun Hydroelectric Project

Maps

Location map

Geological map

Map of superficial deposits

Álfsstaðir
Mjóanes
Hádegisflóð
Syðraflóð
Birnustaðir
Miðmundatjörn
Leirtjörn
Steinteigur
Reykjaholt
Reykholl
Reykir
Reykjahlíð
Reykjarétt
Vorsabær
Efri-Brúnavellir
Húsatóttaholt
Húsatóttir
Leirdæl
Brautarholt
Murnmýrar
Sandlækjarós
Gunnbjarnarholt
Sandholt
Vallarbakkatjörn
Sandlækjarkot
Sandlækur
Klettar
Rauðholt
Tjarnhólar
Breiðanes
Hryggir
Reykjaheiði
Kjóaeyri
Sandeyri
Murneyrar
Þjórsá
Kríueyri
Árnesflúðir
Árneskvísl
Gálgaklettur
Þinghólar
Lambhagi
Skeiða- og Gnúpverjahreppur
Rangárþing ytra
Rangárvallasýsla
Rangárþing ytra
Svanhildartangi
Veiðibjölluhóll
Stóri-Dímon
Litli-Dímon
Kaldárholt
Votamýri
Kirkjuhóll
Ósvötn
Fagurhóll
Smalanípa
Sandskarðaheiði
Hestaklettur
Árnes
Hestafoss
Lækjarey
Langholt
Hnúkar
Búðafoss
Vindásnes
Vindáshólmi
Vindásós
Vindás
Miðás
Nautavað
Vaðvöllur
Vaðeyri
Fjártangi
Árbæjarheiði
(Árbær)
Ferjuklettur
Mosar
Hruni
Varmahraun
Miðmorgunsholt
Minnahof
Stórahof
Kirkjuholt
Miðhúsahólmi
Eyjarvað
Kálfá
Miðhús
Miðhúsafjall
Prándarholt
Prándur
Prándarlundur
Stöðulfell
Bólstaðour
Nónásar
Bleiksbrekkur
Hofsheiði
Þjórsárholtsholt
Þjórsárholt
Krókur
Ölmóðsey
(Á)
Hrossahylur
Heiðarbrún
Hraunholt
Knarrarholt
Núpsheiði
Núpsmýri
Núpsfjall
Stórinúpur
Minninúpur
Ferjuholar
Minnanúpsholmi
Fimmhundraðaárétt
Skaftholtsréttir
Skaftholt
Skaftholtsfjall
Skeljahóll
Löngudæl
Hamratunga
(Hamrar)
Réttarholt
Múli
Fagurhóll
Leiti
Vestra-Geldingaholt
Eystra-Geldingaholt
Langholt
Störholt
Tíðholt
Hamraholt
Hamragil
Kambshóll
Ásamýri
Miðfell
Ásbrekka
Tryni
Skyggnir
Kumbutjarnir
Glóruhóll
Skarðsfjall
(Skarð)
Sandlækjarmýri
Reykjanes
Árnes
Skeiða- og Gnúpverjahreppur
Rangárþing ytra
Lækjarey
Hnúkar
Bjallar
Urðarholt
Lækur
Lyngholt
Selholt
Illakelda
Þinghólt
Flagbjarnarholt
Flagbjarnarholt
Stórholt
Kolbeinsholt
Höfði
Heysholt
Leira
Kolbeinslækur
Vindástjörn
Magnhildartjörn
Leirtjörn
Minnivellir
Brúarlundur
Dráttarhóll
Stóruvellir
Minnivallalækur
Minnivallahraun
Stóruvallaheiði
Gríshólar
Leirdæla
Bót
Hvammur
(Hvammshjáleiga)
(Norðurgarður)
Hvítaskriða
Miðfell
(Erill)
Vixlahnúkur
Garðatjörn
Hellar
(Hátún)
(Múli)
(Fellsmúli)
Stóruvallarétt
Hellismúlaheiði
Teigar
Gíslholtsfjall
Illavatn
Langalækur
Háegg
Kambur
Kambur
Gíslholt
Vestra-Gíslholtsvatn
Eystra-Gíslholtsvatn
Kiðholt
Flatholt
Selfjall
Ketilsstaðaholt
Ketilsstaðir
Kostholt
Drangur
Hagi
Hagaholt
Hagaleira
Saurbær
Kaldárholtslækur
Árlangaeyri
Breiðamýri
Reiðholt
Guttormshagi
Borgarfell
Guttormshagaleira
Miðmundafell
Hádegisfell
Þverlækur
Högnalækur
Nónhólar
Hreiðurrsgil
Hreiður
Kvíarholt
Grenshólar
Rafholtsbjalli
Langalaut
Stórholt
Kambsheiði
Mykjunes
Hnúkur
Hjallanes
Hjallanes
Varghóll
Háheiði
Hnúðholt
Hnúðholtsmýri
Hundabúðuheiði
Torfholt
Skammbeinsstaðir
Búfa
Búfuflóð
Bjalli
Dætur
Hamarsholt
Gilsholt
Skrokkhóll
Lamphóll
Lúnansholt
Lækjarós
Tíðholt
Stóruvallaheiði
Hruni
Hruni
Hvammur
Hvammshjáleiga
Norðurgarður
Ölmóðsey
Ásbrekka
Tryni
Hamragil
Hamraholt
Kambshóll
Ásamýri
Miðfell
Núpsmýri
Núpsfjall
Stórinúpur
Minninúpur
Ferjuhólar
Minnanúpshólmi
Skaftholtsfjall
Skeljahóll
Löngudæl
Hamratunga
Skaftholt
Fimmhundraðaárétt
Réttarholt
Múli
Fagurhóll
Leiti
Vestra-Geldingaholt
Eystra-Geldingaholt
Langholt
Störholt
Tíðholt
Hamraholt
Hamragil
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Ketilsstaðaholt
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Kostholt
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Hagi
Hagaholt
Hagaleira
Saurbær
Kaldárholtslækur
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Mykjunes
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Hjallanes
Hjallanes
Varghóll
Háheiði
Hnúðholt
Hnúðholtsmýri
Hundabúðuheiði
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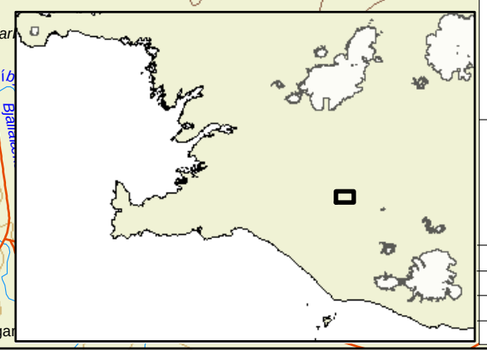
Skammbeinsstaðir
Búfa
Búfuflóð
Bjalli
Dætur
Hamarsholt
Gilsholt
Skrokkhóll
Lamphóll
Lúnansholt
Lækjarós
Tíðholt
Stóruvallaheiði
Hruni
Hruni
Sandskarðaheiði
Sandlækjarmýri
Reykjaheiði
Hjallanes
Hofsheiði
Varmahraun
Árnes
Hestafoss
Búðafoss
Þjórsá
Skeiða- og Gnúpverjahreppur
Rangárþing ytra
Árneskvísl
Árnesflúðir
Eyjarvað
Kálfá
Lækjarey
Ósvötn
Vindásós
Nautavað
Vaðvöllur
Vestra-Gíslholtsvatn
Eystra-Gíslholtsvatn
Illavatn
Kaldárholtslækur
Langalækur
Högnalækur
Árlangaeyri
Hreiðurrsgil
Kolbeinslækur
Minnivallalækur
Stóruvallarétt
Hellismúlaheiði
Teigar
0 500 1.000 1.500 2.000 m



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HOLTAVIRKJUN
HYDROELECTRIC PROJECT
LOCATION MAP

Hannað	ÁÓT	Athugað	JS	M.	1:50.000
Samþ.	SPS			Kt.	
Dags.	Jan. 2007	Nr.	1227.110-J-002		

Áritanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179


Búðafoss - Núpur
Jarðfræðikort - Geological map
THI Búrfellshraun 1100 f.Kr. Burfell lava, 1100 BC
THB Þjórsárhraun 6600 f.Kr. The great Thjorsa lava, 6700 BC
Laust yfirborðsset og mýrlendi Loose overburden
TSG Foksandsteinn Aeolian sandstone (Tephra sand group)
UTS Siltsteinn og jökulgarðar frá síðjökultíma Late glacial siltstone and end-moraines
HIB Hlýskeiðshraun í Holtum, ól.basalt (N) Holt interglacial basalt
LTS Neðra jökulberg/silt Lower tillite/silt series
HIT Hlýskeiðsþóleiít í Hreppum(N) Hreppar Interglacial tholeiites
SKH Móberg í Skyggni Skyggnir hyaloclastite
NP5 Efra Fossnesþóleiít (R) Upper Fossnes tholeiite
NP4 Fossnesjökulberg Fossnes tillite
NP3 Neðra Fossnesþóleiít (R) lower Fossnes tholeiite
NSH Núpsmóberg (R) Núpur hyaloclastite formation
NSH Minnanúpsþóleiít (R) Minninúpur tholeiite
NSH Núpsset Núpur sedimentary series
SPG Skarðsfjallsdílabasalt (R) Skarðsfjall porphyritic group
NTG Skarðsfjallsset Sedimentary layer in Skarðsfjall north
NTG Núpsþóleiít (R) Núpur tholeiite group
SH3 Innskot í Skarðsfjalli (N) Skarðsfjall intrusive rock
SH2 Skarðsfjallsmóberg (N) Skarðsfjall hyaloclastite
SH1 Þjórsárholtsset Þjórsárholt sedimentary group
STG Víxlahnjúkur, dílabasdalt (N) Víxlahnjúkur porphyritic basalt layer
STG Skarðsfjallsþóleiít efri hl. (N) Upper Skarðsfjall tholeiitic group
STG Skarðsfjall, set Sediments inside Skarðsfjall thol. group
STG Skarðsfjall þóleiít Neðri hl. (N) Skarðsfjall lower tholeiite group
LPG Líparítgjóska Rhyolite, tuff and ignimbrite
LPH Líparírhraun eða innskot Rhyolite lava or intrusion
GL Geldingaholtsmyndun (innskot ofl.) Geldingaholt complex (basic intrusions)
Misgengi og sprungur Faults and fissures
Jarðskjálftasprunga Earthquake fissure
Berggangur Dyke
Strik og halli Dip and strike
Lind < 100 l/s Spring < 100 l/s
Stór lind > 100 l/s Spring > 100 l/s
Lindasvæði > 100 l/s Spring area > 100 l/s
Hverir, laugar Hot spring
Rétt segulstefna Normal paleomagnetism
Öfug segulstefna Reverse paleomagnetism
Borhola Drillhole
Vatnsból Water supply
Jarðlagasnið Geologic section
Árni Hjartarson, Páll Einarsson og Snorri P. Snorrason 2001.
Keiluvörpun, viðmiðun ISN93
Unnið í landfræðilegu upplýsingakerfi (Arc/Info®).
© Orkustofnun, Reykjavík
Byggt á/ Based on:
Ingvar B. Friðleifsson o.fl. 1980: Gnúpverjahreppur, jarðfræðikort
Maryam Khodayar and Páll Einarsson 2001: Geological map of Núpur area
Páll Einarssonar et al. 2001: Faults and fractures near the SISZ near Þjórsá
Snorri Páll Snorrason 2002: Núpsvirkjun Preliminary Geological Report
Orkustofnun: Borholuskrá
Drawing 1
20051216
0 1 2 km
20051216.102918 /gis/i/ah/n-thjorsa/aa_busk_gsj.aml
Þjórsá
Búðafoss
Skarðsfjall
Núpur
Miðfell
Hagaey
Skarðsheiði
Yrjaheiði
Hofsheiði
Hofsvaðsheiði
Vindásnes
Vaðeyri
Mosar
Árbæjarheiði
Skaftholtsfjall
Háholtsfjall
Hamar
Hnúkar
Árneskvísl
Kálfá
Stóra-Laxá
Gálgaklettur
Þinghólar
Miðmorgunsholt
Miðhúsahólmi
Víxlahnúkur
Hvítaskriða
Gráfellshólar
Hruni
Brúarlundur
Minnivellir
Stóruvellir
Klofalækur
Skyggnir
Háhnúkur
Hagafjall
Y=395000
X=435000

Hofsheiði
Stórahof
Minnahof
NK-14
Árnesporður
Gálgaklettur
Þinghóll
NK-43
NK-44
(Árneskvísl)
NK-45
Þjórsá
NL-10
NL-11
Hamarinn
Náttfaragahólar
NK-41
NK-42
NK-40
NK-37
NK-36
NL-46
NK-38
Árnes
Búðafoss
NK-39
Selholt
Hestafoss
Ósvatn
Hnúkakelda
Langholt
Lækjarey
Vesturbjalli
Austurbjalli
Árneskvísl
Lækur
0 200 400 600 800 1.000 m

DRAFT

Legend

- Till
- Fluvial deposits
- Eolian soil (Loess)
- Peat
- Þjórárhraun lava -Scoria
- Bedrock covered with discontious weathered material
- Core hole
- Percussion hole

Constructions according to Project Planning Report

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HOLTAVIRKJUN
HYDROELECTRIC PROJECT
MAP OF SUPERFICIAL DEPOSITS

Hannað ÁÓT	Athugað JS	M. 1:20.000	
Samþ. SPS		Kt.	
Dags. Jan. 2007	Nr. 1227.111-J-004		

Áritanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179

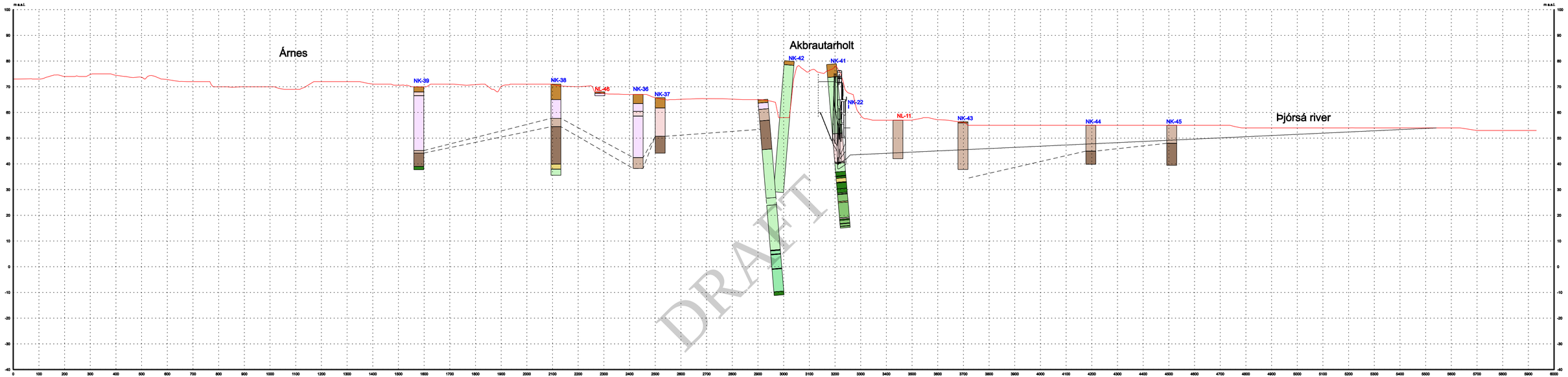
Holtavirkjun Hydroelectric Project

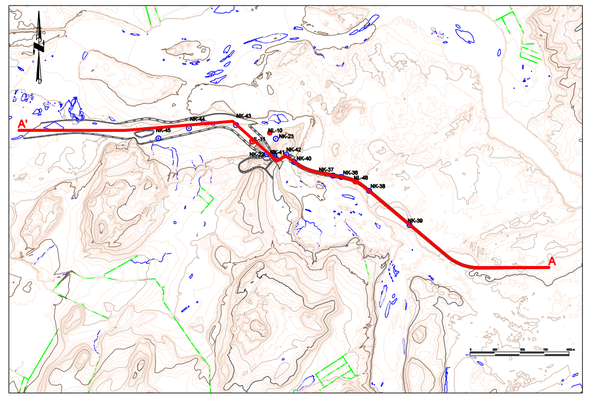
Cross sections

Longitudinal section

A

A'





Constructions according to Project Planning Report

Legend

- Soil
- Þjórsárhraun lava - Scoria
- Þjórsárhraun lava
- Tephra sand & gravel
- Silt/siltstone
- Tillite
- Akbraut Interglacial olivin basalt
- Dyke
- Olivine basalt

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Holtavirkjun HEP
Powerhouse site
Geological section A-A'

Design	AÓT	Checked	Scale
Appr.	SPS		XL
Date	Jan. 2007	No.	1227.111-G-XXX

Holtavirkjun Hydroelectric Project

Core hole logs

Logs of cored holes NK-36 to NK-45

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Landsvirkjun

Cored Boreholes

January 2007

Legend

Plio-Pleistocene rocks

- Hyaloclastite
- Conglomerate
- Porphyritic basalt
- Olivin basalt
- Dyke

Pleistocene rocks

- Akbraut interglacial olivine basalt

Holocene lava

- Þjórsárhraun lava - Scoria
- Þjórsárhraun lava

Holocene sedimentary series

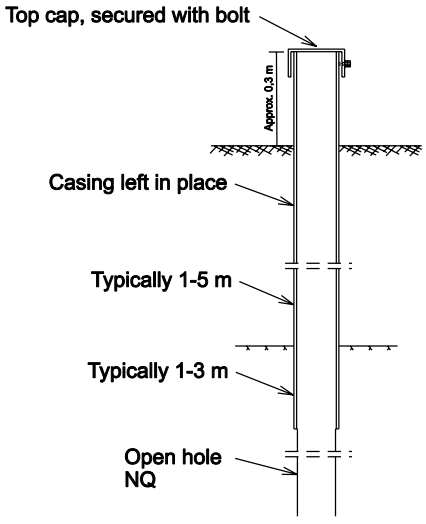
- Soil
- Tephra sand & gravel
- Silt/siltstone
- Tillite

WL=34
HD=65 — Water level/depth of hole

1,4 LU — Permeability

DRAFT

Typical design of a cored borehole



The position of the holes is found with two diffrent methodes:
GPS survey and GPS handheld instrument.

Accuracy of GPS measurement

GPS survey is written as: XXXXXX,XX
YYYYYY,YY
ZZZ,ZZZ

Position measured with handheld instrument is written as: XXXXXX
YYYYYY

Elevation taken from a map: ZZZ

Icelandic grid (ISN93), Datum WGS84

Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun HEP
NK-36

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 19-20.10.2006	Drawn: MM
Drawing no.	

Coordinates: ISN93 X: 434152 Y: 390846 Elevation: x m.a.s.l

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
	0–2		Soil		3" ODEX casing			
	2,7							
x	2–4		Þjórsá-lava.					
	4–6		Holocene basalt with large plagioclase phenochrystals			42	36/22/11/0	WL = 5
	6–8		Scattered vesicles down to 5m.					HD = 39,5
	8–10		Massive 5-7m.			87	63/38/38/0	
	10–12					51	27/0/0/0	6 - 21,5m
	12–14		Vesicular 7-15m.			97	65/0/0/0	48 LU
	14–16					62	32/0/0/0	
	16–18		Scattered vesicles 15-17m.			103	48/0/0/0	
	18–20		Vesicular Rapid drilling				44/16/10/0	
	20–22		Silt			57	47/14/0/0	
	22–24		Stratified down to the last meter where the stratification is faint. Grainsize silt to finesand.			60	0/0/0/0	
	24–26		Diameter of core less than normal due to erosion.			78	10/0/0/0	
x	26–28					87	51/0/0/0	
x	28–30		Tillite in the lowest 10-20cm			0	0/0/0/0	21 - 39,5m
	30–32		Dyke Massive, scattered vesicles filled w/zeolites. Mediumgrained. Cooling margins not visible.				30/7/7/0	12 LU
	32–34		Olivine basalt			77	23/0/0/0	
	34–36		Medium-coarsegrained. Vesicular, filled w/zeolites.			95	52/0/0/0	
	36–38					59	67/43/43/0	
	38–40		Dyke			100	91/52/52/0	
	40–42		Massive, scattered vesicles filled w/zeolites. Mediumgrained. Cooling margins not visible.			94	67/45/0/0	
	42–44					103	22/0/0/0	
	44–46					99	49/0/0/0	
	46–48						64/28/9/0	30 - 39,5m
	48–50					100	72/31/0/0	7,2 LU
			Bottom 39,53m			93	101/57/0/0	
						100	0/0/0/0	
						100	57/0/0/0	
							87/66/28/0	
						96	94/94/47/0	

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun HEP
NK-37

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 19-20.10.2006	Drawn: MM
Drawing no.	

Coordinates: ISN93 X: 434064 Y: 390860 Elevation: x m.a.s.l

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
	0–2			Soil					
x	2–6			Sand and gravel Well rounded gravel pebbles of various origin. Size <1cm					
	6–16			Silt/finesand More finesand above 8m. Siltier below. Partly cemented silt Cuttings mostly soft silt or poorly cemented silt.		3" ODEX casing			
	16–22			Silt/finesand Stratification visible. 15,20-15,70m, coarser lenses. Irregular stratification. Fresh joints.			85 95 95	20/0/0/0 60/0/0/0 59/15/0/0 66/34/0/0	
x	22			Bottom 21,53m					

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun HEP
NK-38

Contractor: RSFS | Drill: Langþráður
Site: Hvammur | Diameter: ODEX 3"/NQTT
Date of drilling: 22.10.2006 | Drawn: MM
Drawing no.

Coordinates: ISN93 X: 434434 Y:390706 Elevation: 90,93 m.a.s.l

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
	0			Soil	0	3" ODEX casing			
x	4			Þjórsá-lava. Scoria					Not tested
	5,00								
x	6			Þjórsá-lava.	6		106	0/0/0/0	
				Broken and vesicular down to 7m			104	71/18/0/0	WL = 7,6m
	8			Scattered vesicles. Vertical and steeply inclined cooling joints.	8				HD = 34,4m
	10				10		71	21/0/0/0	
	12				12		99	79/38/38/0	
								63/30/25/0	
x	13,25						100	88/88/88/0	9,8 - 18,5m 192 LU
	14			Gravel and sand	14		4	0/0/0/0	
				Gravel pebbles <10-30mm rounded. Fine sand.					
x	16				16		0	0/0/0/0	
	16,53								
	18			Silt	18		100	49/0/0/0	
				Soft, massive silt. Stratification visible, slightly inclined, irregular.					
	20			Low density.	20		0	0/0/0/0	
	22				22				
							56	28/15/0/0	
	24				24		73	43/0/0/0	
	26				26		96	82/11/0/0	17,5 - 34,4m 9 LU
								36/4/0/0	
	28				28		98	27/0/0/0	
				Grey color on silt below 28m					
	30				30		91	32/0/0/0	
x							21	0/0/0/0	
	32			Tillite	32		100	0/0/0/0	
				Scattered pebbles 4-10mm. well cemented.			96	64/24/0/0	
x							100	0/0/0/0	
	33,00			Akbraut interglacial basalt			134	111/0/0/0	
	34			Vesicular. Plagioclase and pyroxene microcrystals	34				
x				visible. Black shiny clay on joint surface.			97	55/16/0/0	
	36			Bottom 35,38m	36				
	38				38				
	40				40				
	42				42				
	44				44				
	46				46				
	48				48				
	50				50				

DRAFT

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Landsvirkjun

Holtavirkjun HEP
NK-39

Contractor: RSFS	Drill: Langþráður
Site: Hvammur	Diameter: ODEX 3"/NQTT
Date of drilling: 23.10.2006	Drawn: MM
Drawing no.	

Coordinates: ISN93 X: 434843 Y: 390360 Elevation: xxx m.a.s.l

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
	0			Soil	0	3" ODEX casing			
	2			Sand and gravel. Rounded pebbles <1cm of various origin.	2				
x	4			Þjórsá-lava.	4				
	6				6		97	93/79/63/63	WL = 5,15 m HD = 32,2
	8			Massive down to 6,9m. Scoraceous 10cm zone. Vesicular 7-8,4m	8		92	42/0/0/0	
	10				10		95	41/0/0/0	
	12			Scattered vesicles to 14m	12		72	14/0/0/0	6,5 - 32m 30,4 LU
	14				14		103	82/0/0/0	
	16				16		97	48/0/0/0	
	18				18		98	92/0/0/0	
	20			Cubejointed 14-21m.	20		94	26/0/0/0	
	22				22		98	67/0/0/0	
	24			Massive 21-24,5m	24		105	50/0/0/0	
x				24,78			88	33/25/0/0	
	26			Probably Scoria/sand	26		100	38/0/0/0	
				Core loss				60/16/11/6	
x				27,5			101	95/41/31/0	
	28			Silt	28		100	0/0/0/0	
				Soft, massive silt with scattered pebbles (size 1-30mm). Layers visible, cross bedded			1	0/0/0/0	
	30				30			11/0/0/0	
x				30,91			86	22/0/0/0	
	32			Dyke Broken. Black, shiny clayfill in joints.	32		101	11/0/0/0	
x				32,22			82	30/0/0/0	
				Bottom 32,22m					
	34				34				
	36				36				
	38				38				
	40				40				
	42				42				
	44				44				
	46				46				
	48				48				
	50				50				

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun
NK-40

Contractor:	RSFS
Site:	Hvammur
Date of drilling:	26+30-31.10.2006
Drill:	Langþráður
Diameter:	ODEX 3"/NQTT
Drawn:	MM
Drawing no.	1 of 2

Coordinates: ISN93 X: 433676 Y: 390998 Elevation: 65 m.a.s.l Inclination: 40° Direction of inclination: 300°

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
	2		Þjórsá-lava	2	3" ODEX casing	115	98/60/36/0	Not tested
	4		Holocene basalt with large plagioclase phenochrystals	4		100	98/40/40/0	
x			Massive part of lava between 2,7 and 4,3m					WL=5,3m HD=51,5m
	6		Sand and gravel	6		0	0/0/0/0	WL=6,7
	8			8		3	0/0/0/0	WL=7,2 HD = 61,5 HD = 79,9
x	10		10,6	10		0	0/0/0/0	
	12		Silt	12		100	90/49/0/0	
			Pebbles in upper part, tillite?					
	14		Stratified silt with small pebbles between 12,5-15,4m, matrix supported.	14		102	102/73/45/0	
	16		pebbles	16		102	87/21/21/0	4-24,5m 13,95 LU
	18			18				
	20			20		98	97/67/43/0	
	22			22		47	31/0/0/0	
	24			24				
x			25,29			17	0/0/0/0	22-27,3m 78,26 LU
	26		Akbraut interglacial olivine basalt	26		100	73/0/0/0	
						83	52/37/0/0	
	28			28		90	68/0/0/0	
			Olivine basalt lightgrey.					
	30		Joints healed w/light colored clay.	30		105	90/35/0/0	
						98	76/11/0/0	
	32			32			$Q = \frac{56}{15} \times \frac{2-3}{1-4} \times \frac{1}{2,5}$	26,4-51,5m 12,4 LU
							Q = 0,7-4,5	
	34			34		93	54/0/0/0	
	36			36		96	79/36/0/0	
						99	86/33/20/0	
	38			38			**56/12/2/0**	
	40			40		93	72/0/0/0	28-61,5m 2,6 LU
						97	65/16/0/0	
	42			42				
						97	51/0/0/0	
	44			44		88	27/0/0/0	
						92	64/0/0/0	
	46			46		88	0/0/0/0	
						27	0/0/0/0	
						98	32/0/0/0	
	48			48		81	34/34/0/0	
						104	45/0/0/0	
	50			50		80	17/0/0/0	

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Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun
NK-40

Contractor: RSFS | Drill: Langbráður
Site: Hvammur | Diameter: ODEX 3"/NQTT
Date of drilling: 26+30-31.10.2006 | Drawn: MM
Drawing no. 2 of 2

Coordinates: ISN93 X: 433676 Y: 390998
Elevation: 65 m.a.s.l
Inclination: 40°
Direction of inclination: 300°

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
	52		Akbraut interglacial olivine basalt cont.	52		92	18/0/0/0	
						94	39/0/0/0	
						89	30/30/0/0	
						94	0/0/0/0	
x			53,7			77	0/0/0/0	
	54		Olivine basalt lightgrey, massive but very jointed. Joints healed w/light colored clay.	54		21	0/0/0/0	52-61,5m 19,4 LU
						12	0/0/0/0	
	56			56		39	0/0/0/0	
						43	0/0/0/0	
			Highly broken zone. Very poor core recovery			12	0/0/0/0	28-61,5m 2,6 LU
	58			58		23	0/0/0/0	
						0	0/0/0/0	
	60			60		0	0/0/0/0	
						0	0/0/0/0	
x						42	0/0/0/0	
	62			62		16	0/0/0/0	
						41	14/0/0/0	Not tested
	64			64		91	23/0/0/0	
						68	22/0/0/0	
	66			66		8	0/0/0/0	
x			67,4					
	68		Akbraut interglacial olivine basalt cont.	68		97	45/0/0/0	
						91	42/0/0/0	
	70		Lightgrey colored zone	70		22	0/0/0/0	64-80m 15 LU
						90	43/0/0/0	
	72			72		94	85/0/0/0	
	74			74		81	57/15/0/0	
	76			76		52	28/0/0/0	
xx			76,5			100	0/0/0/0	
						100	0/0/0/0	
						100	0/0/0/0	
			Porphyritic basalt			40	0/0/0/0	
	78			78		102	10/0/0/0	
						100	40/0/0/0	
						100	76/8/8/8	
			Lightgrey mediumgrained basalt. Plagioclase and pyroxene christals visible (~1mm)			21	0/0/0/0	
	80			80		31	0/0/0/0	
						10	0/0/0/0	
	82			82		87	51/0/0/0	
						96	45/0/0/0	
x			Silt			100	100/0/0/0	
	84			84		100	0/0/0/0	
						103	62/0/0/0	
						84	42/0/0/0	
						71	0/0/0/0	
x						100	56/0/0/0	
	86		Silt	86		100	0/0/0/0	
x						100	100/0/0/0	
						53	0/0/0/0	
	88			88		41	18/0/0/0	78-99,5m 10 LU
	90			90				
						86	70/17/0/0	
	92			92				
						56	0/0/0/0	
						50	0/0/0/0	
	94			94		89	51/25/0/0	
						63	0/0/0/0	
	96			96		96	71/71/0/0	
						64	22/0/0/0	
						74	0/0/0/0	
	98		Dyke	98		50	50/0/0/0	
						83	0/0/0/0	
			Bottom 99,53m (xm below surface)			47	9/0/0/0	
	100			100				

