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Forsmark site investigation

A co-ordinated interpretation of ground penetrating radar data from the Forsmark site

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September 2004

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A co-ordinated interpretation of ground penetrating radar data from the Forsmark site

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Abstract

The present report presents a second-generation interpretation of ground penetrating radar (GPR) data collected within the Forsmark site during late winter 2003.

The interpretation is a coordinated analysis of GPR data, results from different types of drillings, and mapping of bedrock outcrops. The interpretation yields basically the depth to the bedrock along the survey lines. By combining these results with the terrain model, a model of the bedrock surface within the area can be established.

The result shows that the area is generally characterized by a relatively shallow bedrock surface, which locally shows significant topography. The soil cover consists mostly of moraine and clay. The main difference between the results from the present interpretation as compared to the previous (preliminary) interpretation is that the interpreted depths to the bedrock along lines measured on lakes have decreased.

The data delivery comprises point data for SICADA containing the interpreted depth to the bedrock at well defined points along the profiles. Maps and sections presented in this report are also delivered as jpeg-files.

Sammanfattning

Föreliggande rapport presenterar en andra generations tolkning av markradardata insamlad inom platsundersökningsområdet Forsmark under vårvintern 2003.

Denna andra generationens tolkning är en samordnad analys av markradardata, resultat från olika typer av borrningar, samt hällkartering. Tolkningen ger huvudsakligen djupet till berggrunden längs mätprofilerna. Genom att kombinera dessa resultat med terrängmodellen kan en modell av berggrundens överyta upprättas.

Resultatet visar att området i stort karakteriseras av en relativt grunt liggande berggrundsyta, som dock lokalt uppvisar kraftig topografi. Jordtäcket i området domineras av morän och lera. Den största skillnaden mellan den nu presenterade tolkningen och den tidigare (preliminära) tolkningen är att det tolkade djupet till berggrunden längs profiler mätta över sjöar är mindre.

Dataleveransen omfattar punktdata för SICADA innehållande djup till berggrunden i väldefinierade punkter längs mätprofilerna. Kartor och tvärprofiler som presenteras i denna rapport har också levererats i jpeg-format.

Contents

1 Background and objectives

A ground penetrating radar survey was conducted in the Forsmark site investigation area during late winter/early spring 2003 and a method specific interpretation has presented /1/. Data from a total of 64,354 metres of surveying was collected in 103 individual files. Figure 1-1 shows the profiles measured.

This document reports a co-ordinated interpretation of data in the light of results obtained by drilling and mapping in the area. The work has been performed according to activity plan AP PF-400-03-88 (SKB internal controlling document).

The data has been reinterpreted mainly in order to:

- Obtain better assignments of depth to the bedrock.
- Produce geological sections
- Correlate results from drilling with observed surface geology.

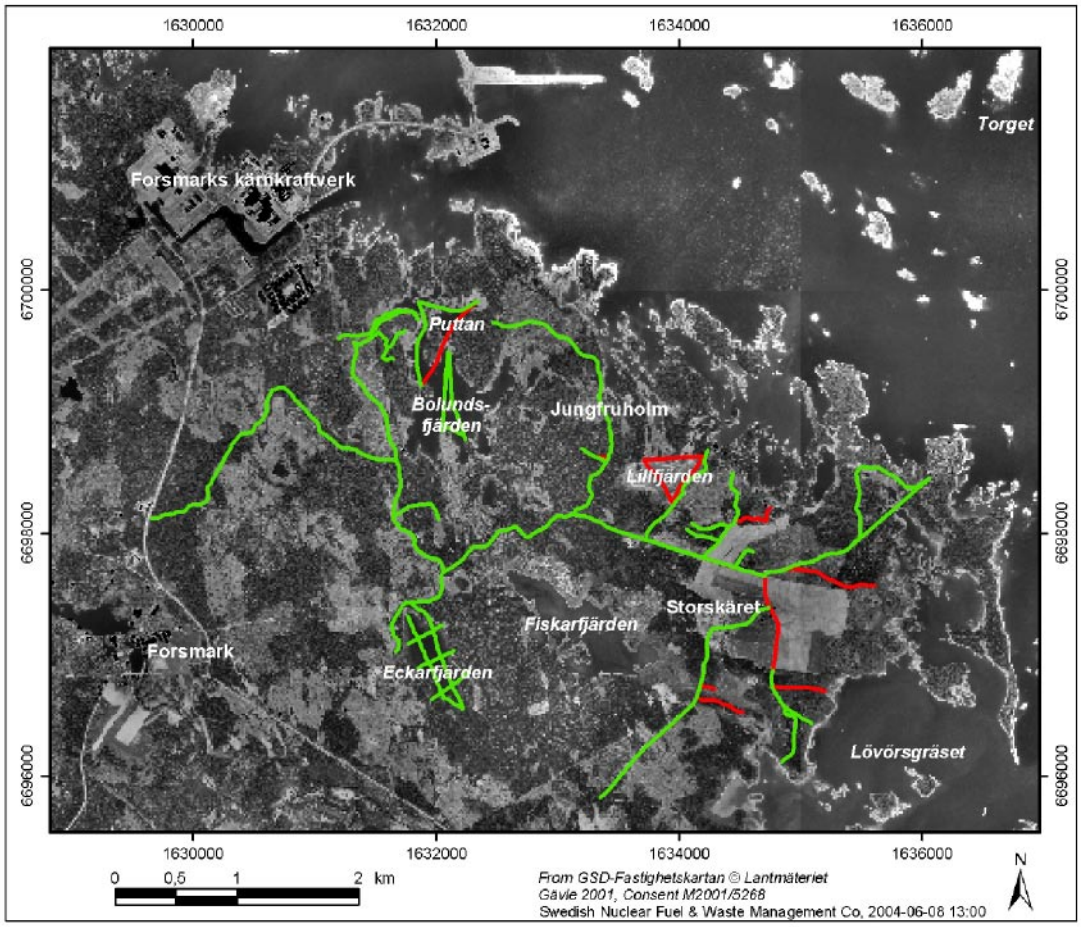


Figure 1-1. *GPR survey profiles. Green lines show profiles, which have yielded interpretable results along at least parts of each profile. Red lines show profiles of poor data. From /1/.*

2 Interpretation

Data from different sources have been combined into correlated interpretation sections. The supporting data (in Excel, ESRI or MapInfo format) provided by SKB could be divided into "drilling results" and "mapping results".

- Drilling results are of several types: KFM (core drilling), HFM (percussion drilling), SFM (soil drilling), PFM (diggings).
- Mapping results are restricted to bedrock mapping, and are divided into observed outcrops and outcrops inferred from aerial photography.

The GPR data have been reinterpreted from raw data (rd2) within the REFLEX-W software. The data are thoroughly described in /1/.

The following priority has been is given to the different data types:

Depth to bedrock

1) Observed outcrops
2) Drilling
3) GPR data
4) Outcrops inferred from aerial photos

Surface geology

1) Observed quaternary geology (which includes field observations of the GPR crew)
2) Drilling

Horizons within the overburden and superficial bedrock

1) GPR data
2) Drilling

3 Results and data delivery

The entire data set upon which the interpretation presented in this report is based is rather large and covers a wide area. The sources of data are differing in type, quantity and relevance to e.g. determination of soil depth. The knowledge about the area is also steadily growing, as more and more investigations are conducted.

To make the result of the work accessible, and to provide the possibility to continuously assess the reliability of the interpretation in any given point, the results are presented in two different manners.

- Maps showing location and approximate depth to bedrock. These maps also show the location and results of drillings along with observed and inferred bedrock outcrops.
- Profile drawings showing the interpreted geological sections.

The profile drawings have been transferred to digital data to be inserted into the SICADA data base, giving the interpreted depth to the bedrock at a series of points along each profile.

During the field campaign /1/, the survey was divided into “survey areas” A-U. Appendix 1 shows these survey areas and lists the interpreted profiles of each area. The individual maps and geological sections (profiles) are presented in Appendix 2. Figure 3-1 summarises the inferred depth to the bedrock.

By using the maps and profiles, it is possible to consult the data in several aspects, from regional overview to a rather detailed geological interpretation of a specific profile.

The maps are built around a geographical data set provided by SKB, and show shorelines, lakes, roads, borehole positions, observed and inferred outcrops. The drilling results are presented in a simplified way. The GPR profiles are shown as a series of dots (the points inserted in the SICADA data base). The dots are colour coded to show the interpreted depth to the bedrock.

The interpretation sections are built around drawings giving the geological interpretation of the combined data set along each GPR profile. The results are presented in relation to surface topography, in order to give a “true” image of the distribution of different geological materials. The assignment of depth to different horizons in the overburden and superficial bedrock is based on correlating GPR data to drilling results, where such are available. Along parts of the profiles where GPR data is poor, indicated by colour coded point numbers, the interpretation is less reliable and based on any type of information available. When the supporting information is more distant and the GPR data is poor, the interpretation gradually becomes hypothetical.

The SICADA files give the interpreted depth to the bedrock at well-defined points along each profile. If the bedrock topography is undulating and the point is located on a slope, the assigned depth might be either smaller than the maximum depth close by or greater that the average depth in the surroundings. This effect has to some extend been removed by a light smoothing of the interpreted depths during the interpretation process.

The data delivery comprises point data for SICADA as described above. All maps and sections are, apart from being part of the present report (Appendix 2), also delivered as jpeg-files.

The SICADA reference to the data is field note Forsmark 112.

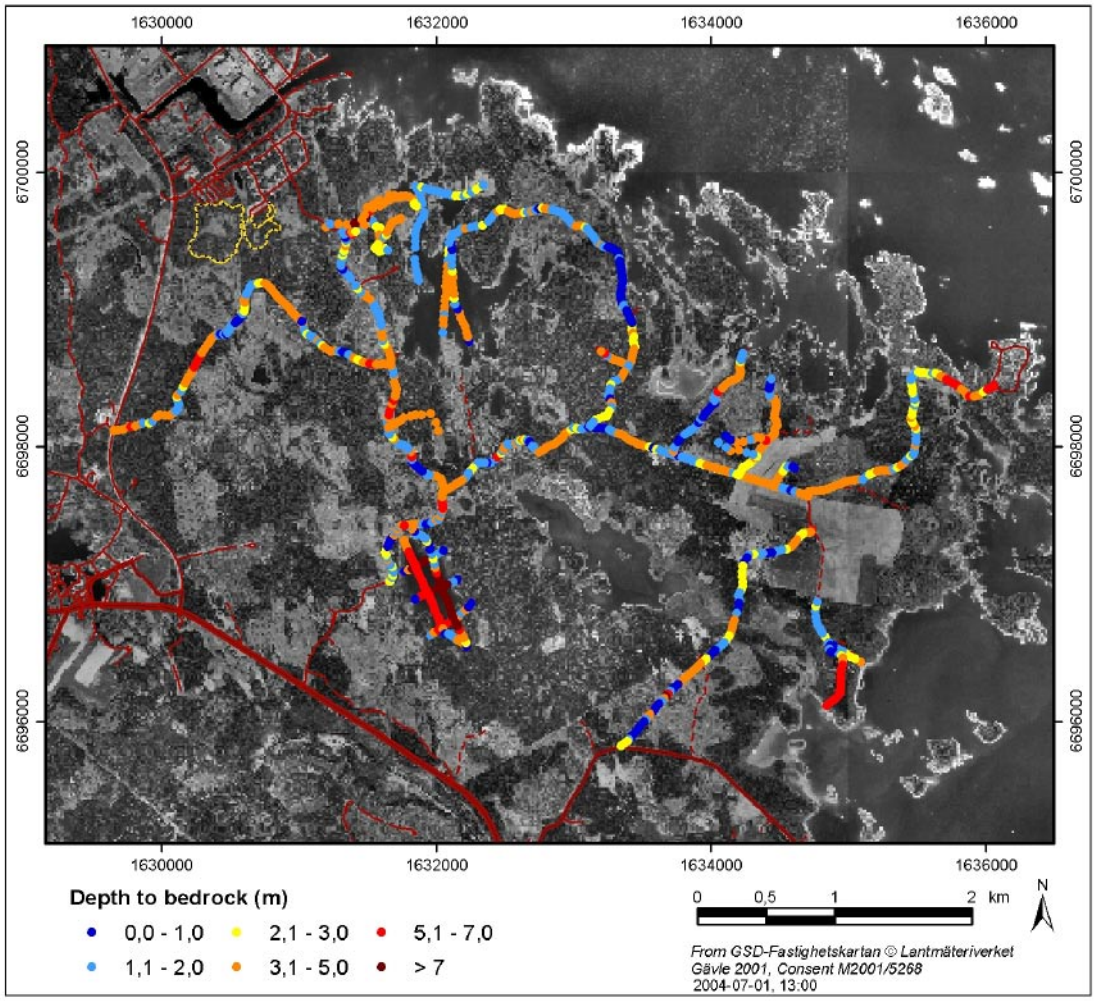


Figure 2-1. *Depth to the bedrock inferred from radar data (GPR) supported by information on soil depth provided from other sources, e.g. mapping and drilling.*

4 Discussion

Previously method specific interpreted GPR data /1/ have been re-interpreted with the support of information from various drilling and mapping campaigns. A major advantage of this re-interpretation is that depth assignments become more reliable, since effects from differing signal velocities otherwise might lead to erroneous interpretation results. For example, measurements made on lake ice have previously been processed using a standard velocity more accurate for moraine than sea water. Also, it is now possible to make educated guesses of the geology at depth in areas with extensive layers of clay and other types of material that have strong attenuation effects. The result of the re-interpretation can therefore be considered as more reliable and better constrained then the previous version presented in /1/.