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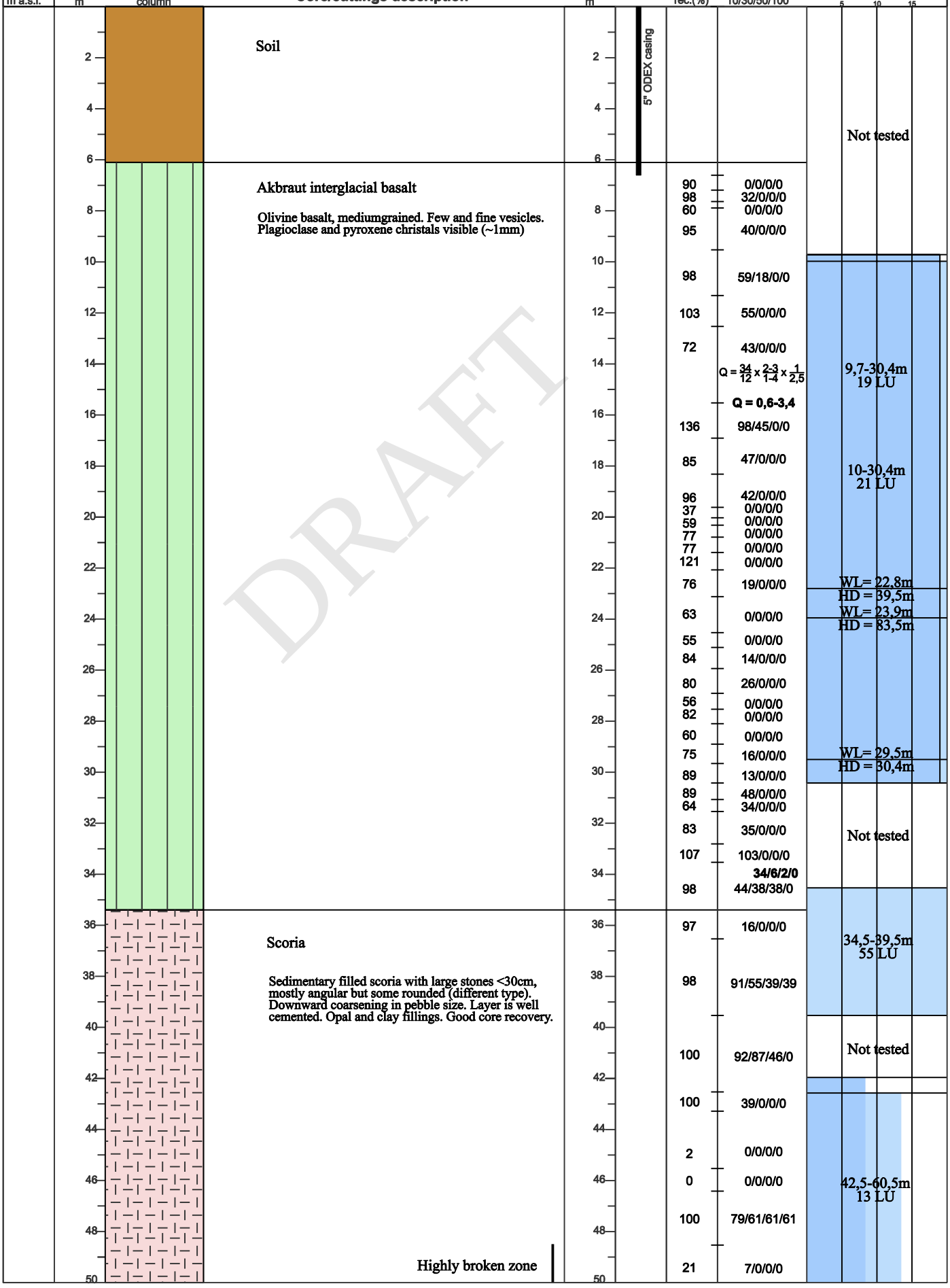
Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun HEP
NK-41

Contractor: RSFS | Drill: Langbráður
Site: Akbraut | Diameter: ODEX 3"/NQTT
Date of drilling: 20-27.11.2006 | Drawn: MM
Drawing no. 1 of 2

Coordinates: ISN93 X: 433478 Y: 391060
Elevation: 79 m a.s.l.
Inclination: 40,5°
Direction of inclination: 290°



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Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun HEP
NK-41

Contractor: RSBF&S
Site: Akbraut
Date of drilling: 20-27.11.2006
Drill: Langþráður
Diameter: ODEX 3"/NQTT
Drawn: MM
Drawing no. 2 of 2

Coordinates: ISN93 X: 433478 Y: 391060
Elevation: 79 m a.s.l.
Inclination: 40,5°
Direction of inclination: 290°

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
			Akbraut interglacial basalt			50	0/0/0/0	
	52			52		21	0/0/0/0	
			Highly broken zone			6	0/0/0/0	
						100	0/0/0/0	
	54			54		44	24/0/0/0	
						84	26/0/0/0	42,5-60,5m 13 LU
						76	32/0/0/0	
			Dyke					
	56		Dykes, general description: Olivine basalt, almost no vesicles, filled with zeolites. Massive finegrained, different cooling rate.	56		95	76/34/0/0	
			Dyke					
	58		Dyke	58		61	46/35/0/0	
			Conglomerate			100	0/0/0/0	
			Tillite? Groundmass of sand and silt. Matrix supported. Pebbles <2cm. Evenly dispersed.			87	81/0/0/0	
	60			60				
			Dyke			100	46/0/0/0	
						96	82/34/34/0	
	62		Dyke	62				
						95	65/30/0/0	
	64		Dyke	64		30	0/0/0/0	42-83,5m 8,2 LU
						96	71/0/0/0	
	66		Olivine basalt	66				
			Dyke					
			Olivine basalt			83	41/0/0/0	
	68		Few but large vesicles. Secondary minerals: Chalk/calcite Finegrained, plagioclase needles visible. Fissure surface dark shiny clay.	68		102	68/0/0/0	
						78	12/0/0/0	
	70			70		66	13/0/0/0	
			Conglomerate					
			Highly broken zone					
			Olivine basalt			61	40/0/0/0	62-83,5m 1,3 LU
	72			72				
						107	64/0/0/0	
			Olivine basalt			125	69/30/0/0	
	74			74				
	76			76		76	47/8/0/0	
	78			78				
			Scoria Highly broken zone					
			Dyke			69	39/0/0/0	
	80		Olivine basalt	80		63	20/0/0/0	
			Dyke			183	0/0/0/0	
	82		Olivine basalt	82		50	18/0/0/0	
			Dyke					
			Olivine basalt			50	11/0/0/0	
	84		Bottom 83,53m (xm below surface)	84				
	86			86				
	88			88				
	90			90				
	92			92				
	94			94				
	96			96				
	98			98				
	100			100				

DRAFT

Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun HEP
NK-42

Contractor: RSFS
Site: Akbraut
Date of drilling: 20-27.11.2006
Drill: Langþráður
Diameter: ODEX 3"/NQTT
Drawn: MM
Drawing no. 1 of 2

Coordinates: ISN93 X: 433596 Y: 391073
Elevation: 79 m a.s.l.
Inclination: 40°
Direction of inclination: 130°

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
	0		Soil	0				
	2		Akbraut interglacial olivine basalt	2	5" ODEX casing			
	4			4		103	14/0/0/0	
						89	72/0/0/0	Not tested
	6		Fine vesicles. Scattered plagioclase chrystals visible <2mm, and pyroxene chrystals <1mm. Slight hydrothermal alteration. Mediumgrained. Rusty clay minerals on fissure surface.	6		86	40/0/0/0	
						96	60/0/0/0	
	8			8		93	77/34/34/0	
						107	37/0/0/0	
	10			10		77	0/0/0/0	
						89	48/0/0/0	
						103	33/0/0/0	
	12		Highly broken zone	12		75	0/0/0/0	
						90	14/0/0/0	
						77	62/0/0/0	
	14			14		82	0/0/0/0	
						80	15/0/0/0	WL=15,6m
	16			16		93	28/0/0/0	HD = 30,3m
						87	67/0/0/0	
						104	79/79/0/0	
	18			18		88	37/0/0/0	
						94	64/0/0/0	
	20		Fissure surface coated with dark colored clay minerals.	20		92	18/0/0/0	
						66	24/0/0/0	8-30m 3,6 LU
	22			22		75	0/0/0/0	
						81	13/0/0/0	
						73	15/0/0/0	
	24			24		2	0/0/0/0	
						0	0/0/0/0	
						0	0/0/0/0	
						0	0/0/0/0	
	26		Poor, almost no core recovery	26		3	0/0/0/0	WL=25,6m HD = 66,5m
						0	0/0/0/0	
						66	0/0/0/0	
	28			28		83	26/0/0/0	
						83	21/0/0/0	
						15	0/0/0/0	
	30			30		83	24/0/0/0	
						92	68/0/0/0	
	32			32		89	44/0/0/0	
						0	0/0/0/0	
	34			34		14	0/0/0/0	
							$Q = \frac{75}{15} \times \frac{2-3}{1-4} \times \frac{1}{2,5}$	
	36			36			Q = 1-6	
						90	72/0/0/0	
	38			38		102	73/21/0/0	
						87	75/0/0/0	
	40			40		107	69/42/0/0	
						98	89/29/0/0	30,6-66,5m 9 LU
	42			42		91	73/26/0/0	
	44			44		50	50/0/0/0	
						16	0/0/0/0	
	46			46		31	26/0/0/0	
						119	54/0/0/0	
	48			48		104	99/20/0/0	
						99	65/29/0/0	
	50			50				

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Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun HEP
NK-42

Contractor: RSFS	Drill: Langbráður
Site: Akbraut	Diameter: ODEX 3"/NQTT
Date of drilling: 20-27.11.2006	Drawn: MM
Drawing no. 2 of 2	

Coordinates: ISN93 X: 433596 Y: 391073

Elevation: 79 m a.s.l.
Inclination: 40°

Direction of inclination: 130°

Elev. m a.s.l.	Depth m	Rock column	Core/cuttings description	Depth m	Casing	Core rec. %	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
	52			52		96	89/63/0/0	
	54			54		100	68/54/0/0	
	56			56		101	39/0/0/0	
	58			58		95	75/9/1/0 68/27/0/0	
	60			60		80	53/0/0/0	48-66,5m 14 LU
	62		Highly broken zone	62		70	0/0/0/0	
	64			64		88	25/0/0/0	
	66			66		49	0/0/0/0	
	68		Bottom 66,53m (xm below surface)	68		88	35/0/0/0	30,6-66,5m 9 LU
	70			70		82	0/0/0/0	
	72			72		85	24/0/0/0	
	74			74		58	0/0/0/0	
	76			76		88	0/0/0/0	
	78			78		93	56/0/0/0	
	80			80		97	64/0/0/0	
	82			82		51	0/0/0/0	
	84			84		28	0/0/0/0	
	86			86		145	24/0/0/0	
	88			88		85	38/0/0/0	
	90			90				
	92			92				
	94			94				
	96			96				
	98			98				
	100			100				

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Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun HEP
NK-43

Contractor: RSFS	Drill: Langbráður
Site: Akbraut	Diameter: ODEX 3"/NQTT
Date of drilling: 3.12.2006	Drawn: MM
Drawing no. 1 of 1	

Coordinates: ISN93 X: 433091 Y: 391370 Elevation: 56 m a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
	0–8			Sand and gravel Coarse sand - gravel. Pebbles <1cm. Rounded. Coarse gravel from 5-7,5m, pebbles <3cm, subrounded. Zone of harder sediments. Silty sand and gravel.	0–8	3" ODEX casing			
	8–10				8–10		64 17	0/0/0/0 0/0/0/0	
	10–18			Large gravel pebbles up to <10cm of various origin. Also sedimentary pebbles. Smallest pebbles >1cm, well rounded.	10–18		1	0/0/0/0	
	18			Bottom 18,53m	18				

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Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun HEP
NK-44

Contractor: RSFS	Drill: Langbráður
Site: Akbraut	Diameter: ODEX 3"/NQTT
Date of drilling: 3.-4.12.2006	Drawn: MM
Drawing no. 1 of 1	

Coordinates: ISN93 X: 432615 Y: 391338 Elevation: 56 m a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU)
	0–10			Sand and gravel		3" ODEX casing			
	10–14			Silty cuttings, tillite? Tillite Rich in silt. Faint stratification visible. Coarse sandstone lens between 13,75-14,05m			104	84/25/0/0	
	14–50			Bottom 15,13m					

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Almenna Consulting Ltd.