The most obvious difference between the two generations of interpretation is found in areas where GPR data have been collected on lake ice. Generally, depth assignments in these areas have decreased dramatically. In some cases, drilling results have revealed faulty interpretations of geological horizons, for example moraine instead of bedrock, internal reflectors within the overburden that have been misinterpreted for important geological horizons etc. It has been found that the previous depth assignments made in areas with predominantly moraine overburden have been very good, while areas with abundant clay have been exaggerated,

It has also been found that the interpretation in areas with undulating bedrock topography or blocky moraine is made more reliable by incorporating information on outcropping bedrock. In addition, this data have been found to be very useful for the interpretation in areas with no information from boreholes and poor GPR data.

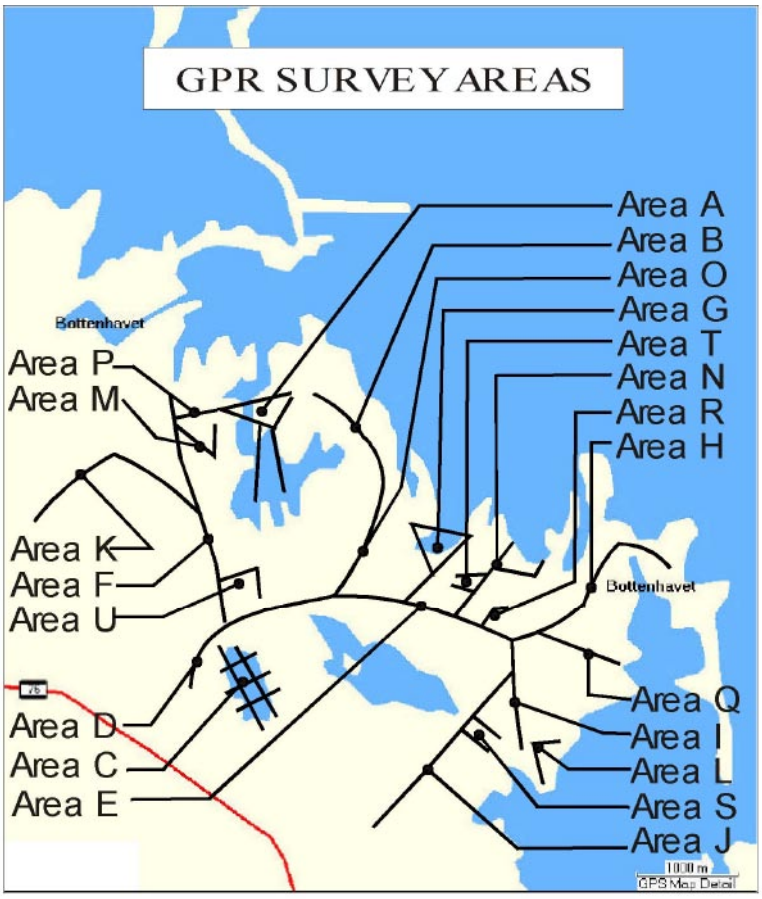
Inevitably, discrepancies between the results presented in this report and new data will emerge. By incorporating new data in future re-interpretations of the GPR data, the new data can be used to improve the interpretation rather than dismantling it.

5 References

/1/. **Marek R, 2004.** Ground penetrating radar survey 2003. SKB P-04-78. Svensk Kärnbränslehantering AB:

Appendix 1

GPR survey areas

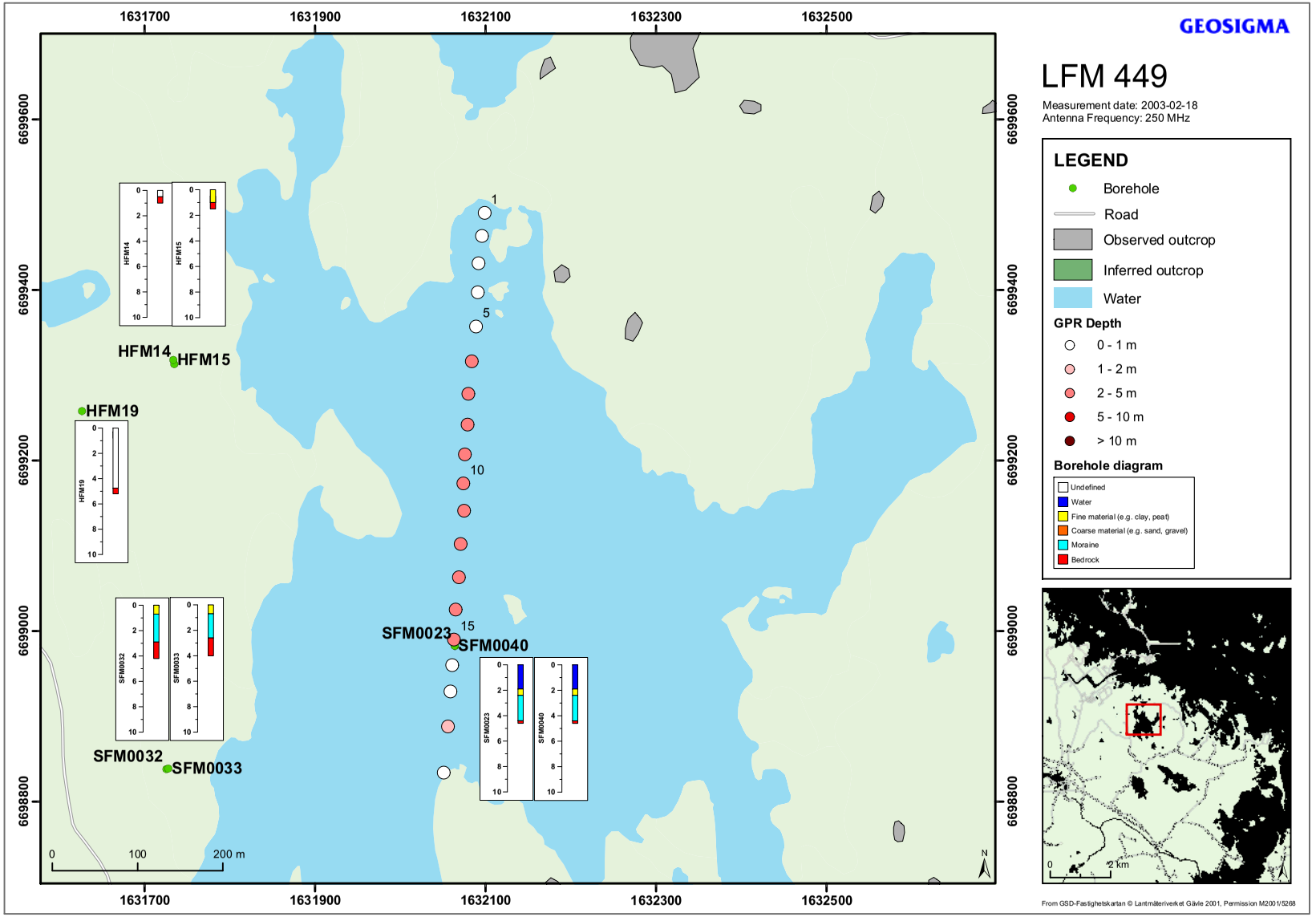


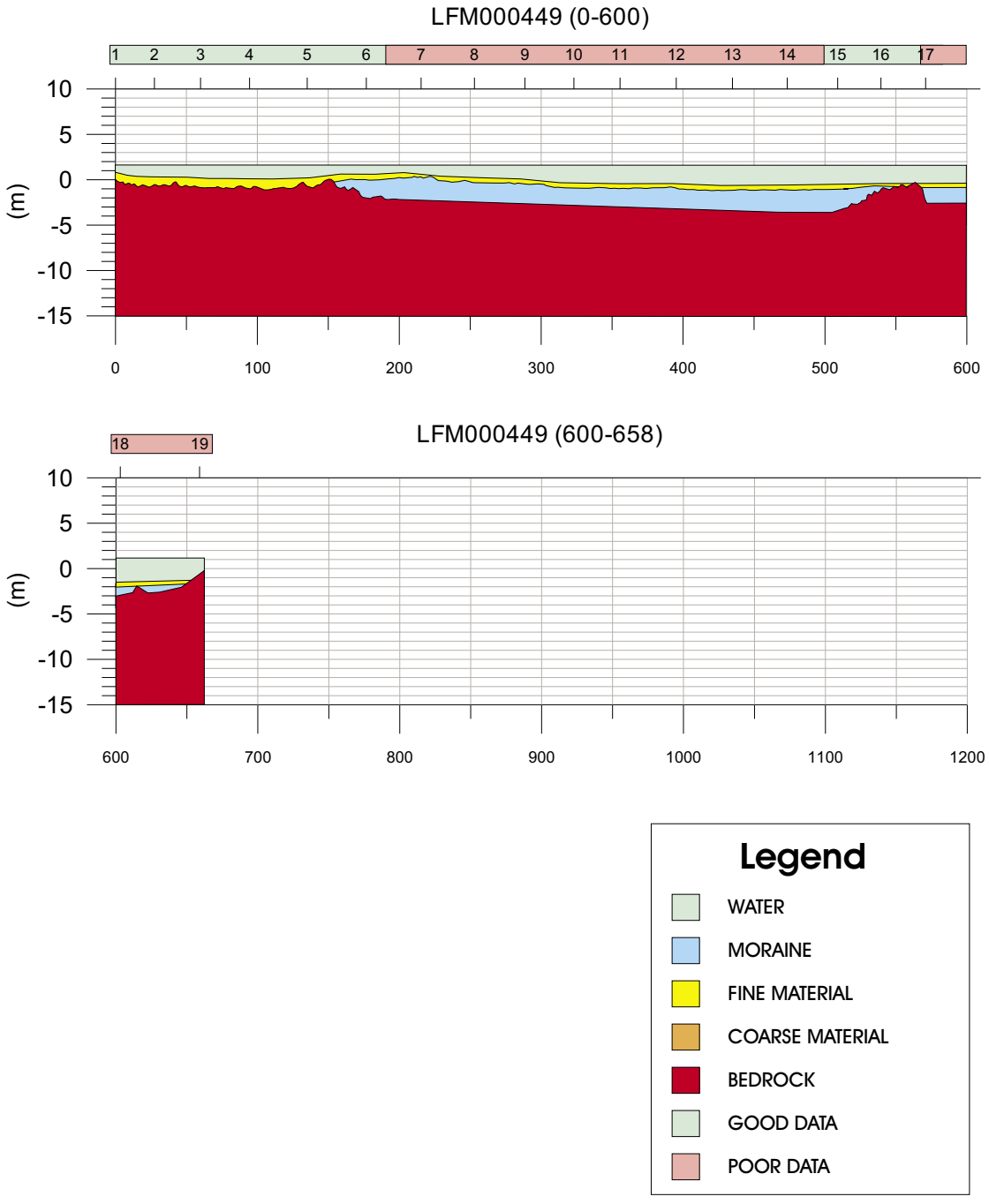
Interpreted profiles (LFM – ID:s) within the survey areas:

Area A	LFM000449-451, LFM000453-454
Area B	LFM000461-463
Area C	LFM000464-473
Area D	LFM000474-479, LFM000481-482
Area E	LFM000483, LFM000486-487
Area F	LFM000489, LFM000491-492
Area G	LFM000494
Area H	LFM000502-505
Area I	LFM000508
Area J	LFM000510-511
Area K	LFM000514, LFM000517-519
Area L	LFM000521
Area M	LFM000523-524
Area N	LFM000525-526
Area O	LFM000529-530
Area P	LFM000533-534
Area Q	-
Area R	LFM000537
Area S	-
Area T	LFM000543, LFM000545-547
Area U	LFM000548-549

Interpretation maps and sections

(här följer ritningar o sektioner i LFM-nr ordning)

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10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000449 (600-658)
18 19
10
5
0
-5
-10
-15
(m)
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Legend
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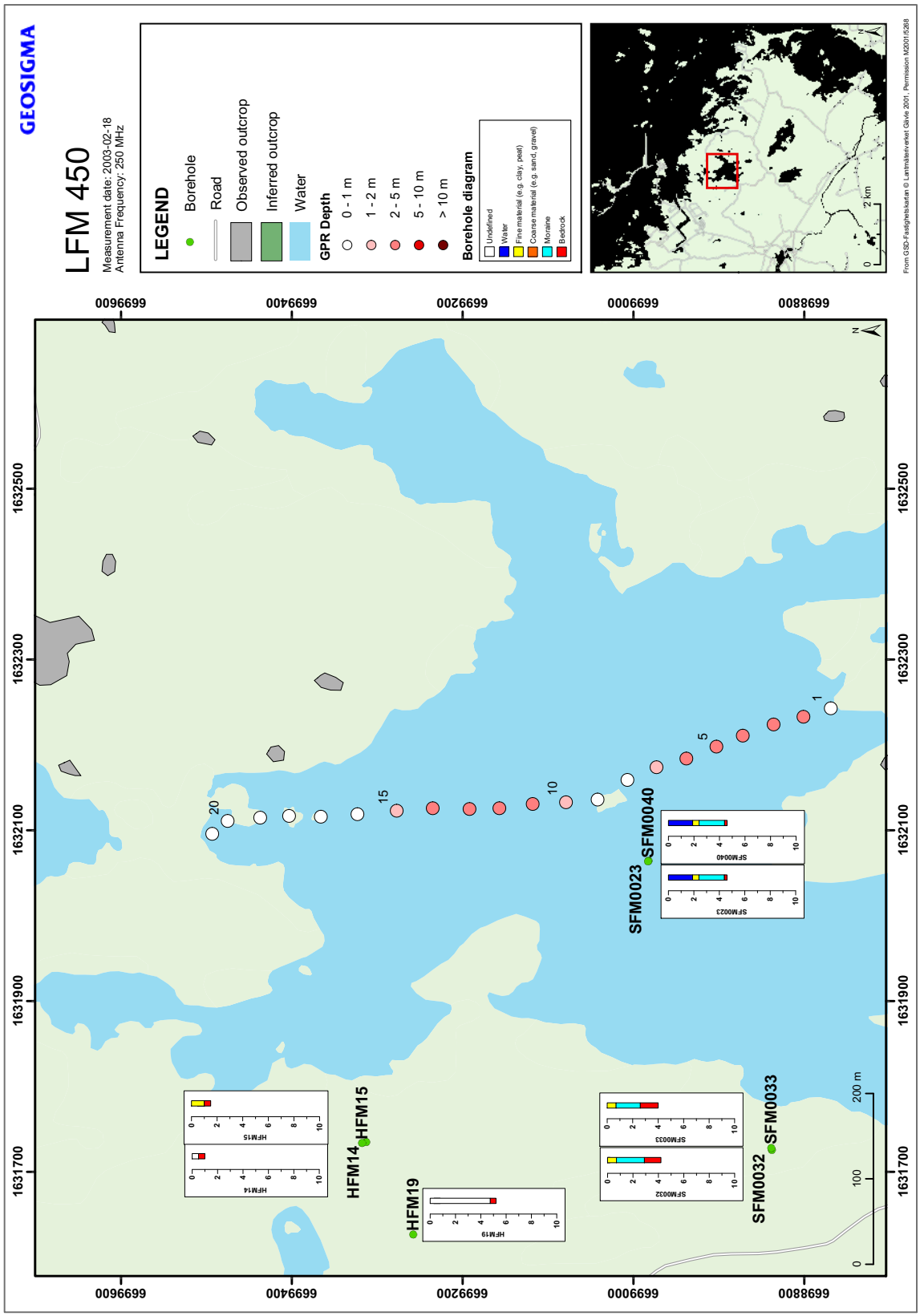
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA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Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001. Permission M2001/5368
6699600
6699400
6699200
6699000
6698800
1632500
1632300
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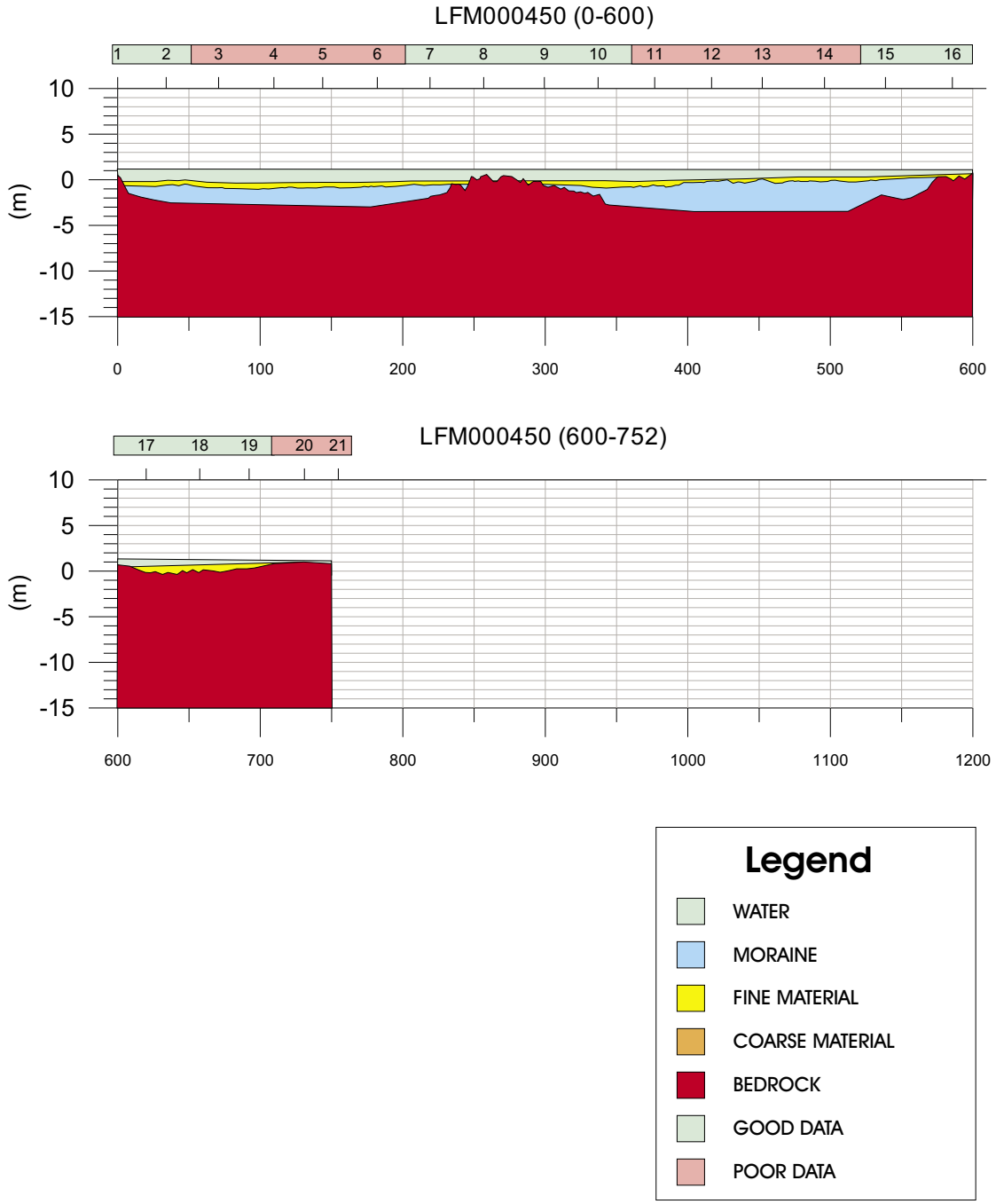
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(m)
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LFM000450 (600-752)
17 18 19 20 21
10
5
0
-5
-10
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(m)
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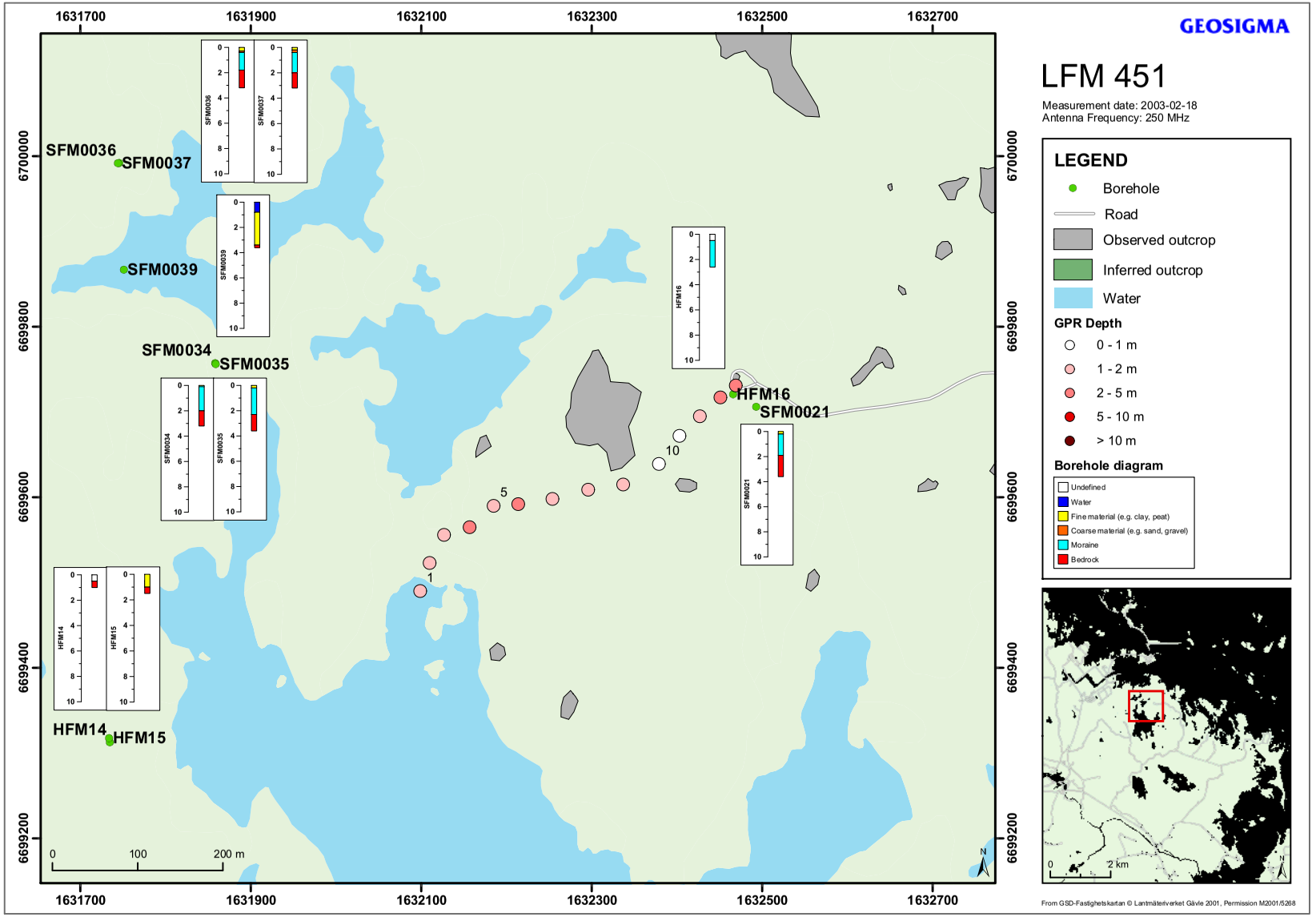
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA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LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0036
SFM0037
SFM0039
SFM0034
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SFM0021
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HFM15
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100
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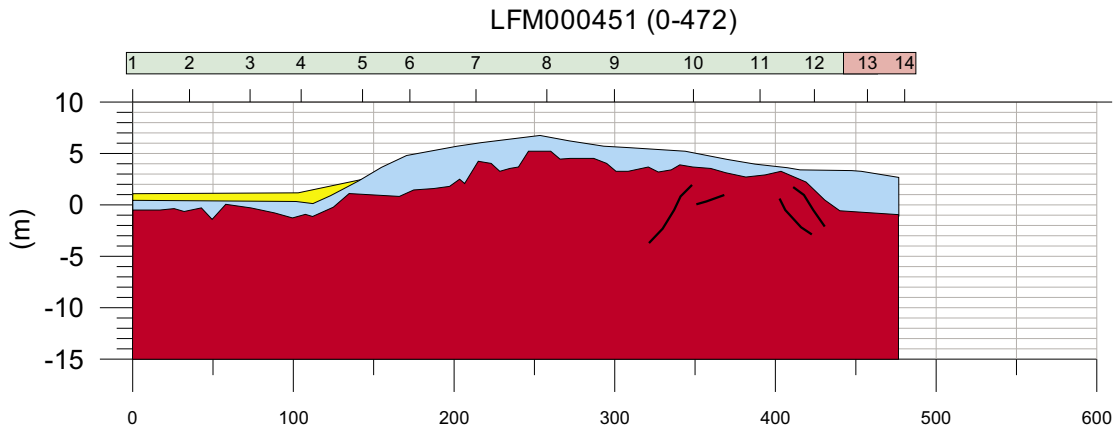
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268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-10
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(m)