Landsvirkjun

Holtavirkjun HEP
NK-45

Contractor: RSFS	Drill: Langþráður
Site: Akbraut	Diameter: ODEX 3"/NQTT
Date of drilling: 4.-5.12.2006	Drawn: MM
Drawing no. 1 of 1	

Coordinates: ISN93 X: 432307 Y: 391236 Elevation: 55 m a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing	Core rec.(%)	RQD % Q 10/30/50/100	Water table and Permeability Lugeon units (LU) 5 10 15
	0–8			Sand and gravel	0–8	3" ODEX casing			WL=0,9m HD = 15,5m
	8–14			Silt and fine sand Faint stratification down to 9m. Scattered pebbles of various origin <2cm (rhyolite). 5 cm gravel lens in 10m. Pebbles 3-20mm.	8–14		96 91 96 64	65/33/33/0 36/0/0/0 73/14/0/0 25/0/0/0	9,4-15,5m 91 LU
	16–50			Bottom 15,53m	16–50				

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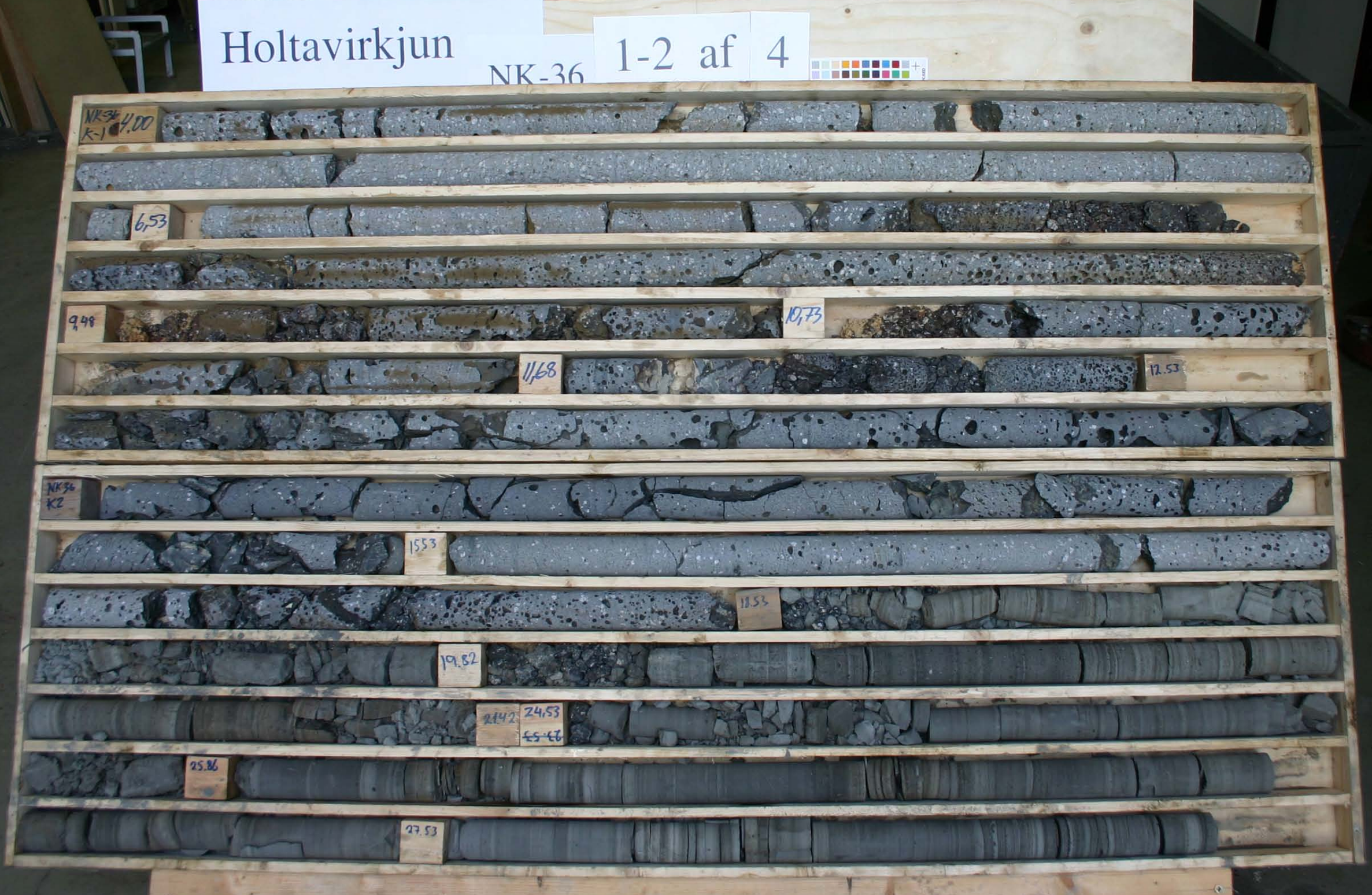
Holtavirkjun Hydroelectric Project

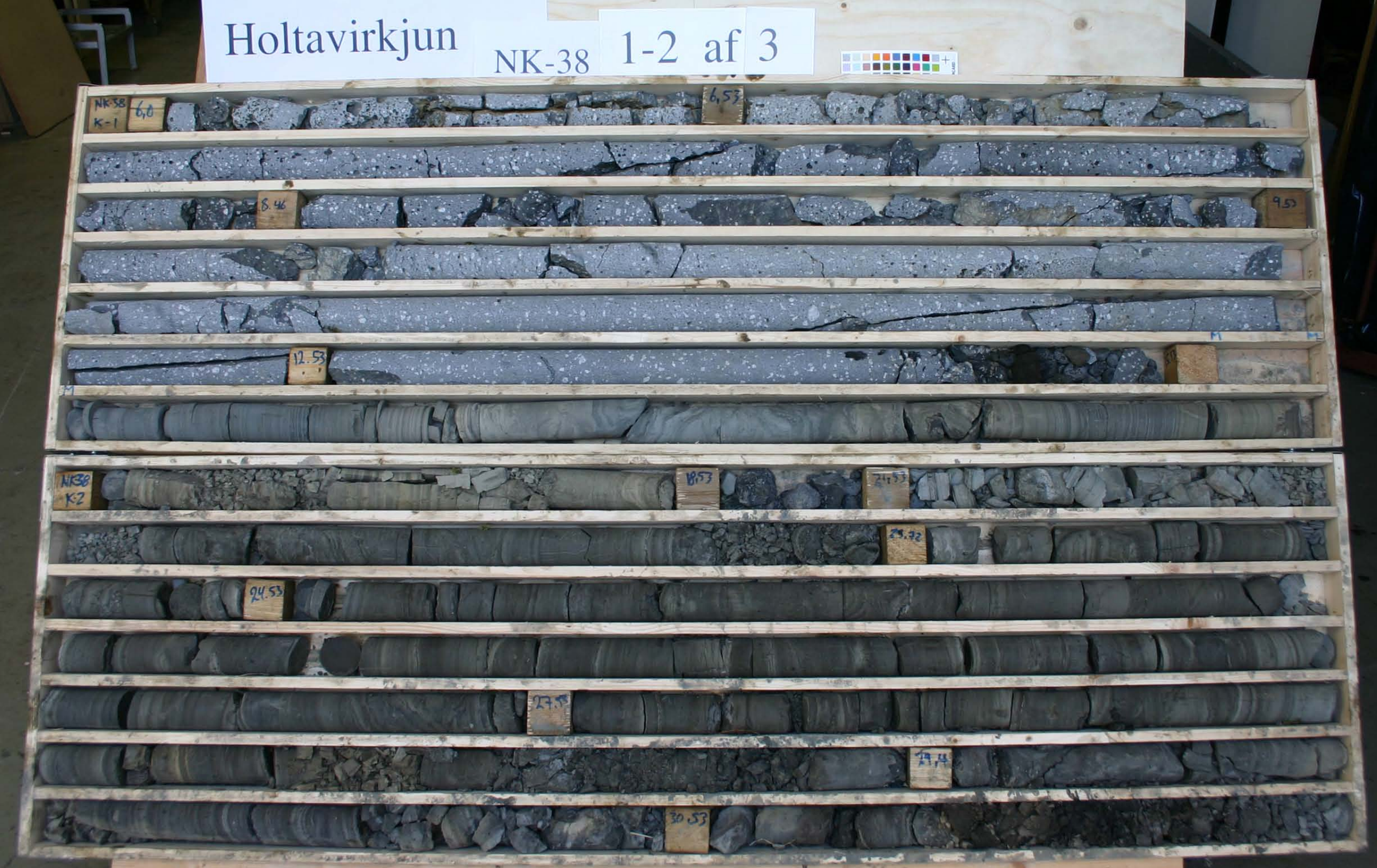
Photos of core

Photos of cores in NK-36 to NK-45


Holtavirkjun
NK-36
1-2 af 4
NK36 K-1 4.00
6,53
9,48
10,73
11,68
12.53
NK36 K2
15.53
18.53
19.82
21.42
24,53
25.86
27.53


Holtavirkjun
NK-36
3-4 af 4
30.53
32.4
33.03
34.68
36.53
39.75
Nk36
K4
39.53


Holtavirkjun
NK-37
1
NK-37
K1
15A
1553
1853
2157


Holtavirkjun
NK-38 1-2 af 3
NK-38 K-1 6,0
6,53
8.46
9.53
12.53
NK38 K-2
18.53
21.53
24.53
27.53
30.53


Holtavirkjun
NK-38
3
NK 38
K-3
31.85
31.13
33.09
33.53
34.38

Holtavirkjun

NK-39 1-2 af 3

NK-39 K-1 4.50

6,53

8.43

9.53

10.48

12.53

NK-39 K-2

14.63

15.53

16.61

17.87

18.53

19,92

21.53


Holtavirkjun
NK-39
3
NK-39
K-3
24.53
27.53
32.22

Holtavirkjun NK-40 1-2 af 9

NK-40 K-1 1,6

3,53

6,53

9,53

12,53

15,53

NK-40 K-2

18,53

21,53

24,53

26,38

Holtavirkjun NK-40 3-4 af 9

NK40
K=3

27,24

29,61

30,53

33,53

35,11

35,75

NK-40
K-4

38,69

39,92

42,05

43,75

44,44

Holtavirkjun NK-40 5-6 af 9

NK 40 K-5

45/42 46,10 46,35

47,26

48,15

49,18 49,74

50,68

51,53

52,67 53,29

NK K6

53,68 54,77 55,83 56,34

56,77 57,53 58,62 60,36 60,92 61,31 61,55 61,80

63,53

64,40

66,11 67,39

68,26 69,34

69,71

Holtavirkjun NK-40 7-8 9

NK-40 K-7 | 71,58 | 72,53 | 75,26 | 76,58 | 77,27 | 78,31 | 79,91 | 81,09 | 82,11 | 82,63

K/8 NK 40 | 83,52 | 84,53 | 84,90 | 85,04 | 86,19 | 87,12 | 90,53 | 92,36 | 92,53 | 93,71


Holtavirkjun NK-40 9- 9
NK 40
K/9
94,93
96,53
95,73
97,73
98,19
99,53

Holtavirkjun NK-41 1-2 af 8

NK-41 K-1 6,60 7,19 7,44 7,89 9,53 11,32 12,53 15,53

NK-41 K-2 16,91 18,32 19,62 20,03 20,32 20,79 21,39 22,07 23,12 24,53 25,11

Holtavirkjun NK-41 3-4 af 8

NK-41
K-3

25,94

26,9

27,53

28,10

28,90

29,66

30,42

31,07

31,54

32,81

33,53

NK-41
K-4

36,53

39,53

42,53

Holtavirkjun NK-41 5-6 af 8

NK-41 K-5 45,53 48,53 50,49 50,97 51,53 53,69 53,87 54,28 54,66 55,07 57,53 58,69

NK-41 K-6 60,53 62,30 63,53 64,56 66,16 67 68,26

Holtavirkjun NK-41 7-8 af 8

NK-41 K-7

69,16

69,96

72,16

73,26

74,81

78,43

NK 41-K8

79,63

81,23

81,53

82,53

82,63

Holtavirkjun NK-42 1-2 af 7

NK-42 K-1 3,55 4,24 5,45 6,42 7,39 9,21 9,70 10,07 10,71 11,07 11,82

NK-42 K-2 12,53 13,80 14,82 15,53 16,70 17,45 17,84 18,53 19,74 20,46

Holtavirkjun NK-42 3-4 af 7

NK-42
K-3
21,53
22,08
23,12
24,01
24,53
24,80
25,00
25,10
26,02
26,85
27,14
28,23
29,23
29,43
30,29
31,69
32,64
33,53
NK-42
K-4
35,82
36,53
38,02
39,53
41,30
42,53
43,90

Holtavirkjun NK-42 5-6 af 7

NK-42
K-5

44,95

45,40

46,22

47,00

48,53

50,13

51,53

NK-42
K-6

53,52

54,53

56,00

57,23

57,50

58,30

58,71

59,75

60,53

61,32

61,75

62,27

Holtavirkjun NK-42 7 af 7

NK-42
K-7

62,91

63,53

63,90

64,90

65,34

66,53

Holtavirkjun NK-43 1 af 1

Holtavirkjun NK-44 1 af 1

NK-44
K-1
12,10

15,13


Hvammsvirkjun NK-45 1 af 1

Holtavirkjun Hydroelectric Project

Percussion hole log

Log of NL-46

Almenna Consulting Ltd.

Landsvirkjun

Hvammsvirkjun HEP
NL-46

Contractor:	Drill:
RSFS	Langþráður
Site:	Diameter:
Hvammur	ODEX 3"/NQ
Date of drilling:	Drawn:
05.09.2006	MM
Drawing no.	

Coordinates: ISN93 X: 434297,00 N: 390803,00 Elevation: x,x m.a.s.l.

Elev. m a.s.l.	Depth m	Rock column	Cutting samples	Core/cuttings description	Depth m	Casing
x,x	0			Soil	0	3" ODEX casing
				Þjórsá-lava Scoria fragm. w/plg phenochrystals		
	2				2	
	4				4	
	6				6	
	8				8	
	10				10	
	12				12	
	14				14	
	16				16	
	18				18	
	20				20	
	22				22	
	24				24	
	26				26	
	28				28	
	30				30	
	32				32	
	34				34	
	36				36	
	38				38	
	40				40	
	42				42	
	44				44	
	46				46	
	48				48	

WL=4.24 (14.09.06)
HD=6

Holtavirkjun Hydroelectric Project

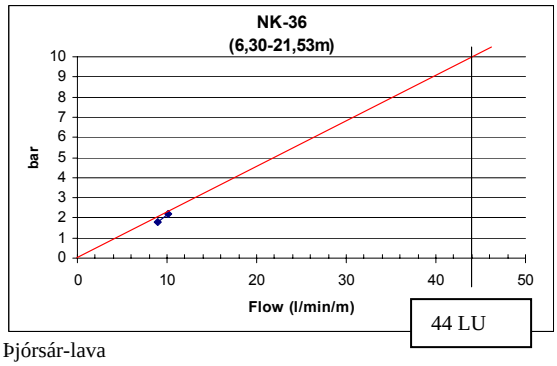
Lugeon tests and temperature readings

Lugeon test in holes NK-36, NK-38 to NK-42 and NK-45

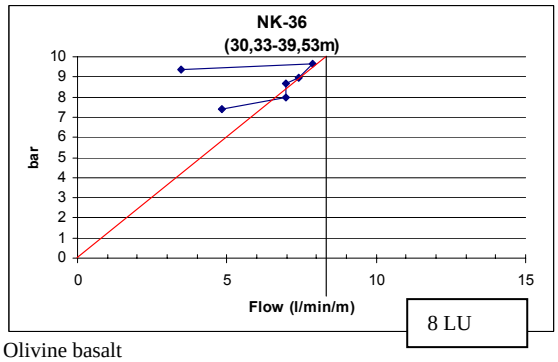
Temperature readings in holes NK-36 to NK-39 and NK-41 to NK-45