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400
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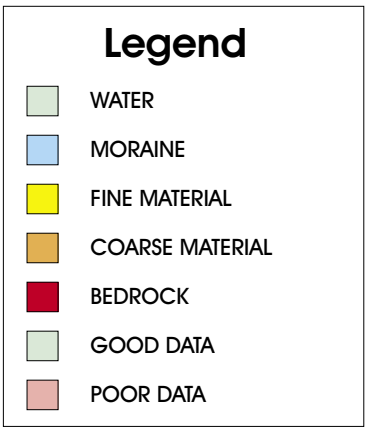
600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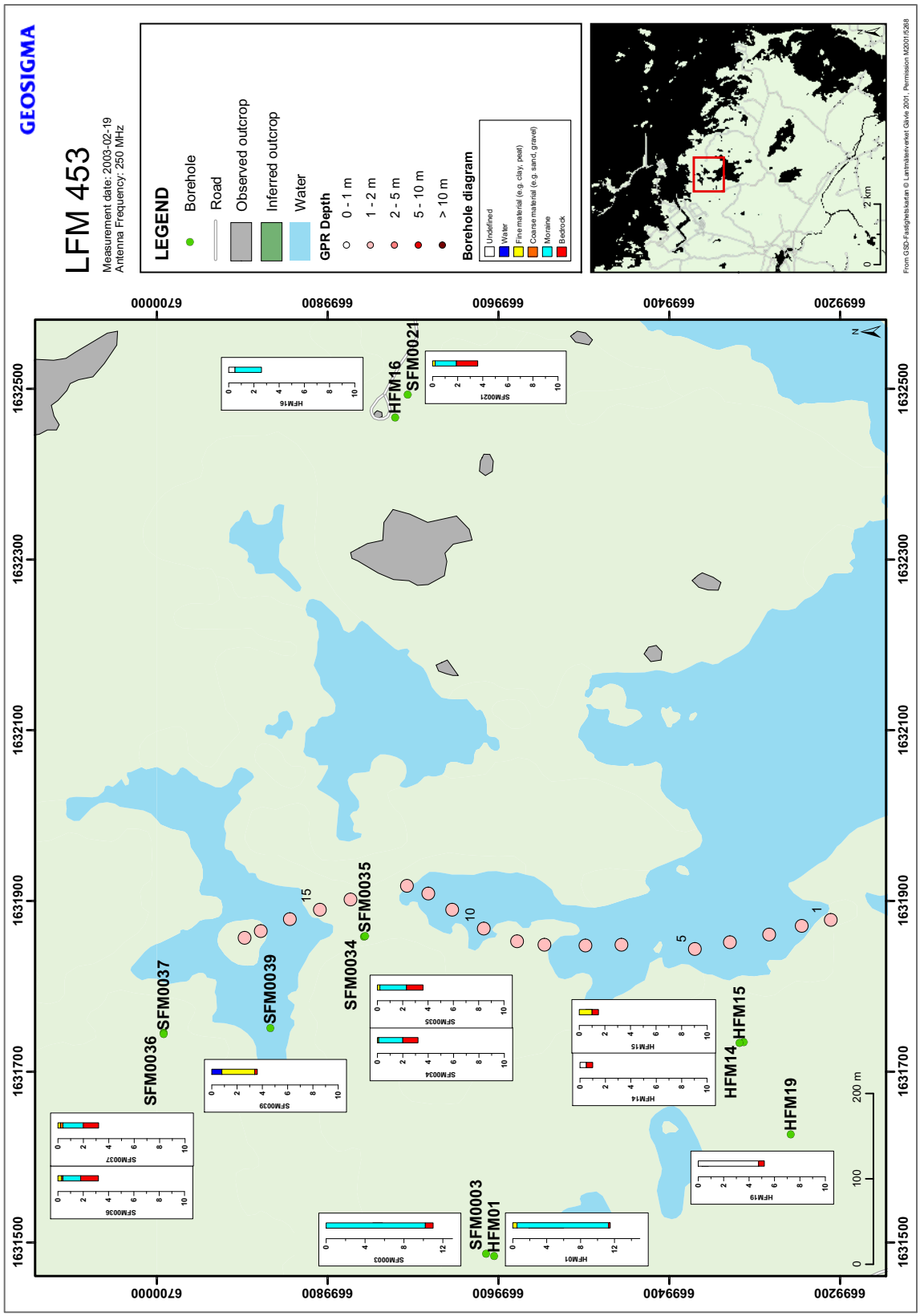
POOR DATA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Inferred outcrop
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GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
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Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0021
HFM16
SFM0035
SFM0034
SFM0039
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SFM0003
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200 m
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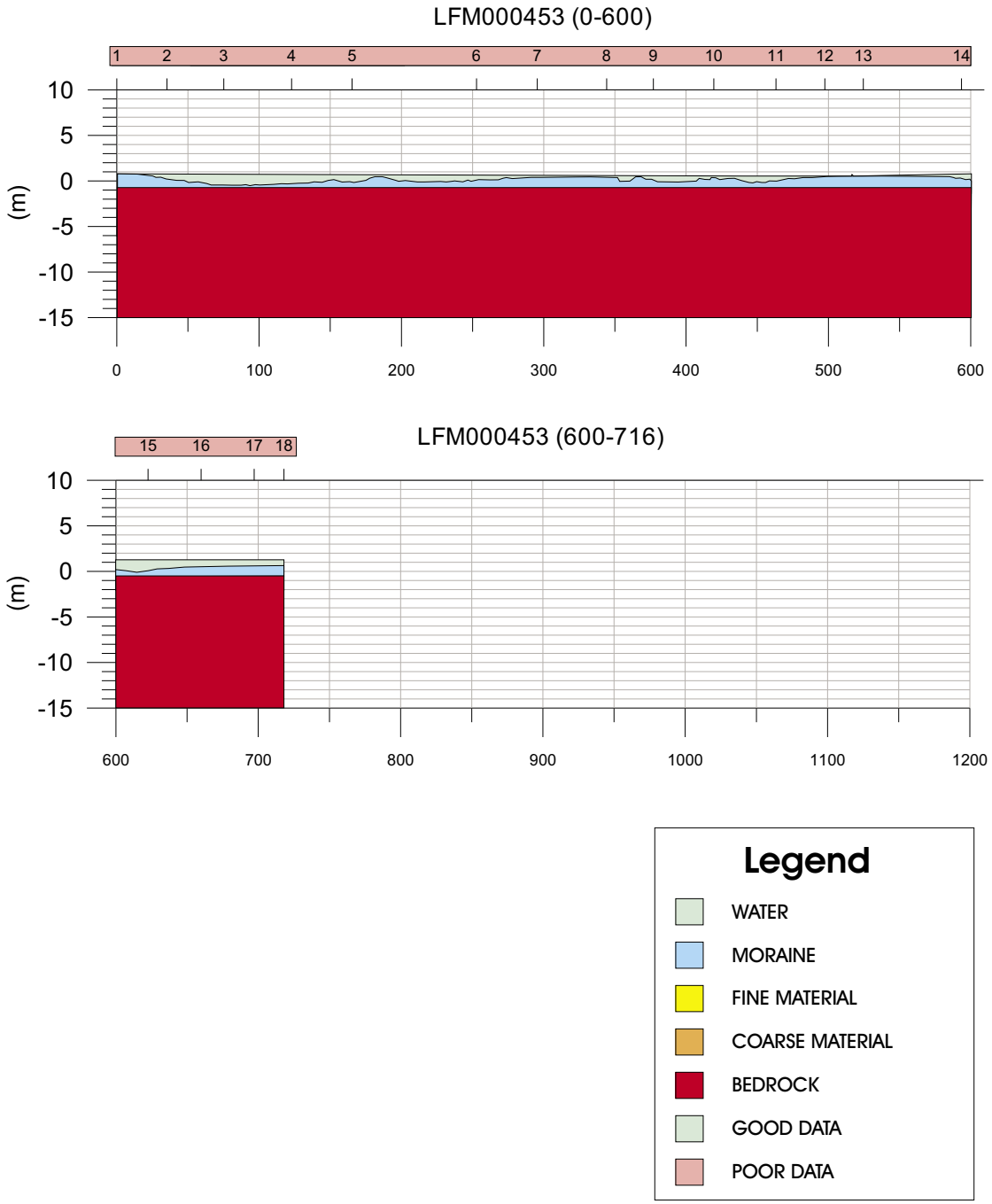
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-10
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COARSE MATERIAL
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GOOD DATA
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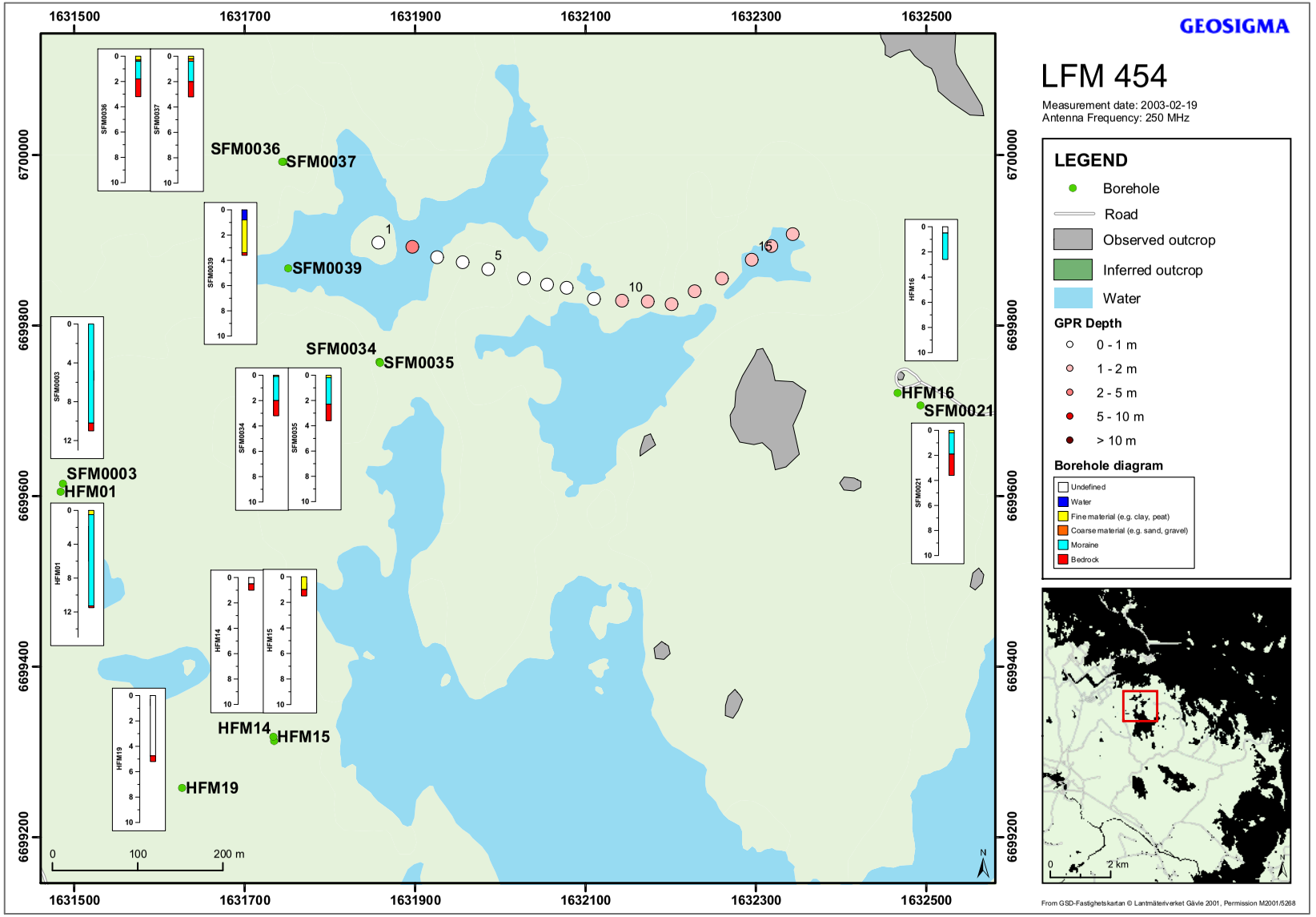
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1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
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Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0036
SFM0037
SFM0039
SFM0034
SFM0035
HFM16
SFM0021
SFM0003
HFM01
HFM14
HFM15
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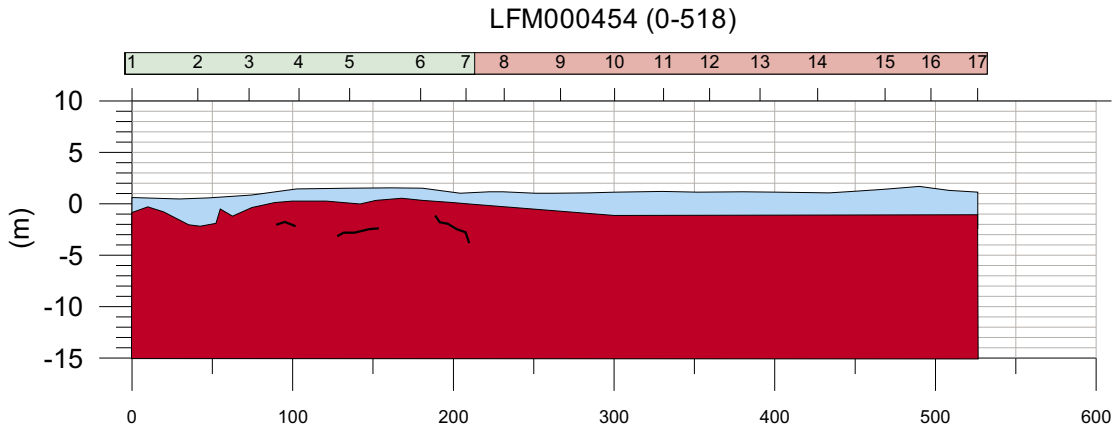
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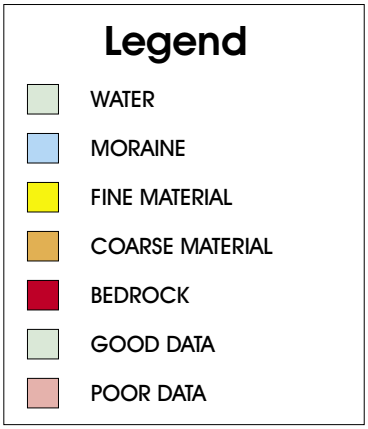
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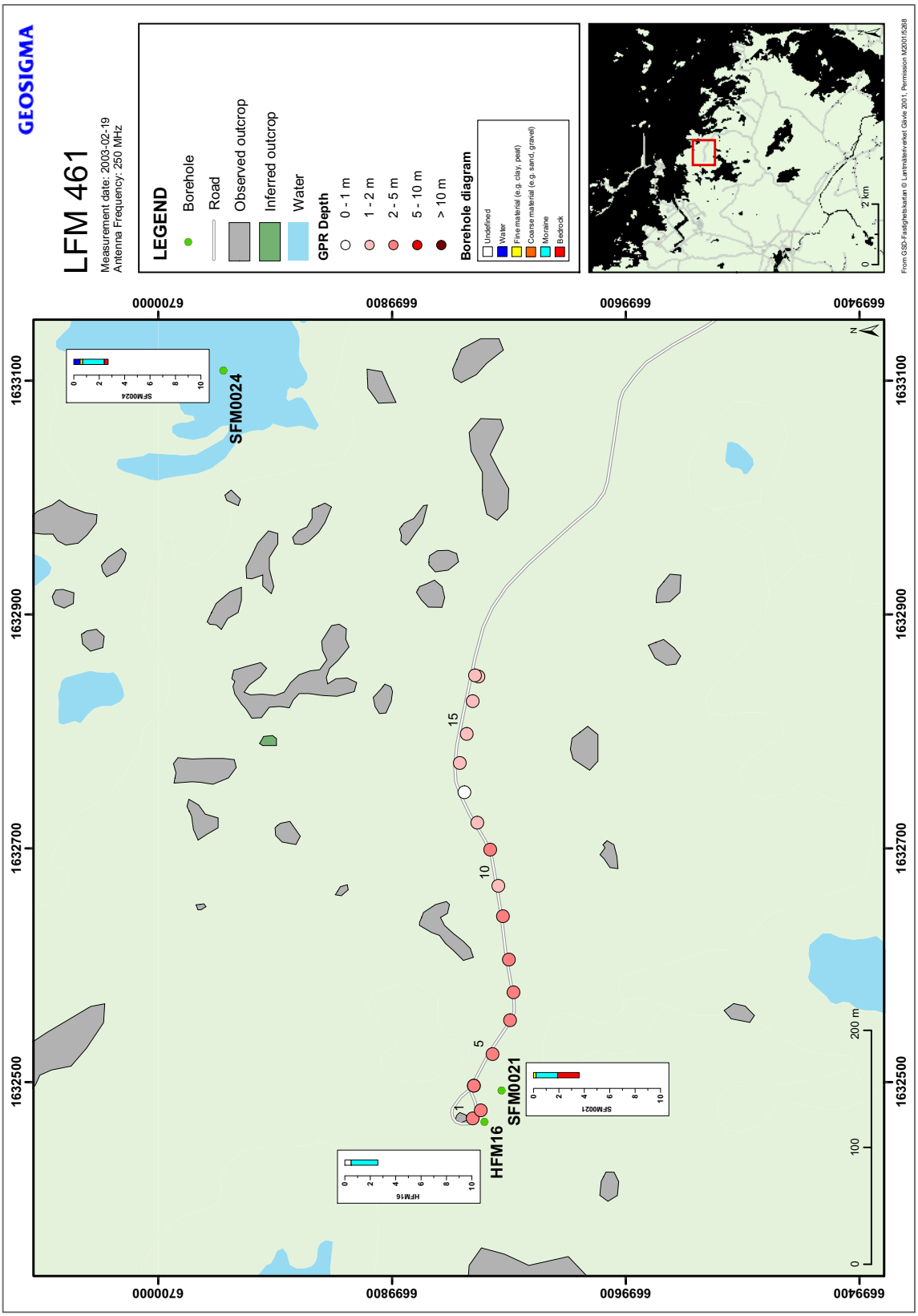
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Inferred outcrop
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GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
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Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0024
SFM0021
HFM16
1
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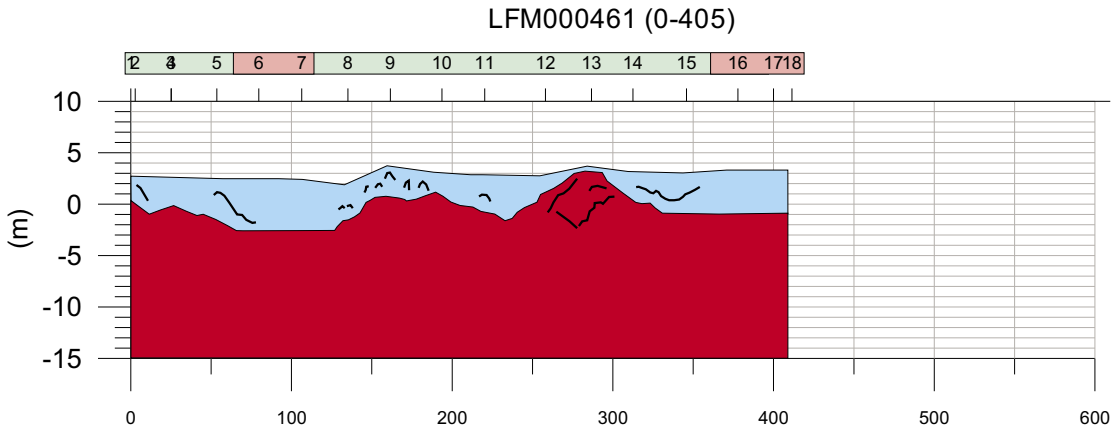
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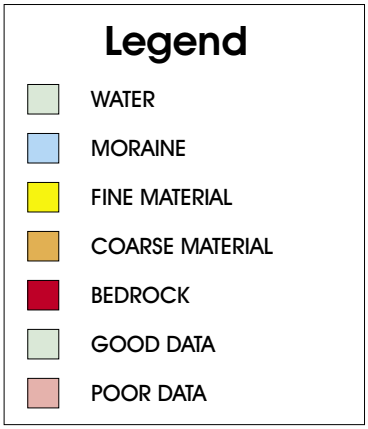
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MORAINE
FINE MATERIAL
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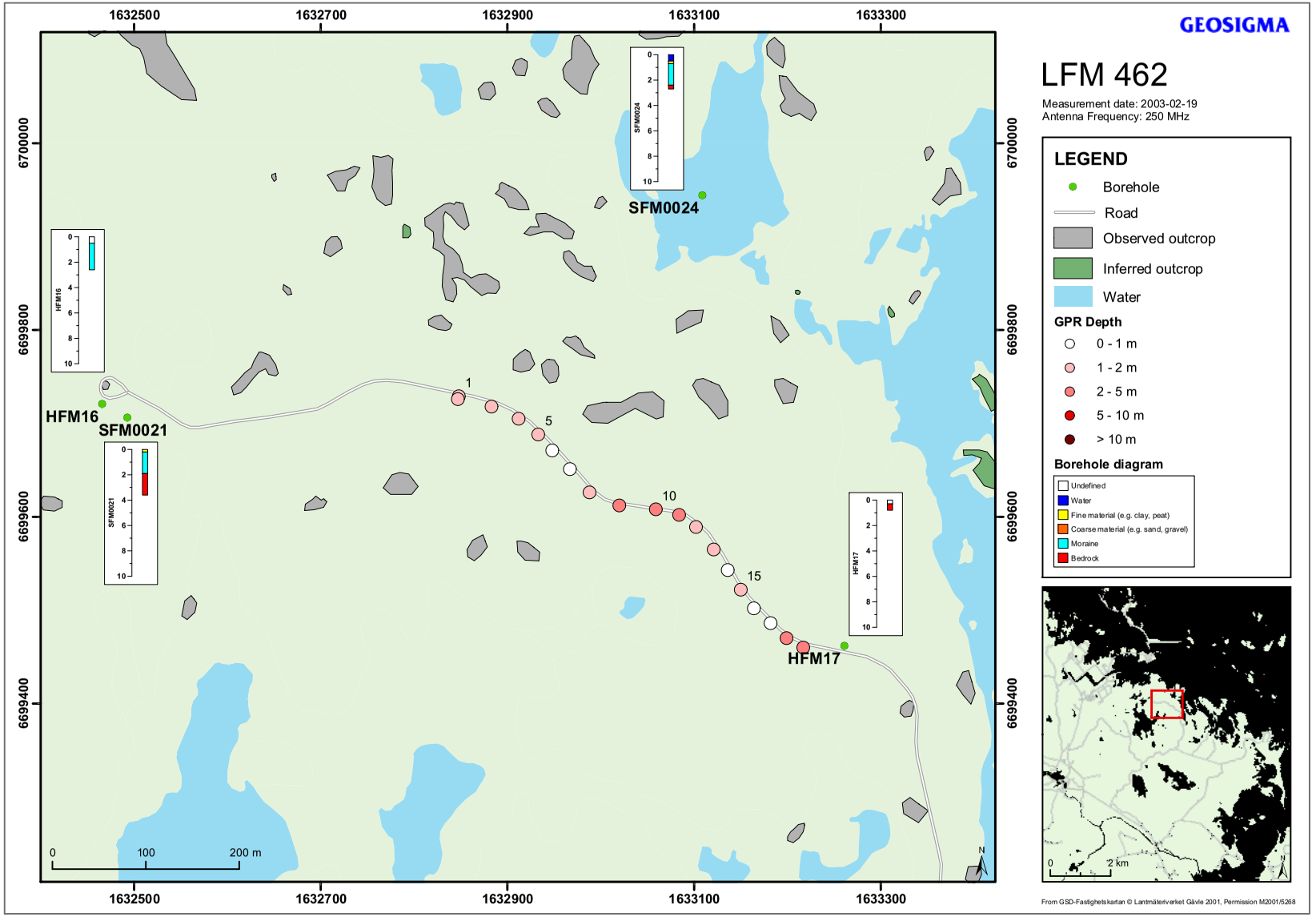
GEOSIGMA
LFM 462
Measurement date: 2003-02-19
Antenna Frequency: 250 MHz
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Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
1632500
1632700
1632900
1633100
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6700000
6699800
6699600
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SFM0024
HFM16
SFM0021
HFM17
1
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100
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2 km
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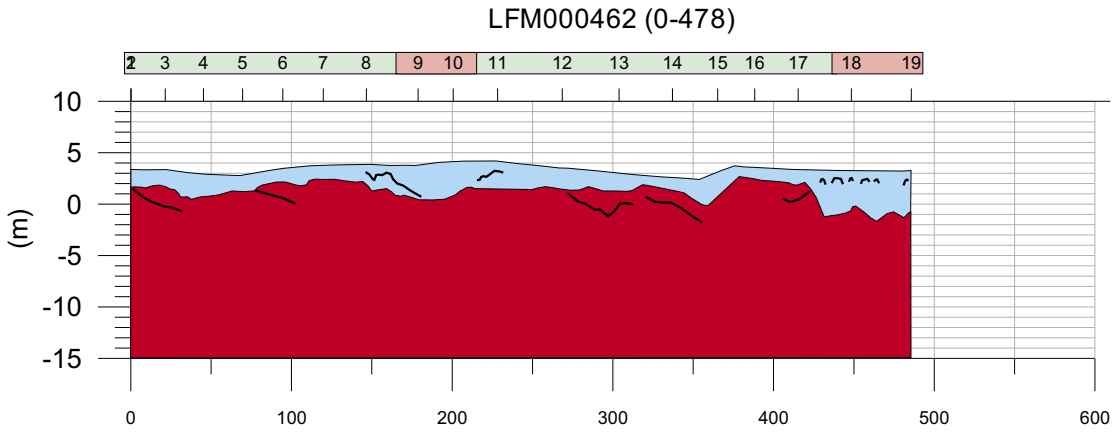
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-5
-10
-15
(m)
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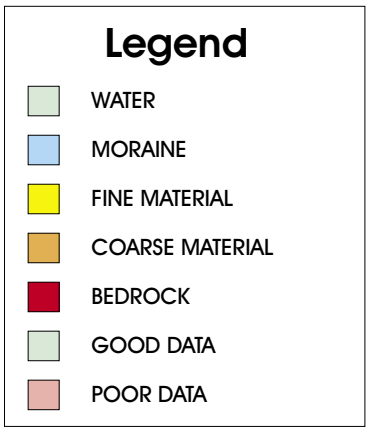
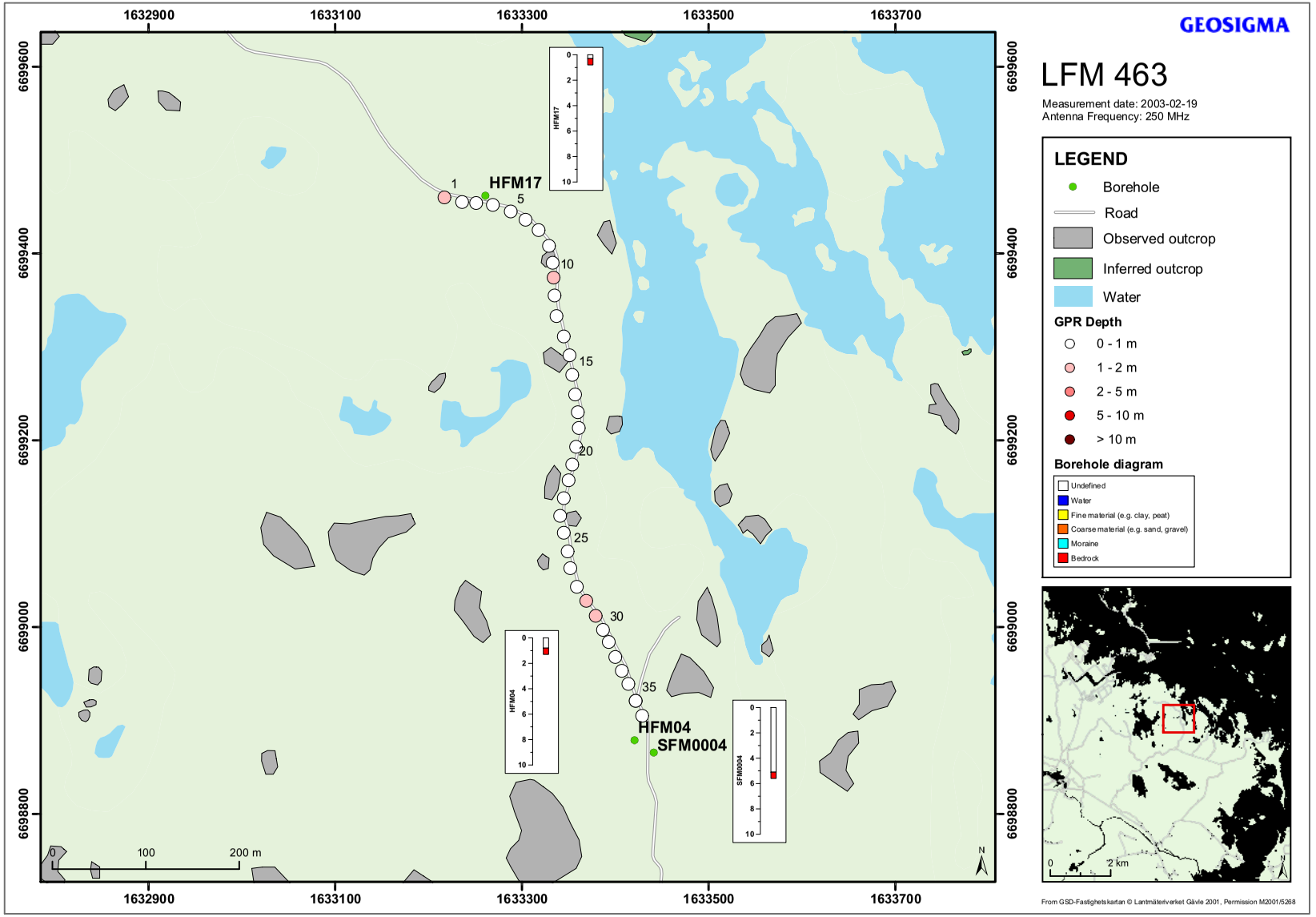
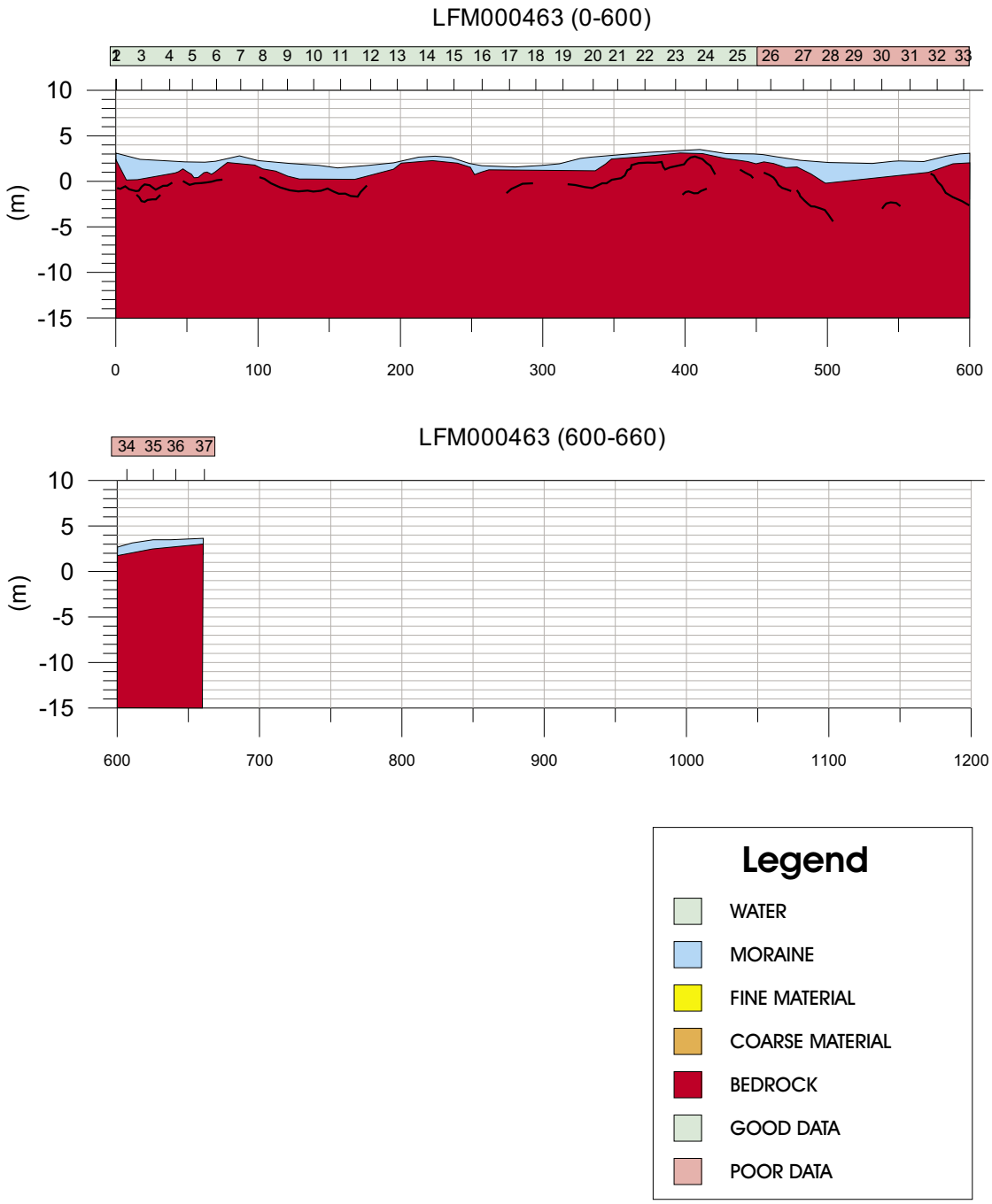
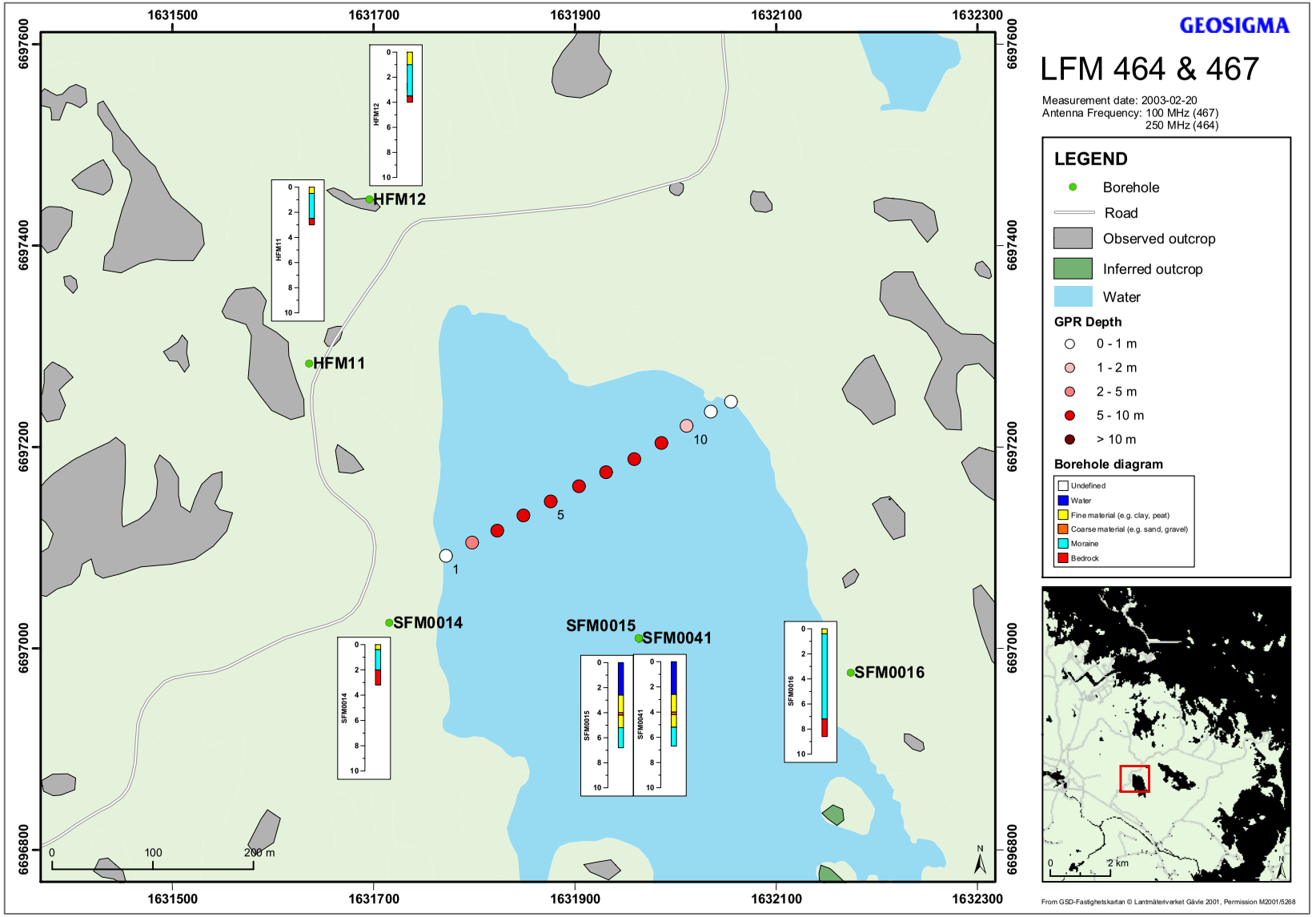
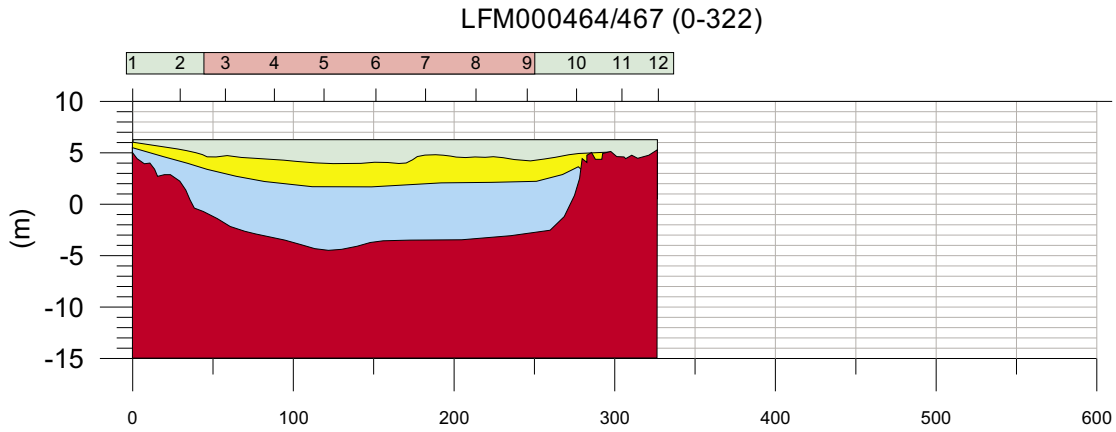
100
200
300
400
500
600