Temperature readings in Test pits

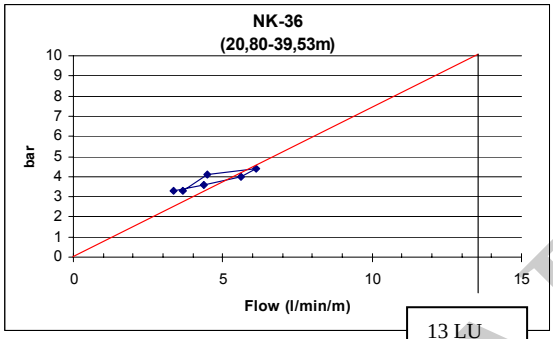
Permeability of NK-36



Þjórsár-lava



Olivine basalt



Silt and olivine basalt

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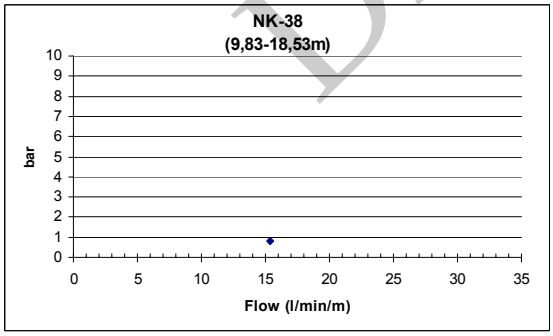
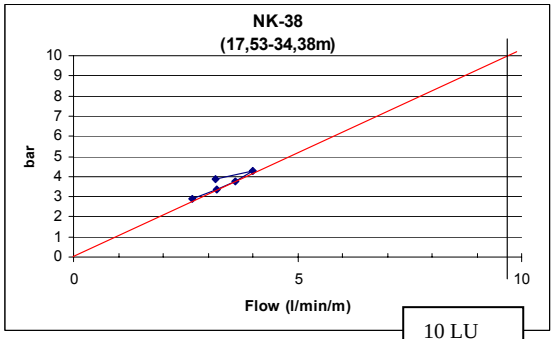
Permeability of NK-38

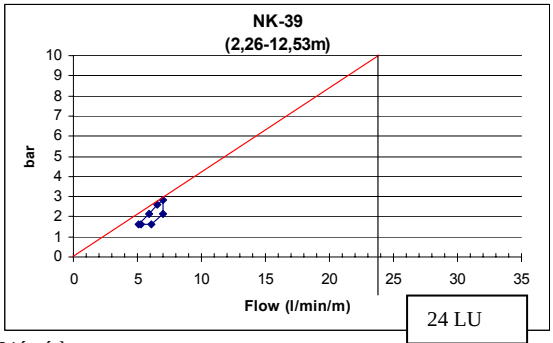


Þjórsá-lava, gravel & sand and silt
pressure does not build, borhole sucks



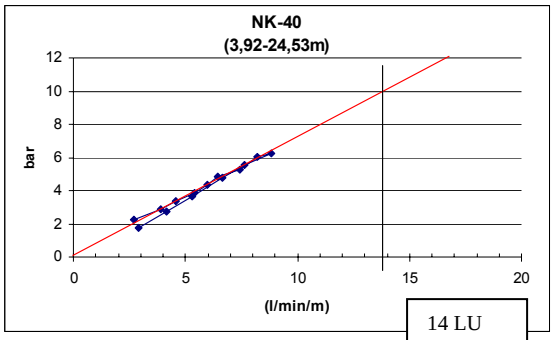
Silt, tillite and Akbraut interglacial basalt

Permeability of NK-39

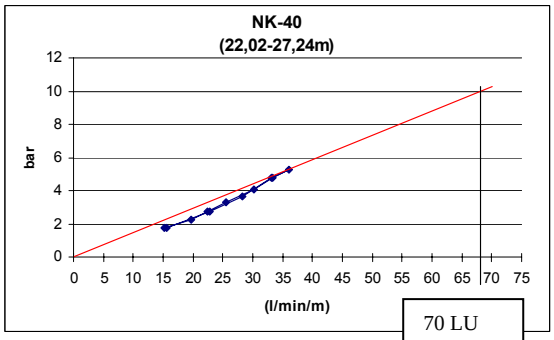


Þjórsá-lava

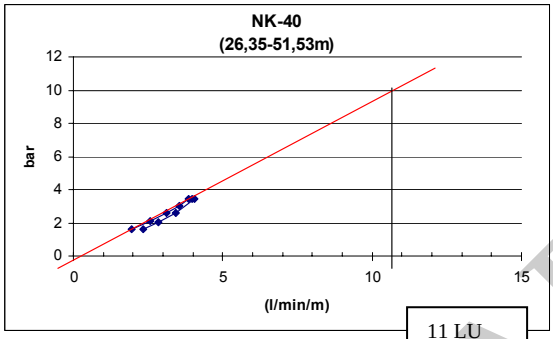
Permeability of NK-40



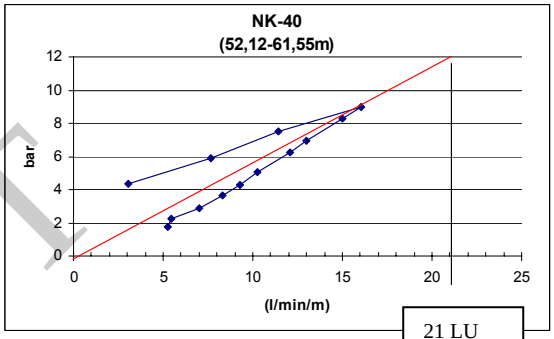
Þjórsá-lava, sand & gravel and stratified silt



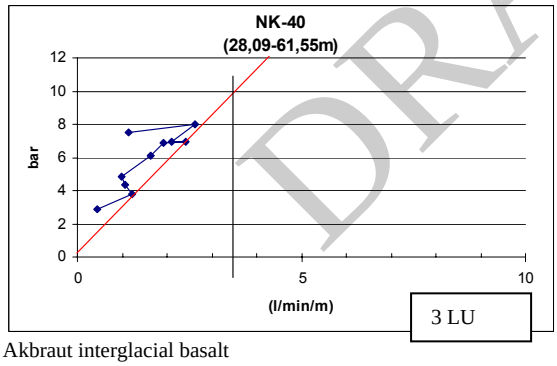
Stratified silt and Akbraut interglacial basalt



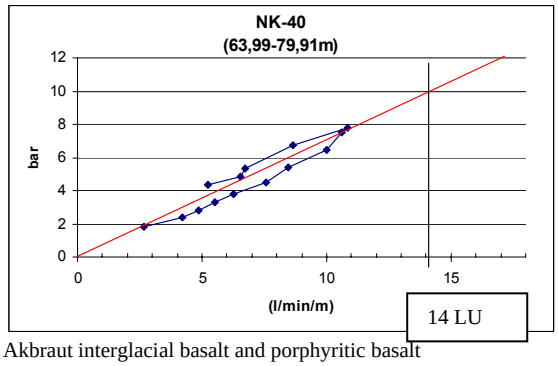
Akbraut interglacial basalt



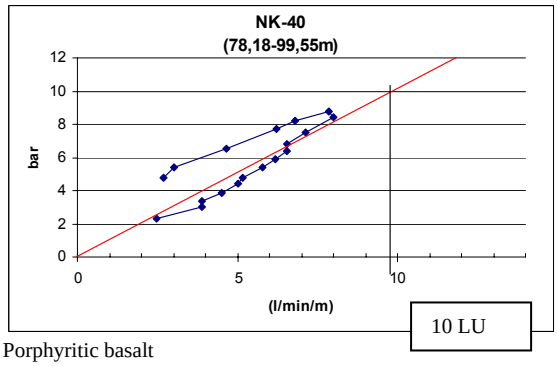
Akbraut interglacial basalt



Akbraut interglacial basalt



Akbraut interglacial basalt and porphyritic basalt



Porphyritic basalt

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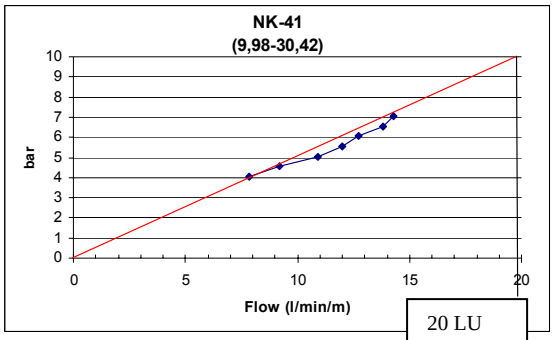
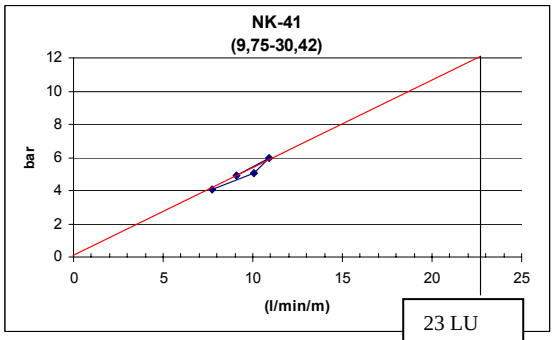
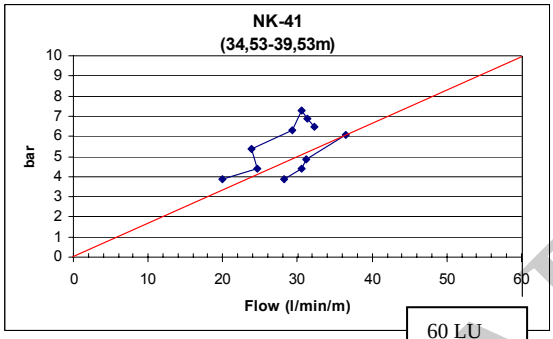
Permeability of NK-41



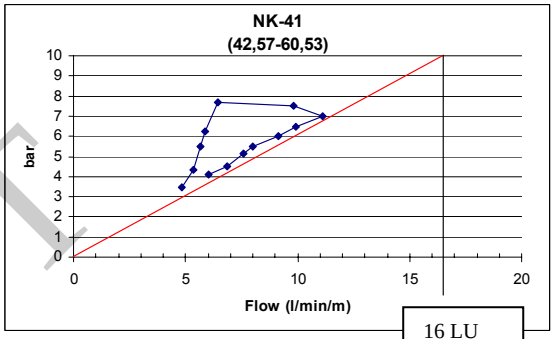
Akbraut interglacial basalt



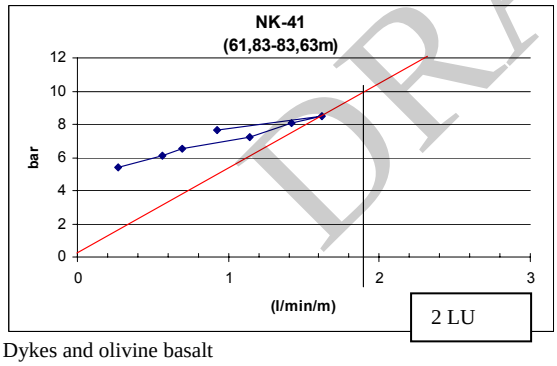
Akbraut interglacial basalt



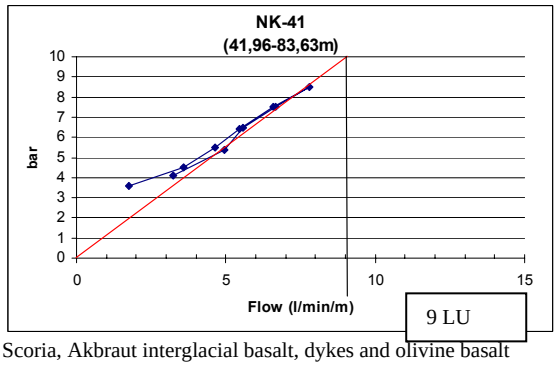
Scoria



Scoria and Akbraut interglacial basalt

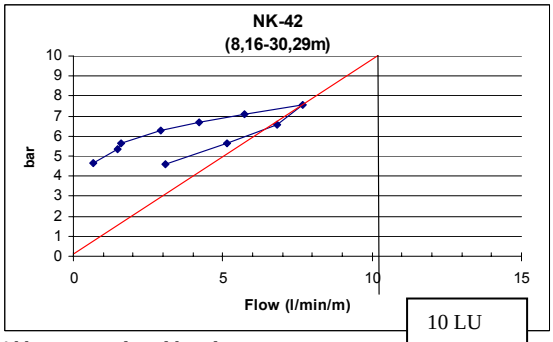


Dykes and olivine basalt

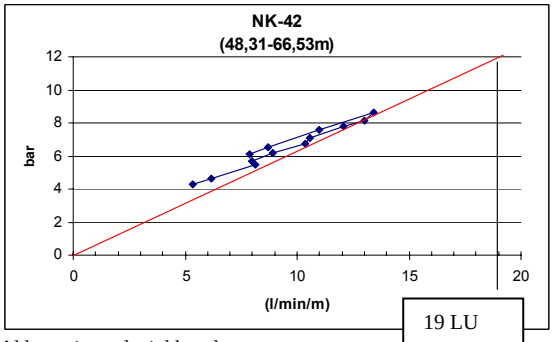


Scoria, Akbraut interglacial basalt, dykes and olivine basalt

Permeability of NK-42

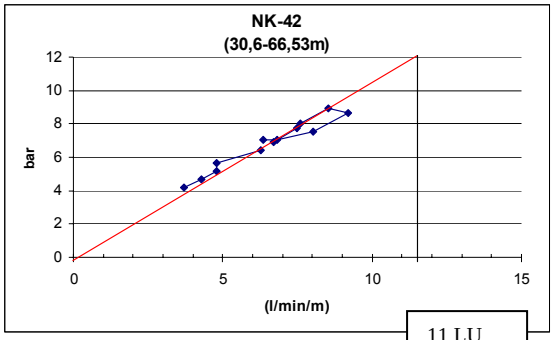


Akbraut interglacial basalt



Akbraut interglacial basalt

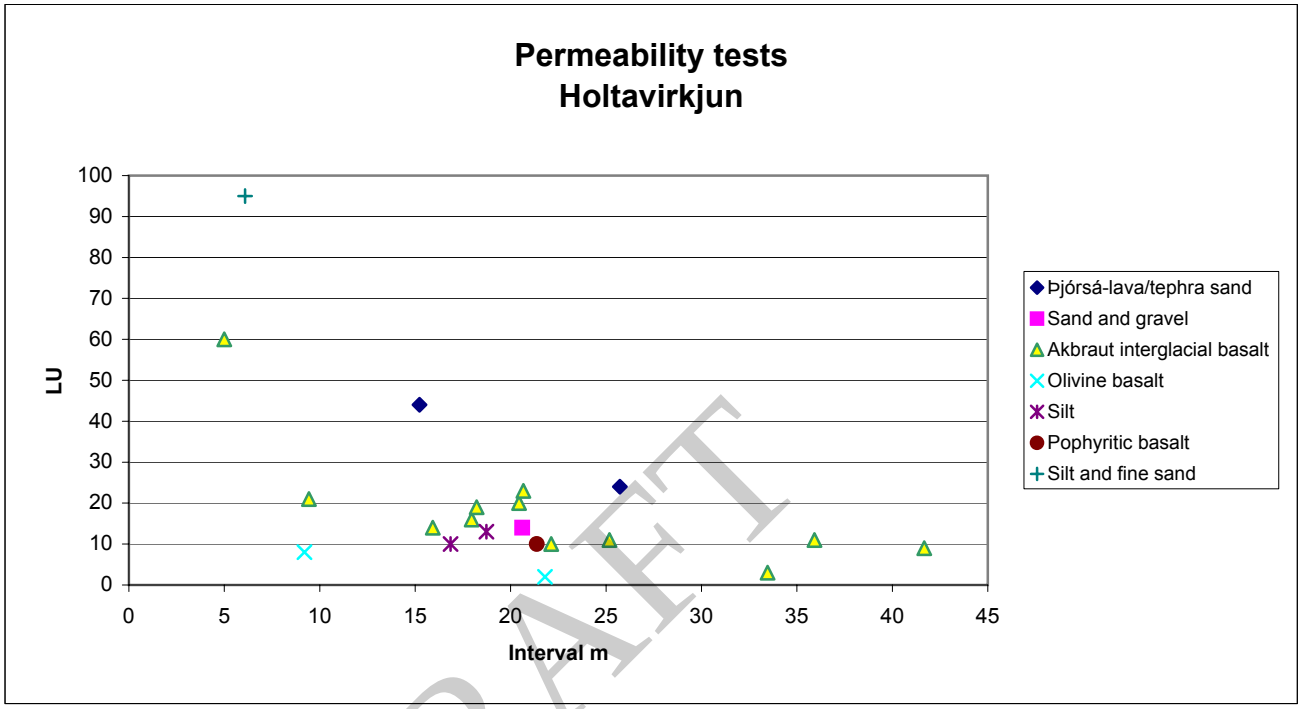
DRAFT



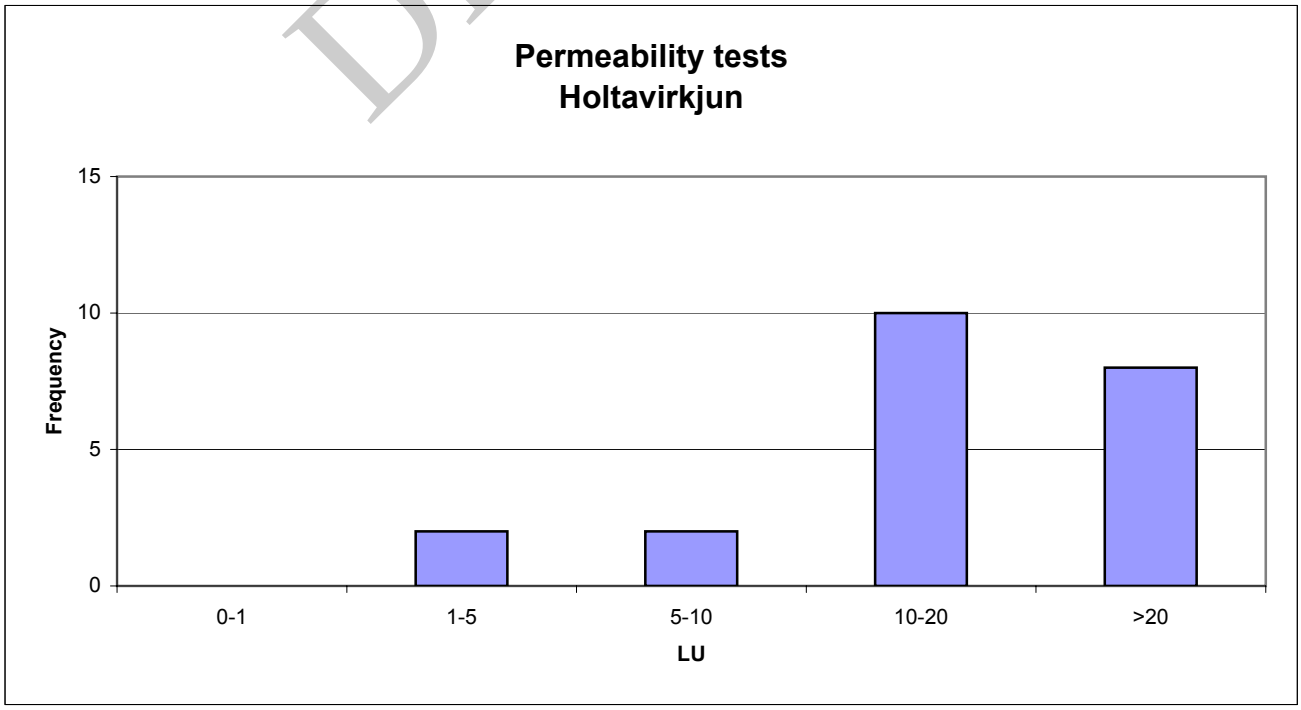
11 LU

Akbraut interglacial basalt

DRAFT

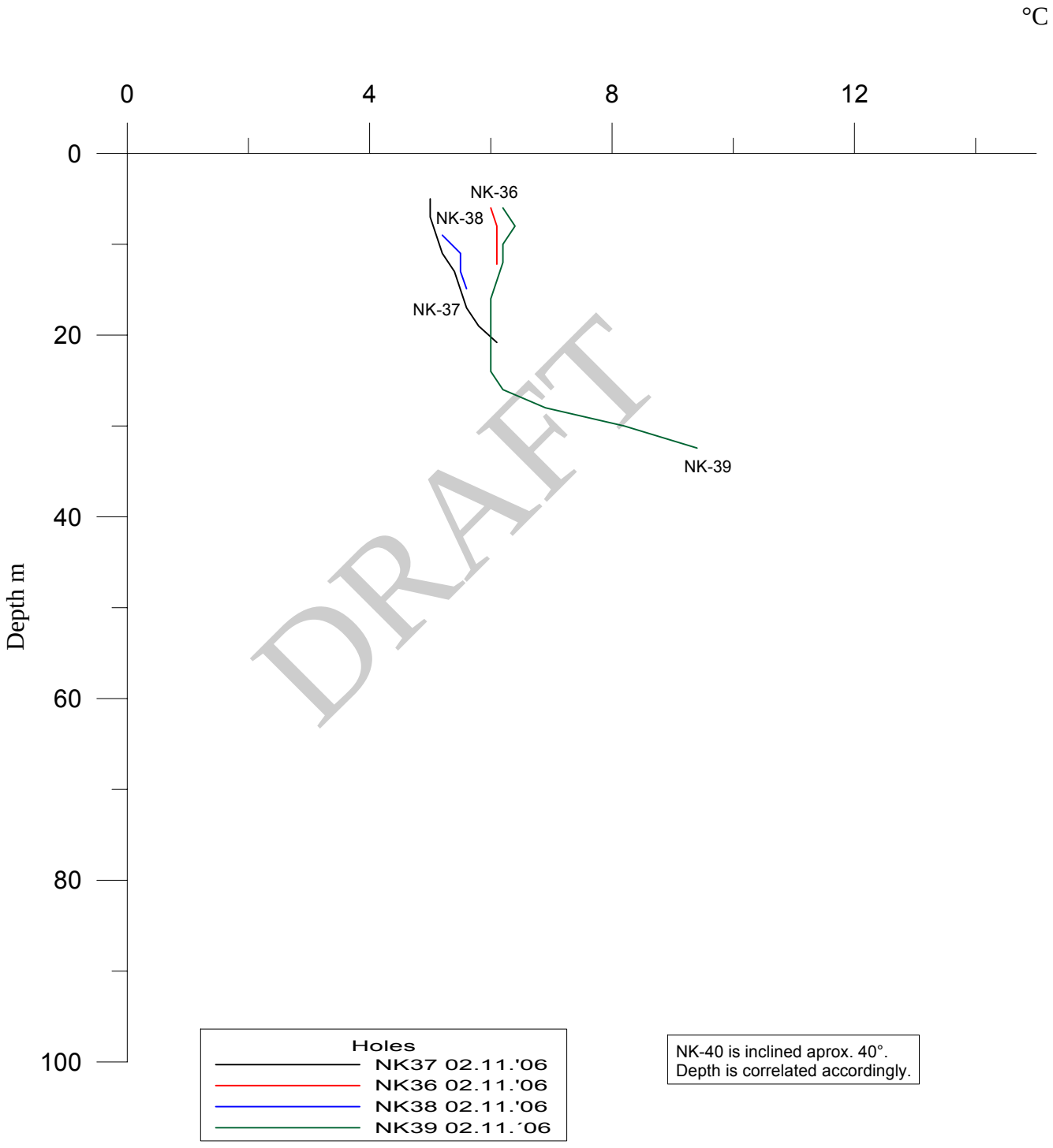

Permeability tests
Holtavirkjun
LU
Interval m
0
5
10
15
20
25
30
35
40
45
0
10
20
30
40
50
60
70
80
90
100
Þjórsá-lava/tephra sand
Sand and gravel
Akbraut interglacial basalt
Olivine basalt
Silt
Pophyritic basalt
Silt and fine sand

DRAFT


Permeability tests
Holtavirkjun
Frequency
LU
0
5
10
15
0-1
1-5
5-10
10-20
>20

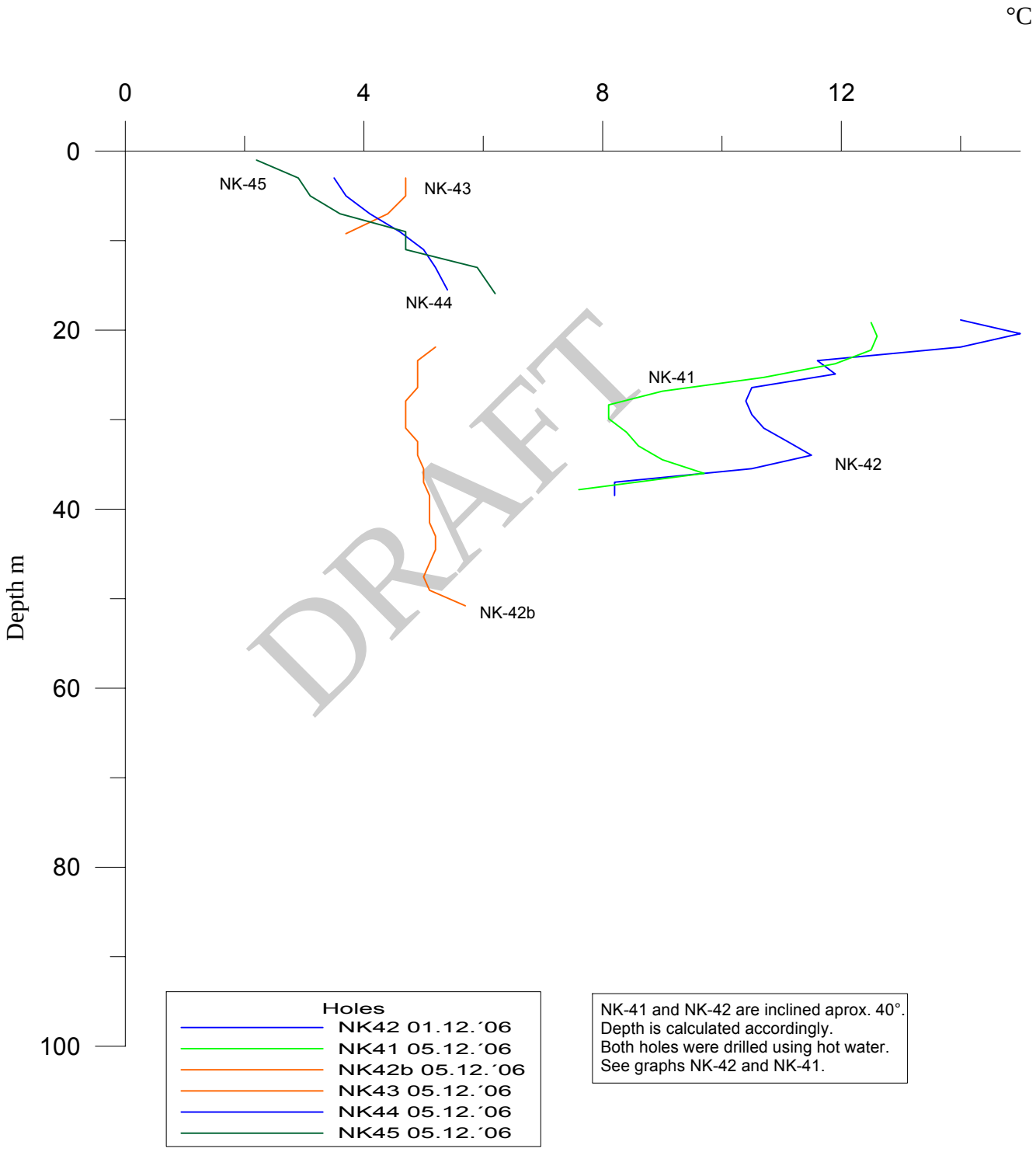
Holtavirkjun hydrelectrical project
Temperature readings in boreholes

Árnes island



Holtavirkjun hydroelectrical project
Temperature readings in boreholes

Akbraut



NK-41 and NK-42 are inclined aprox. 40°.
Depth is calculated accordingly.
Both holes were drilled using hot water.
See graphs NK-42 and NK-41.