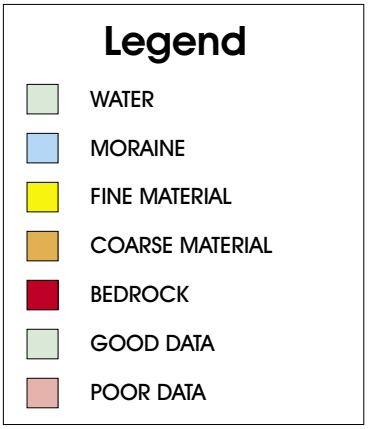

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

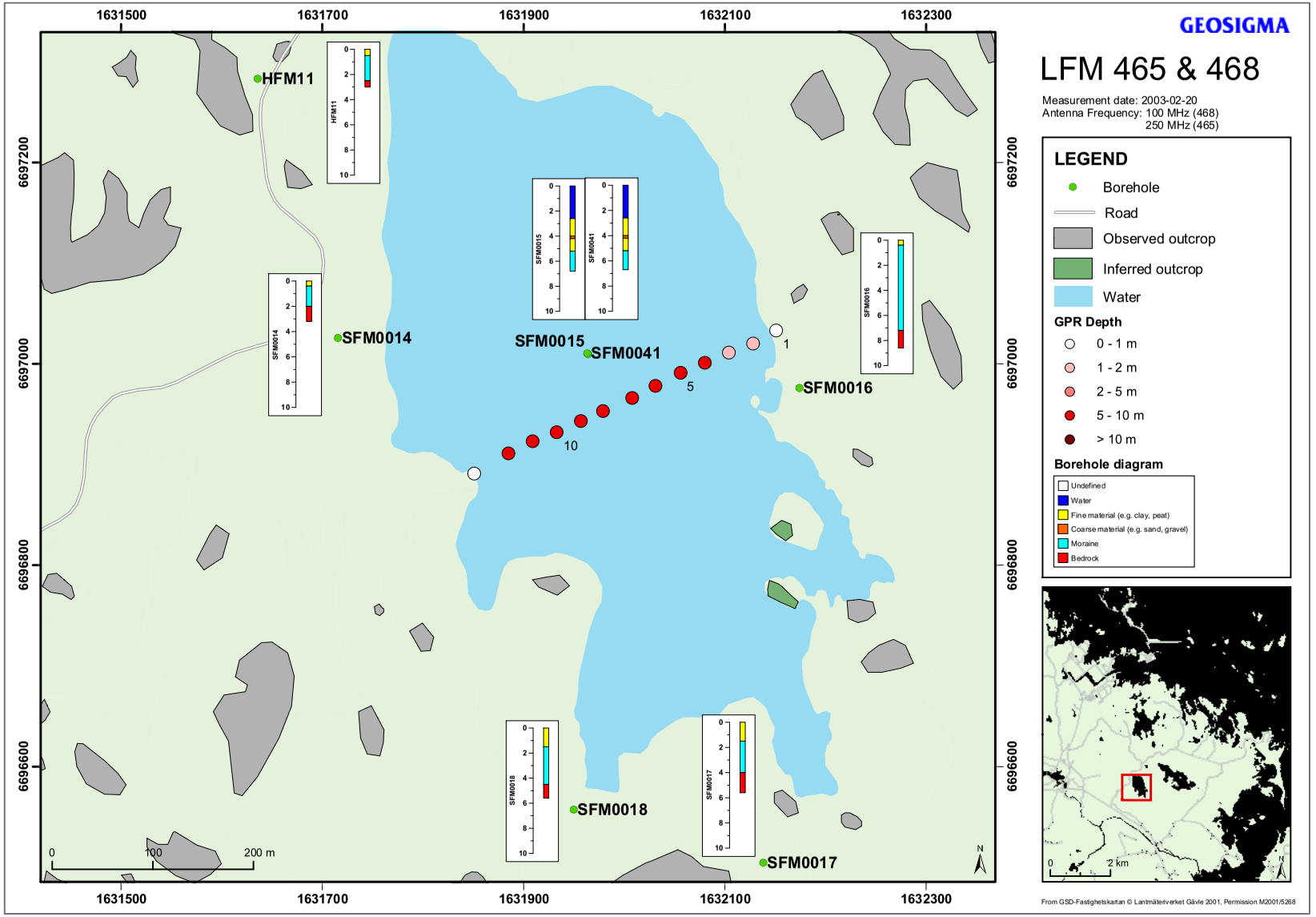

GEOSIGMA
LFM 463
Measurement date: 2003-02-19
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM17
HFM04
SFM0004
1632900
1633100
1633300
1633500
1633700
6699600
6699400
6699200
6699000
6698800
0
100
200 m
N
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

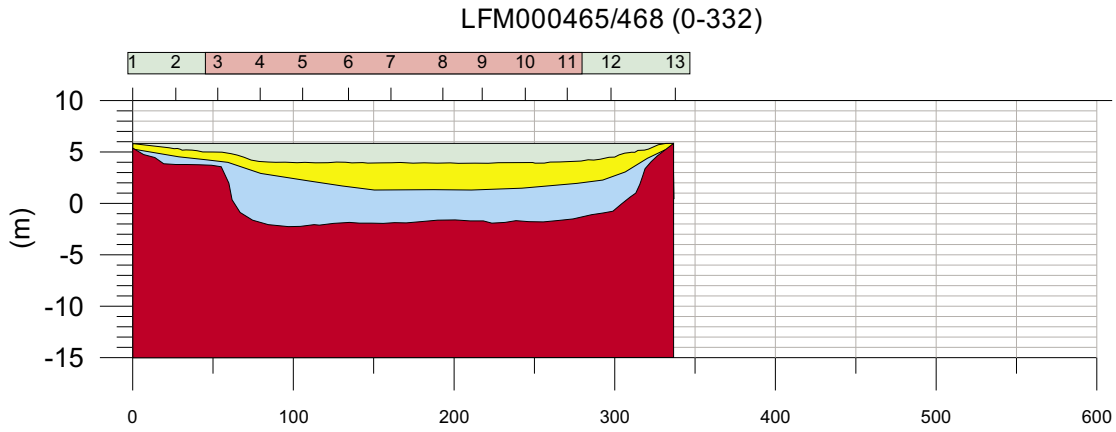

LFM000463 (0-600)
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000463 (600-660)
34 35 36 37
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200
Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

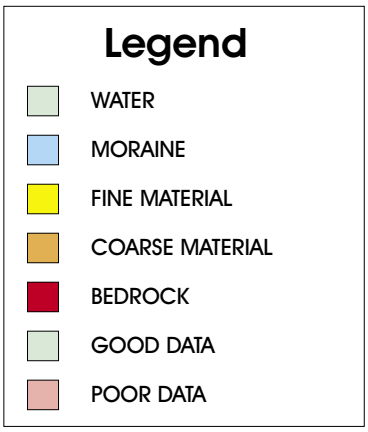

GEOSIGMA
LFM 464 & 467
Measurement date: 2003-02-20
Antenna Frequency: 100 MHz (467)
250 MHz (464)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM12
HFM11
SFM0014
SFM0015
SFM0041
SFM0016
1
5
10
1631500
1631700
1631900
1632100
1632300
6697600
6697400
6697200
6697000
6696800
0
100
200 m
N
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

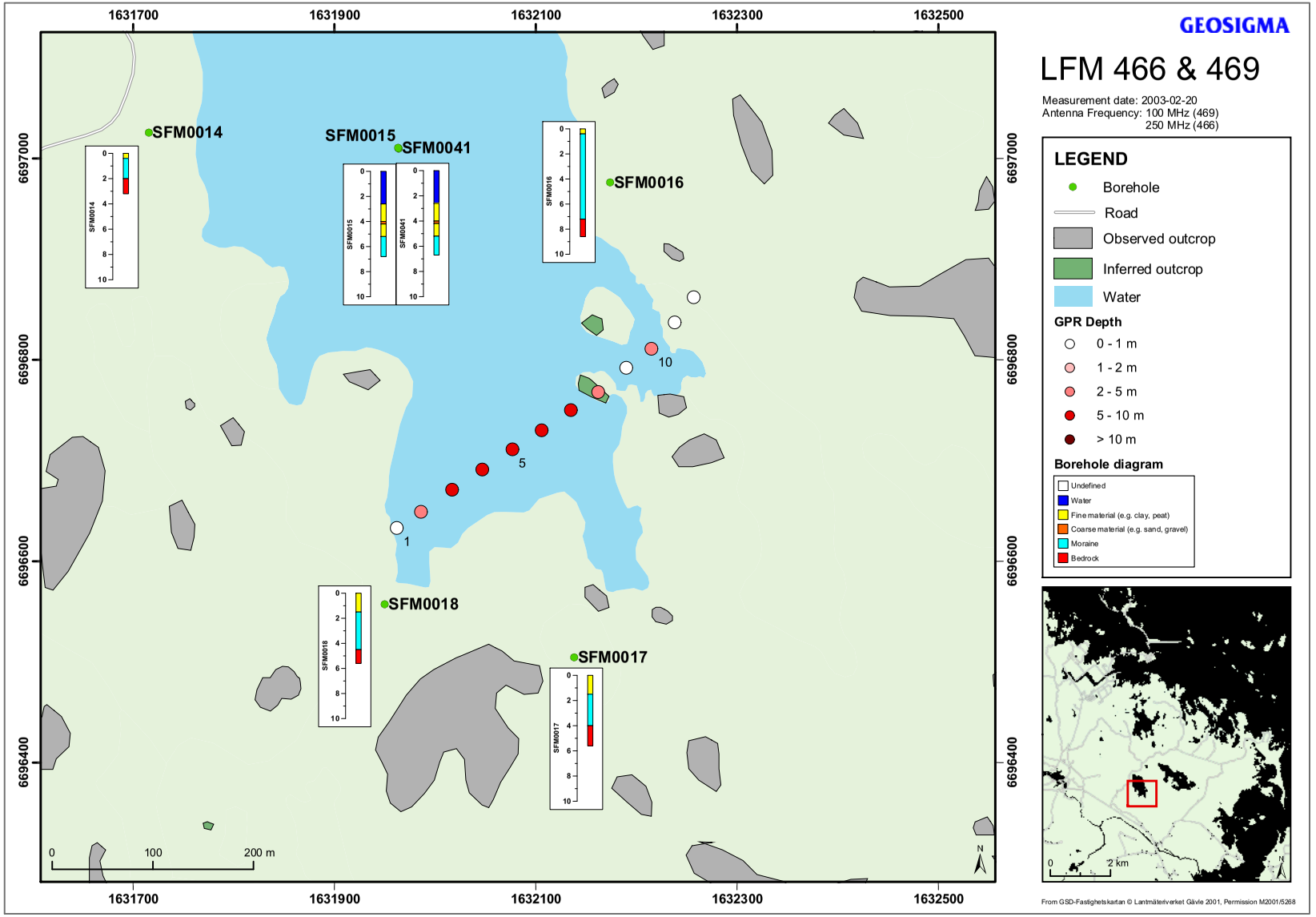

LFM000464/467 (0-322)
1 2 3 4 5 6 7 8 9 10 11 12
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

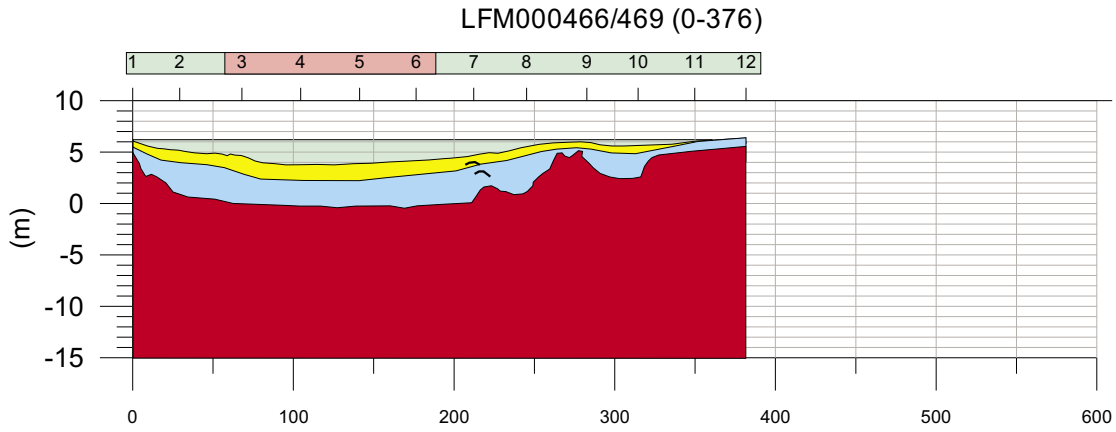

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

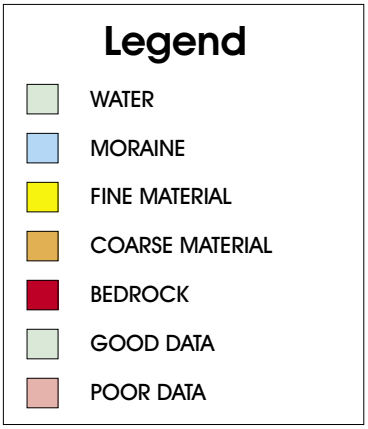

GEOSIGMA
LFM 465 & 468
Measurement date: 2003-02-20
Antenna Frequency: 100 MHz (468)
250 MHz (465)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM11
SFM0014
SFM0015
SFM0041
SFM0016
SFM0018
SFM0017
1
5
10
1631500
1631700
1631900
1632100
1632300
6697200
6697000
6696800
6696600
0
100
200 m
0
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

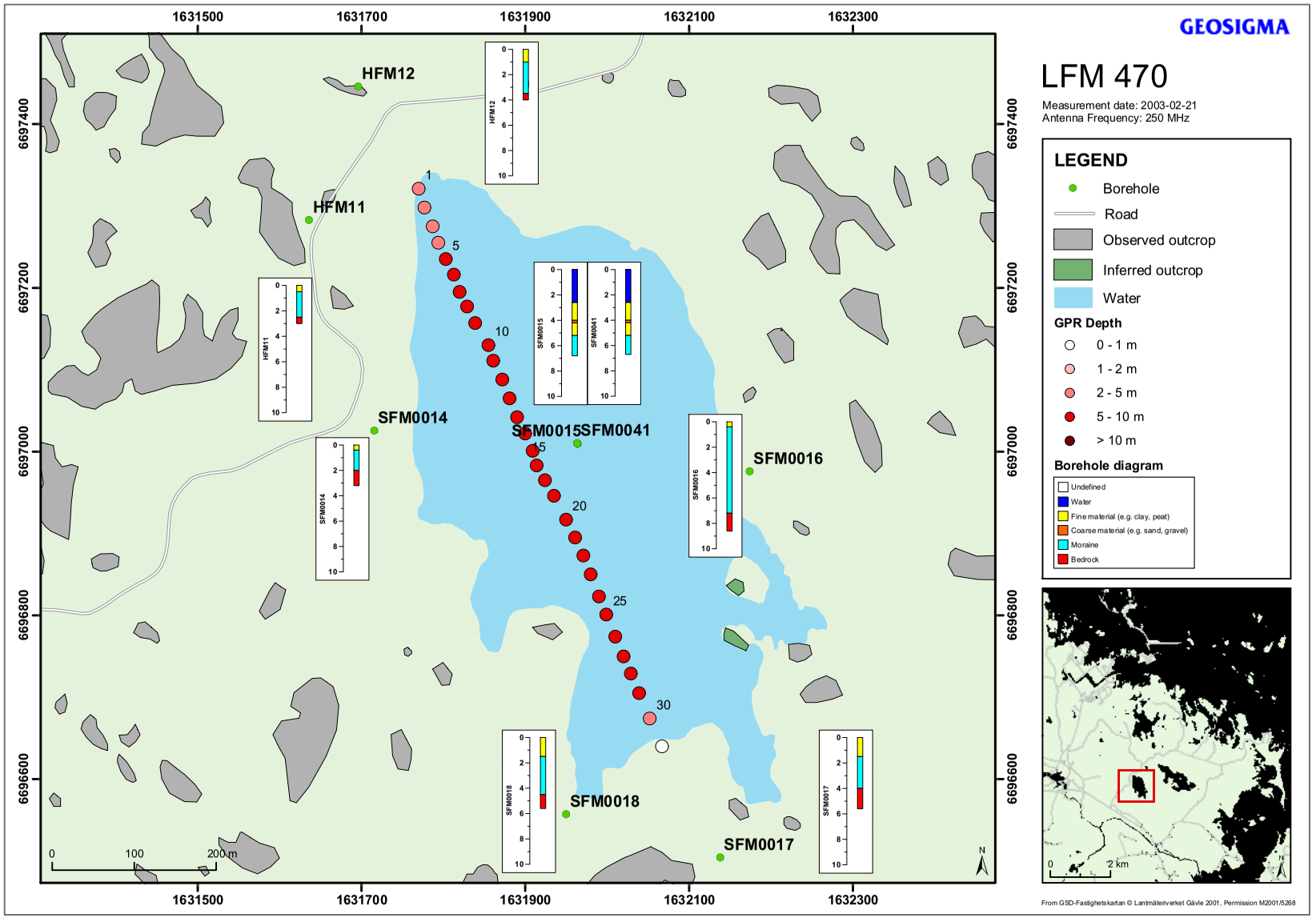

LFM000465/468 (0-332)
1 2 3 4 5 6 7 8 9 10 11 12 13
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