Holtavirkjun hydroelectric powerplant

Temperature readings in test pits

Date: 2.11.2006

Test pits	Heat °C
L1A	5,7-5,9
L1B	6,0
L21E	6,2-6,4
L22A	6,1-6,5
L22B	6,4-6,5
L22C	6,0-6,4
L22D	6,5-6,6
L22E	6,4-6,6
L23A	6,4
L23B	6,7
L23C	6,5-6,7
L23D	6,4
S3A	6,5
S3B	5,6

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Holtavirkjun Hydroelectric Project

Point load tests

Point load tests

NK-36

Depth (m)	Rock type	Number of tests	P (kN)	Point load strength (IS)	Is (50) (Mpa)	Apparent UCS (Mpa)
4,5	Þjórsár-lava	7	5,3	2,6	2,5	0
20,0	Silt	6	1,5	0,7	0,7	0
25,9	Silt	6	1,3	0,7	0,6	0
29,7	Dyke	6	10,6	5,2	5,0	0
30,4	Silt	6	1,2	0,6	0,6	0
33,3	Hyaloclastite	4	4,0	2,0	1,9	0
38,8	Dyke	7	10,1	5,0	4,8	0

NK-38

Depth (m)	Rock type	Number of tests	P (kN)	Point load strength (IS)	Is (50) (Mpa)	Apparent UCS (Mpa)
14,9	Þjórsár-lava	12	6,4	3,1	3,0	0

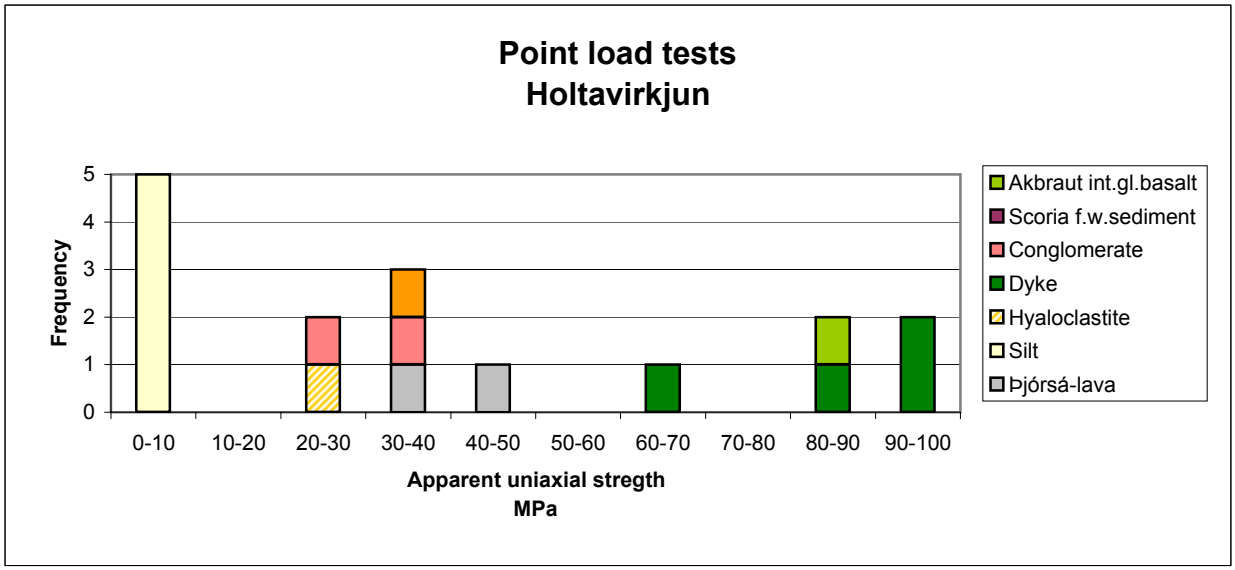
NK-41

Depth (m)	Rock type	Number of tests	P (kN)	Point load strength (IS)	Is (50) (Mpa)	Apparent UCS (Mpa)
36,0	Sediment filled scoria	11	4,2	2,1	2,0	0
46,0	Sediment filled scoria	9	2,9	1,4	1,4	0
59,5	Conglomerate	7	2,6	1,3	1,2	0
61,9	Dyke	11	6,8	3,4	3,2	0
66,3	Dyke	5	11,3	5,6	5,3	0
73,4	Akbraut int.gl.basalt	6	8,4	4,1	3,9	0

NK-45

Depth (m)	Rock type	Number of tests	P (kN)	Point load strength (IS)	Is (50) (Mpa)	Apparent UCS (Mpa)
10,5	Silt	7	0,7	0,3	0,3	0
11,0	Silt	5	0,8	0,4	0,4	0

DRAFT



Urriðafossvirkjun Hydroelectric Project

Maps

Percussion hole logs

Urriðafossvirkjun Hydroelectric Project

Maps

Location map

Almenna
Consulting Engineers

Fellsmúla 26 - 108 Reykjavík
S:580 8100 - Fax: 580 8101
av@almenna.is - www.almenna.is

URRIÐAFOSSVIRKJUN
HYDROELECTRIC PROJECT
LOCATION MAP

Hannað ÁÓT	Athugað JS	M.	1:50.000		
Samþ. SPS		Kt.			
Dags. Jan. 2007	Nr.	1227.112-J-002			

Áritanir á teikningu eru á ábyrgð Almennu verkfræðistofunnar hf. kt. 470671-0179

Urriðafossvirkjun Hydroelectric Project

Percussion hole logs

Damsite location map

Logs of ULO-76 to ULO-94

Tailrace tunnel location map

Logs of ULO-95 to ULO-107

Tectonic lineaments

Dam dyke

X- 424500
Y- 387000

X- 425500
Y- 387000

No sign of the Thjorsa lava is detected inside this area

Quarternary bedrock

X- 424500
Y- 386000

Dam dyke

PRELIMINARY

200 m

Legend

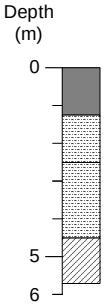
- UF-7 — Cored borehole
- ULO-41 — Percussion borehole
- *44.58* — Groundwater elevation

Jarðfræðistofan ehf / JFS Geological services	Urriðafoss Hydroelectric Project	JFS - 72
Landsvirkjun	Damsite area at Skeiðaháholt	Nov. 2006
Scale 1:10.000	Design ÁgG; Drawn ÁgG/CAD; Chk.; Appr.	Percussion boreholes 2006 Location map	Drawing X

ULO-76

X: 423662
Y: 385430
m a.s.l.

Vertical cased hole drilled on a grass plain near the west bank of the river Þjórsá. Drilled with an Odex bit and 90mm outside diameter (OD) casing



Damp soft brown organic silt

Soft blue green grey silt.

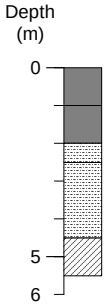
Soft grey silt. Slight water inflow at ~2,5m

Moderately hard to hard basalt bedrock

ULO-77

X: 423787
Y: 385534
m a.s.l.

Vertical cased hole drilled on a grass plain, next to a track, near the west bank of the river Þjórsá. Odex bit, 90mm OD casing



Soft dark brown organic silty sand

Soft brown clayey silt

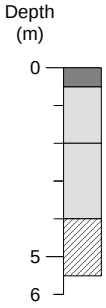
Wet grey clayey silt.
Soft brown grey silt

Weak to moderately hard basalt bedrock

ULO-78

X: 423935
Y: 385643
m a.s.l.

Vertical cased hole drilled on a grass plain, next to a track, near the west bank of the river Þjórsá. Odex bit, 90mm OD casing



Soft dark brown organic silty sand
Dark grey silty sand

Grey silty sand

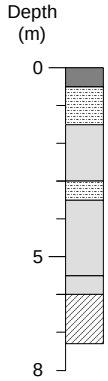
Dense at 3,5m for 0,2m

Weak to moderately hard basalt bedrock

ULO-79

X: 424022
Y: 385733
m a.s.l.

Vertical cased hole drilled on a grass plain, next to a track, near the west bank of the river Þjórsá. Odex bit, 90mm OD casing



Soft dark brown organic silty sand
Soft brown clayey silt

Grey medium to coarse sand with some light brown pummice sand

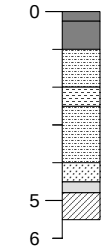
Brown sandy silt
Gravel and coarse sand (basalt with some pummice). Occoasional light brown fibrous wood, max.~10mm.

Sand with fractured rock at base. Water inflow at 5,5m
Moderately hard basalt bedrock

ULO-80

X: 424149
Y: 385841
m a.s.l.

Vertical cased hole drilled on a grass plain near the west bank of the river Þjórsá. Odex bit, 90mm OD casing



Grey organic silty sand
Dark grey organic silty sand
Brown clayey silt

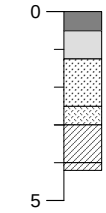
Grey brown becoming grey silty clay
Few cuttings, interpreted to be silt.
Brown red layer at 3m

Gravel
Sand
Moderately hard basalt bedrock.
Water inflow at 5,3m

ULO-81

X: 424331
Y: 385926
m a.s.l.

Vertical cased hole drilled on a grass plain, next to a track, near the west bank of the river Þjórsá. Odex bit, 90mm OD casing



Dark brown grey organic silty sand
Dark grey sand

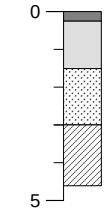
Light brown grey sandy gravel and cobbles (mostly vesicular basalt).
Water inflow at 2,5m
Scoriaceous broken rock
Moderately hard basalt bedrock

Hard dry basalt bedrock

ULO-82

X: 424426
Y: 386103
m a.s.l.

Vertical cased hole drilled on a grass plain, next to a track, near the west bank of the river Þjórsá, south of the farm Skeiðháholt. Odex bit, 90mm OD casing

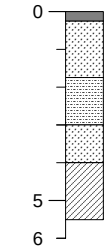


Dark grey organic silty sand
Dark grey sand with well rounded, often elongate, gravel (max. ~30mm)
Blue grey angluar vesicular basalt gravel with occasional red brown clay coatings. Wet from 2,5m
Hard dry basalt bedrock

ULO-83

X: 424592
Y: 386201
m a.s.l.

Vertical cased hole drilled on a marshy grass plain, next to a track, near the west bank of the river Þjórsá. Odex bit, 90mm OD casing



Dark grey organic silty sand
Grey sand and gravel

Grey sandy silt

Wet grey fine to medium gravel and cobbles
Hard basalt bedrock. Becoming dry from 4 to 4,4m. Water inflow at 4,5m

Preliminary

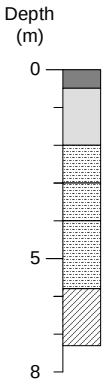
Note: hole coordinates measured using a hand-held GPS. Only the x and y components are reported here. Additionally, the legend is included with logs ULO-92 to ULO-94

Jarðfræðistofan ehf / JFS Geological services Ltd		Urridafoss HEP	JFS - XX
Landsvirkjun		Percussion drilling Holes ULO-76 to ULO-83	Nov. 2006
Scale Horiz. Vertical	Design ÁgG Drawn ÁgG Chk. Appr.		Drawing X-X

ULO-84

X: 424706
Y: 386354
m a.s.l.

Vertical cased hole drilled in a grass field, near the west bank of the river Þjórsá.
Odex bit, 90mm OD casing



Dark grey organic silty sand
Dark grey sand

Soft brown clayey silt

Brown grey soft clayey silt

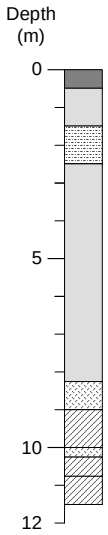
Grey soft clayey silt, wet at base

Wet hard basalt bedrock

ULO-85

X: 424845
Y: 386498
m a.s.l.

Vertical cased hole drilled in a grass field, near the west bank of the river Þjórsá.
Odex bit, 90mm OD casing



Dark grey organic silty fine sand
Dark grey rounded medium sand

Damp brown clayey silt with occasional well rounded basalt gravel
Damp slightly green grey silty fine sand

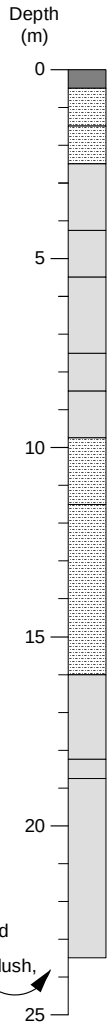
Weak broken rock. Water inflow at 8,5m

Wet moderately hard basalt bedrock, vesicular with zeolites
Weak layer
Wet moderately hard basalt bedrock
Hard basalt bedrock

ULO-86

X: 425003
Y: 386625
m a.s.l.

Vertical cased hole drilled in a grass field, near the west bank of the river Þjórsá.
Odex bit, 90mm OD casing



Dark brown organic clayey silt
Brown clayey silt

Brown grey clayey sandy silt with some green grey clay coated fine basalt gravel
Brown grey fine to medium sand

Dark slightly green grey silty medium sand, becoming wet at base

Dark grey rounded medium sand

Dark slightly green grey fine sand

Dark green grey silty fine sand

Wet soft dark green grey semi-cohesive clayey silt

Wet soft green grey semi-cohesive clayey silt

Dark grey medium sand

Water inflow at 17m

Dark grey fine sand
Dark grey coarse sand and fine subangular to subrounded gravel with occasional well rounded coarse basalt gravel

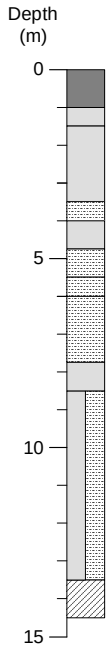
Large inflow of clear becoming light brown grey water at 21m

Much water-carried sand entered hole, no return. Remedial foam-based flush, pumped through bit at 20bar, unsuccessful.

ULO-87

X: 425076
Y: 386810
m a.s.l.

Vertical cased hole drilled in a field of tusocky grass, near the west bank of the river Þjórsá.
Odex bit, 90mm OD casing



Soft brown organic clayey sandy silt

Brown sand with subrounded gravel
Dark grey coarse sand with subrounded to rounded basalt (some scoria and zeolites) gravel

Dark brown clayey silt
Dark brown rounded medium sand

Dark brown clayey silt

Few cuttings, interpreted to be silt

Slightly green grey silt with abundant sand to fine gravel sized clasts of dense clayey silt

Wet, slightly green grey clayey silty fine sand.

Few cuttings. Interpreted to be green grey clayey silt or sand

Water inflow at 13,5m
Hard bedrock

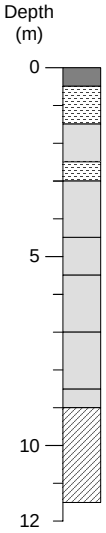
Note: hole coordinates measured using a hand-held GPS. Only the x and y components are reported here. Additionally, the legend is included with logs ULO-92 to ULO-94

Preliminary

Jarðfræðistofan ehf JFS Geological services Ltd		Urridafoss HEP	JFS - XX
Landsvirkjun		Percussion drilling Holes ULO-84 to ULO-87	Nov. 2006
Scale Horiz. Vertical	Design ÁgG Drawn ÁgG Chk. Appr.		Drawing X-X

ULO-88

X: 425145
Y: 387010
m a.s.l.



Vertical cased hole drilled in a field of tusocky grass, near the west bank of the river Þjórsá.
Odex bit, 90mm OD casing

Soft brown organic clayey sandy silt
Brown silty sandy clay

Wet brown silty very fine sand

Moist grey brown silty sandy clay
Dark grey medium to coarse sand with fine to medium well rounded basalt gravel

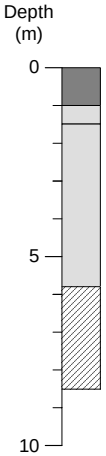
Dark grey fine to medium sand with occasional gravel
Dark grey medium to coarse sand

Dark grey fine to medium sand

Wet green grey clayey silty fine sand
Moderately hard to hard basalt vesicular (with zeolites) bedrock with some green grey clay infillings.
Water inflows at 10,2m and 10,7m

ULO-89

X: 425175
Y: 387221
m a.s.l.



Vertical cased hole drilled in a field of tusocky grass, near the west bank of the river Þjórsá.
Odex bit, 90mm OD casing

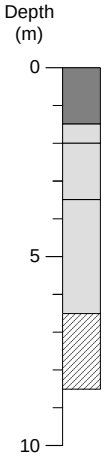
Soft dark and light brown organic silty clay
Brown sand and fine gravel
Dark grey medium and coarse sand and gravel
Dark grey medium to coarse sand with occasional rounded fine gravel
Fine medium to sand at 4m

Wet at base

Wet moderately hard to hard basalt bedrock becoming dry at 6,5m
Water inflow at 7,5m

ULO-90

X: 425261
Y: 387390
m a.s.l.



Vertical cased hole drilled in small field of tusocky grass, near a track, near the west bank of the river Þjórsá. Odex bit, 90mm OD casing

Soft brown organic silty clay

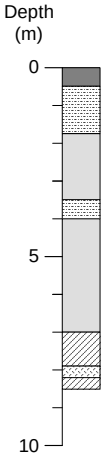
Grey silty clayey fine sand
Brown clayey silty very fine sand

Moist dark grey medium sand.
No cuttings return between 2,5m and 3,5m.

Moderately hard (hard from 8m) basalt bedrock.
Water inflow at 7,5m

ULO-91

X: 425315
Y: 387605
m a.s.l.



Vertical cased hole drilled next to a track, near the west bank of the river Þjórsá. Odex bit, 90mm OD casing

Soft brown organic clayey sandy silt
Brown clayey silt

Wet brown grey clayey silty very fine sand

Brown grey clayey silt with much fibrous wood fragments (5 to 10mm)
Wet green grey clayey silty very fine sand

Moderately hard to hard basalt, becoming dry at 7,5m. Weak layer at 7,9m - grey coarse gravel and silt. Water inflow at 8,1m

Preliminary

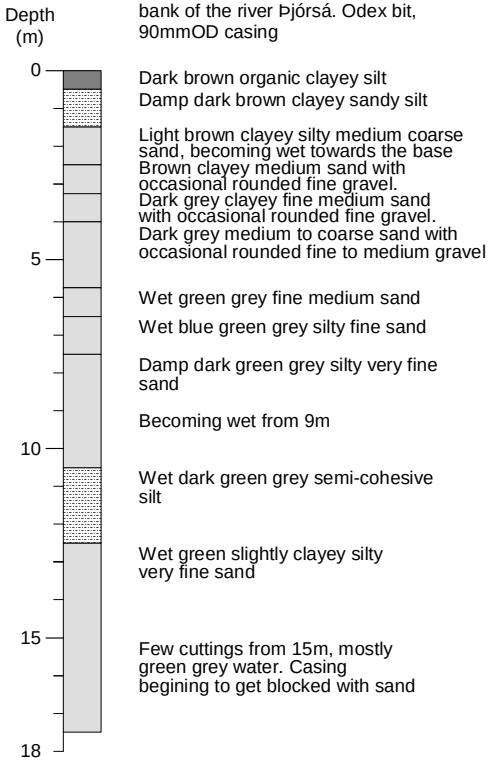
Note: hole coordinates measured using a hand-held GPS. Only the x and y components are reported here. Additionally, the legend is included with logs ULO-92 to ULO-94

Jarðfræðistofan Ehf JFS Geological services		Urridafoss HEP	JFS - XX
Landsvirkjun		Percussion drilling Holes ULO-88 to ULO-91	Nov. 2006
Scale Horiz. Vertical	Design ÁgG Drawn ÁgG Chk. Appr.		Drawing X-X

ULO-92

X: 425050
Y: 386712
m a.s.l.

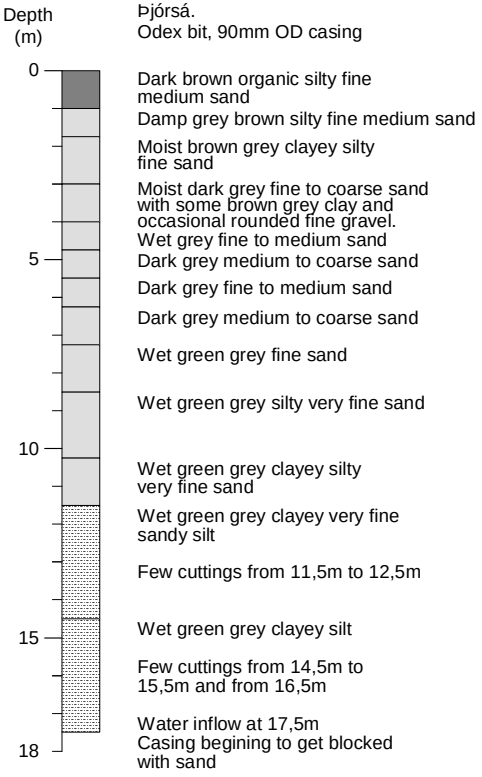
Vertical cased hole drilled in a wet area of a grass field, near the west bank of the river Þjórsá. Odex bit, 90mmOD casing



ULO-93

X: 424945
Y: 386542
m a.s.l.

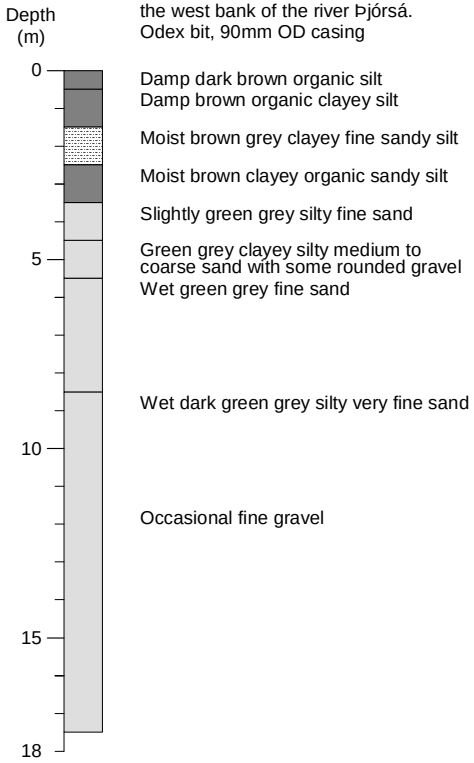
Vertical cased hole drilled in a grass field, near the west bank of the river Þjórsá.
Odex bit, 90mm OD casing



ULO-94

X: 424890
Y: 386695
m a.s.l.

Vertical cased hole drilled in a marshy area of a grass field, near the west bank of the river Þjórsá.
Odex bit, 90mm OD casing



Legend

- Organic silt or sand
- Clay
- Silt
- Sand
- Gravel
- Scoria
- Bedrock

Preliminary

Note: hole coordinates measured using a hand-held GPS. Only the x and y components are reported here.

Jarðfræðistofan Ehf JFS Geological services		**Urridafoss HEP**	JFS - XX
Landsvirkjun		**Percussion drilling Holes ULO-92 to ULO-94**	Nov. 2006
Scale Horiz. Vertical	Design ÁgG Drawn ÁgG Chk. Appr.		Drawing **X-X**

X-419500
Y-381000

Bjórsártún farm

Tailrace tunnel

Access tunnel

UF-2

Main road national one

X-419500
Y-381000

ULO-106 >14,8 m
ULO-107 >11,8 m
ULO-104 >17,8 m
ULO-44 >21 m
ULO-105 >20,8 m
ULO-98 5,2 m
ULO-42
ULO-95 8,8 m
ULO-99 7,8 m
ULO-102 7,9 m
ULO-100 8,5 m
ULO-97 4,8 m
ULO-43 5 m
ULO-101 >15 m
ULO-96 5,2 m
ULO-103 9 m
ULO-51 10 m
ULO-50 11,5 m
ULO-49 6 m
ULO-48 8 m

Tailrace tunnel

0 0,1 0,2 0,3 0,4 0,5 km

PRELIMINARY

Legend

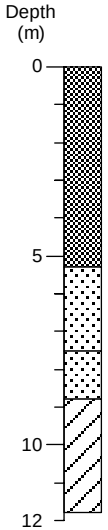
- UF-7 Cored borehole
- ULO-41 Percussion borehole
- Tectonic lineament

Jarðfræðistofan ehf JFS Geological services	Urriðafoss Hydroelectric Project	JFS - 72
Landsvirkjun	Powerhouse and tailrace	Nov. 2006
Scale 1:5.000	Design ÁgG / Drawn ÁgG/CAD / Chk. / Appr.	Percussion boreholes 2006 Location map	Drawing X

ULO-95

X: 418593
Y: 380780
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Soft silty very fine sand

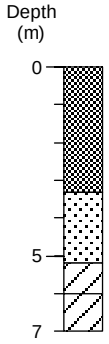
Loose sandy fine gravel

Moderately hard rock

ULO-96

X: 418659
Y: 380681
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Soft silty very fine sand

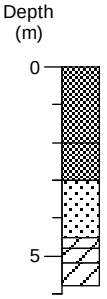
Hard rock

Hard rock

ULO-97

X: 418726
Y: 380728
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Soft dark brown silt

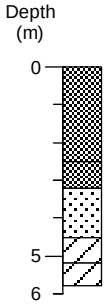
Grey silty very fine sand

Weak/broken rock
Moderately hard rock
Hard rock

ULO-98

X: 418691
Y: 380796
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Soft dark brown silt

Slightly green grey silty very fine sand

Weak/broken rock

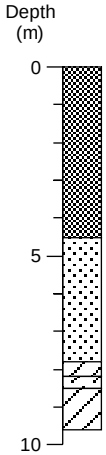
Hard rock

Jarðfræðistofan ehf JFS Geological services Ltd			Urridafoss HEP	JFS - XX
Landsvirkjun			Percussion drilling Holes ULO-95 to ULO-98	Oct. 2006
Scale Horiz. Vertical	Design	ÁgG		Drawing
	Drawn	ÁgG		X-X
	Chk.			
	Appr.			

ULO-99

X: 418653
Y: 380765
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Grey silty very fine sand

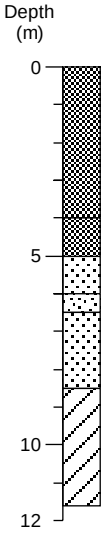
Cobbles at 6,5m

Modertely hard rock. Water inflow at 7,9m
Weak rock
Modertely hard rock

ULO-100

X: 418616
Y: 380718
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Soft dark brown silt

Slightly green grey silty very fine sand

Dense gravel or cobbles
Slightly green grey silty very fine sand

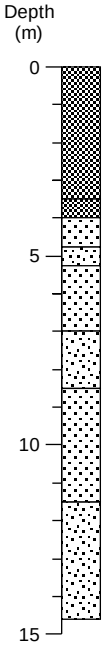
Slightly green grey silty gravelly very fine sand
Fine occasionally medium angular gravel
Silty sandy fine medium coarse gravel

8,5m to 11,6m interpreted to be bedrock with sediment infiltrations.

ULO-101

X: 418581
Y: 380679
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Soft dark brown silt
Slightly green grey silty very fine sand
Cobbles
Slightly green grey silty very fine sand

Grey sandy fine medium coarse subangular to rounded gravel

Grey silty fine sand

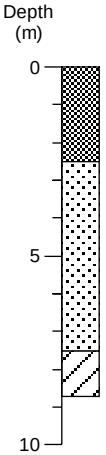
Water inflow at 9,5m

Grey sandy fine medium subrounded to rounded gravel

ULO-102

X: 418492
Y: 380745
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Grey silty very fine sand

Water inflow at 6m

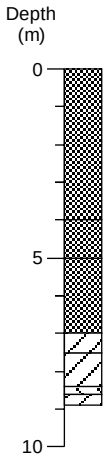
Weak to modertely hard rock

Jarðfræðistofan Ehf / JFS Geological services Ltd			Urridafoss HEP	JFS - XX
Landsvirkjun			Percussion drilling Holes ULO-99 to ULO-102	Oct. 2006
Scale Horiz. Vertical	Design	ÁgG		Drawing
	Drawn	ÁgG		X-X
	Chk.			
	Appr.			

ULO-103

X: 418617
Y: 380628
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Soft dark brown silt

Grey silty very fine sand

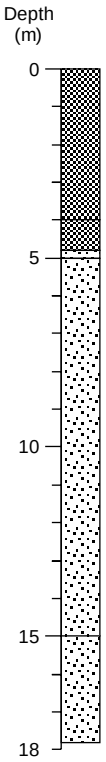
Water inflow at 7m
Weak/broken rock
Bedrock - moderately hard rock

Very weak rock
Hard rock

ULO-104

X: 418614
Y: 380801
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Soft dark brown silt
Dense gravel or cobbles
Grey sandy gravel

Grey sandy fine to coarse gravel, mostly basalt with occasional scoria
Water inflow at 9m

Grey slightly sandy fine medum subangular to subrounded gravel.
Water inflow at 11m

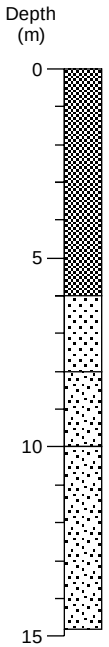
Grey sand with much fine subrounded gravel, mostly basalt with occasional scoria

Dense grey sandy subangular to subrounded fine to medium gravel

ULO-105

X: 418621
Y: 380793
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Grey silty very fine sand

Grey sandy gravel
Water inflow at 9m

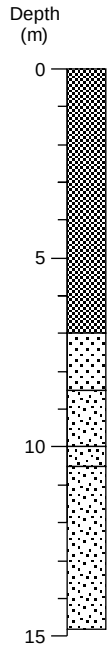
Dense grey sandy subangular and subrounded fine to medium occasionally coarse gravel, mostly basalt with some brown and orange grey scoria

Dense grey sandy subrounded gravel, mostly basalt with some scoria

ULO-106

X: 418634
Y: 380832
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Grey silty very fine sand

Grey sandy gravel
Water inflow at 9m

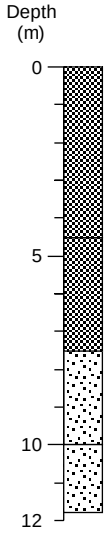
Medium dense grey sandy gravel
Dense grey sandy gravel

Jarðfræðistofan Ehf / JFS Geological services Ltd			Urridafoss HEP	JFS - XX
Landsvirkjun			Percussion drilling Holes ULO-103 to ULO-106	Oct. 2006
Scale Horiz. Vertical	Design	ÁgG		Drawing
	Drawn	ÁgG		X-X
	Chk.			
	Appr.			

ULO-107

X: 418673
Y: 380834
m a.s.l.

Drilled in a field south of Road 1 and east of Urridafoss. The land surface is tussocky grass. Drilled vertical.



Soft medium brown organic silt

Soft dark brown silt

Medium dense grey sandy gravel

Water inflow at 10m
Dense grey sandy gravel

Jarðfræðistofan Ehf / JFS Geological services Ltd			Urridafoss HEP	JFS - XX
Landsvirkjun			Percussion drilling Hole ULO-107	Oct. 2006
Scale Horiz. Vertical	Design	ÁgG		Drawing
	Drawn	ÁgG		X-X
	Chk.			
	Appr.			