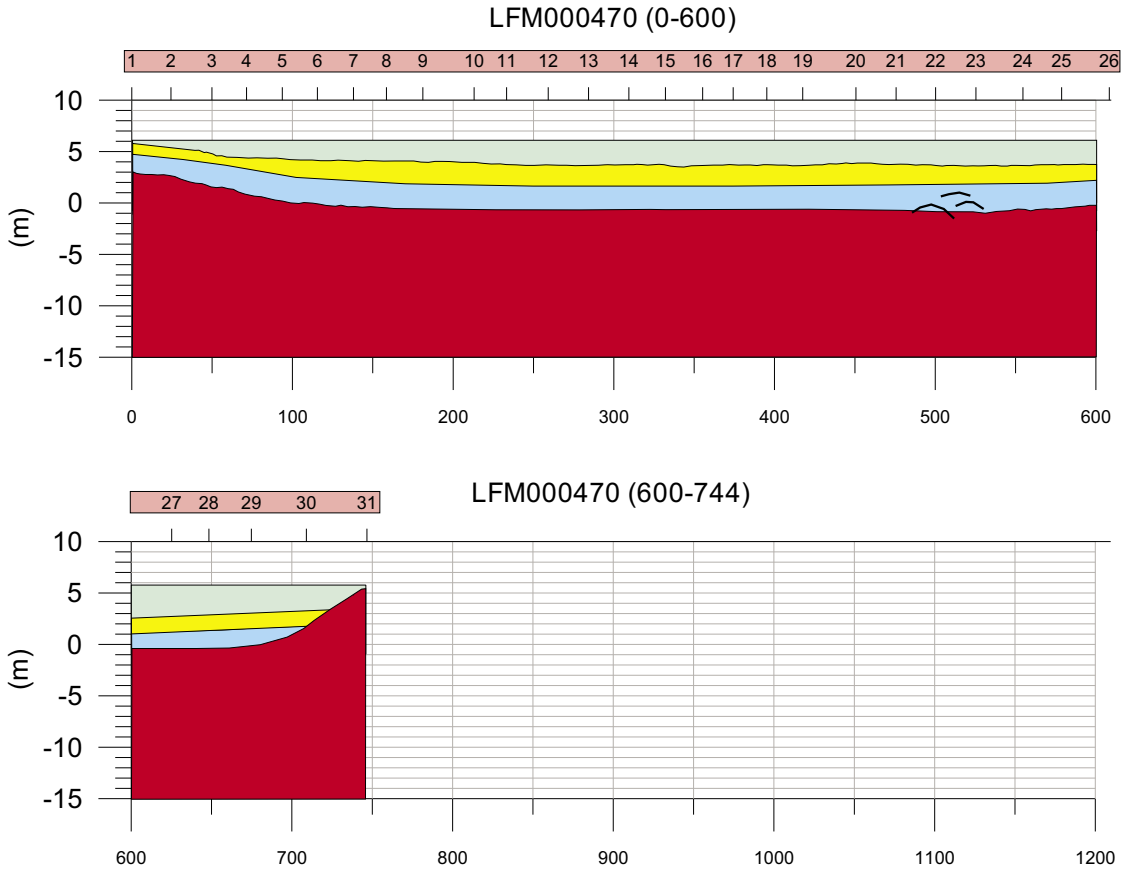

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

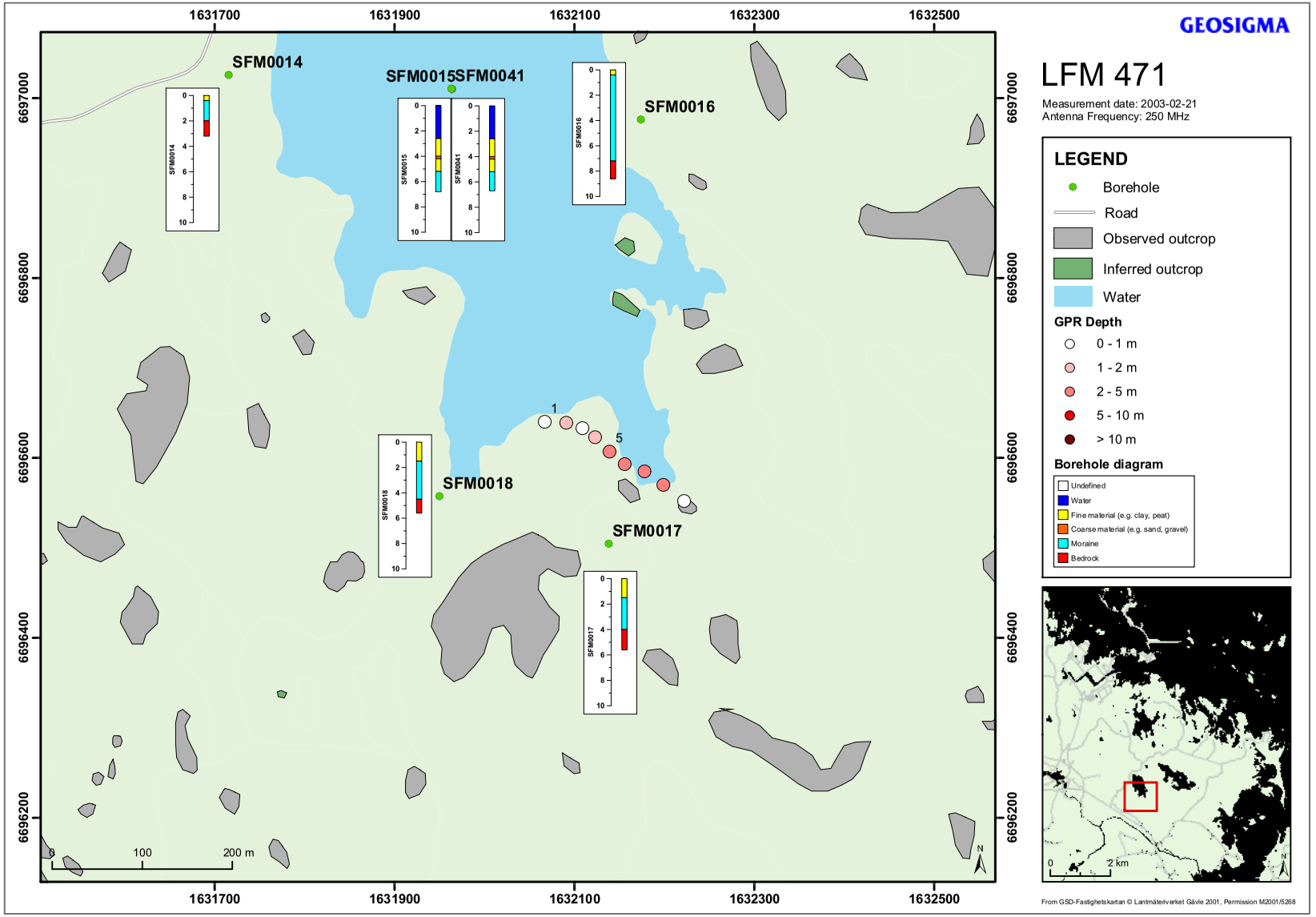

GEOSIGMA
LFM 466 & 469
Measurement date: 2003-02-20
Antenna Frequency: 100 MHz (469)
250 MHz (466)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0014
SFM0015
SFM0041
SFM0016
SFM0018
SFM0017
1
5
10
1631700
1631900
1632100
1632300
1632500
6697000
6696800
6696600
6696400
0
100
200 m
N
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

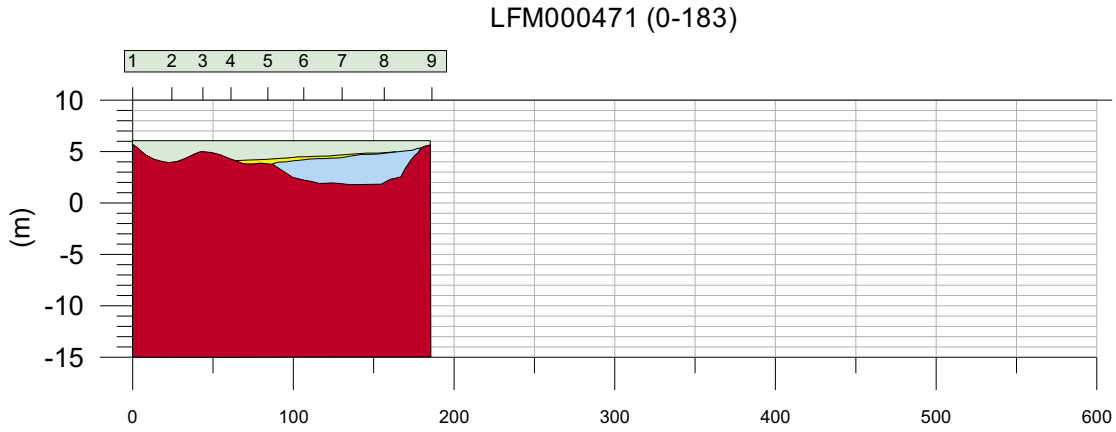

LFM000466/469 (0-376)
1 2 3 4 5 6 7 8 9 10 11 12
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

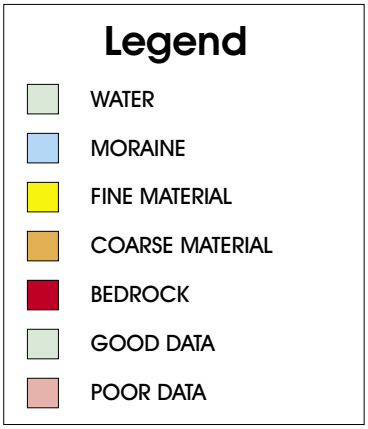

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

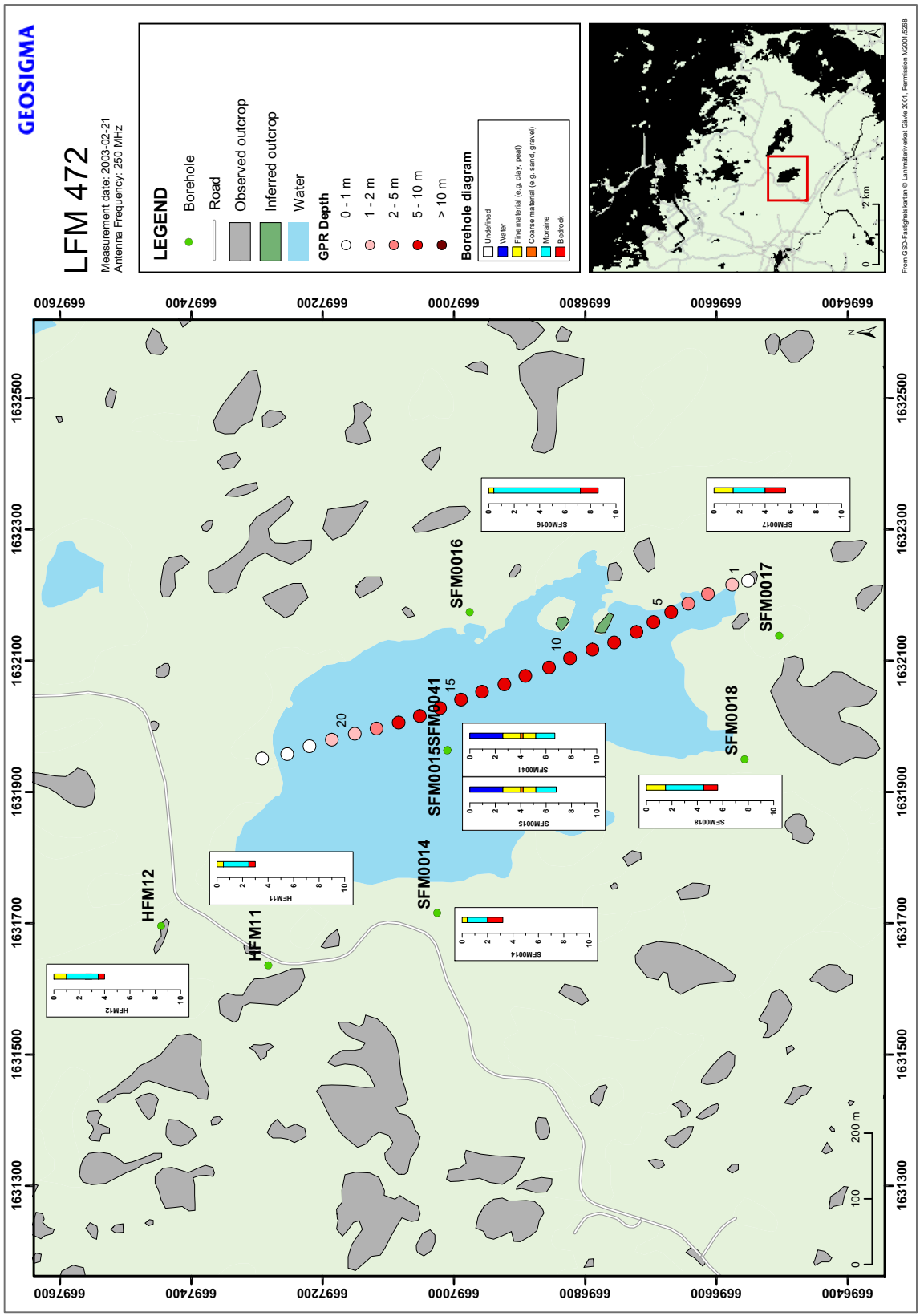

GEOSIGMA
LFM 470
Measurement date: 2003-02-21
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM12
HFM11
SFM0014
SFM0015
SFM0041
SFM0016
SFM0018
SFM0017
1631500
1631700
1631900
1632100
1632300
6697400
6697200
6697000
6696800
6696600
0
100
200 m
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

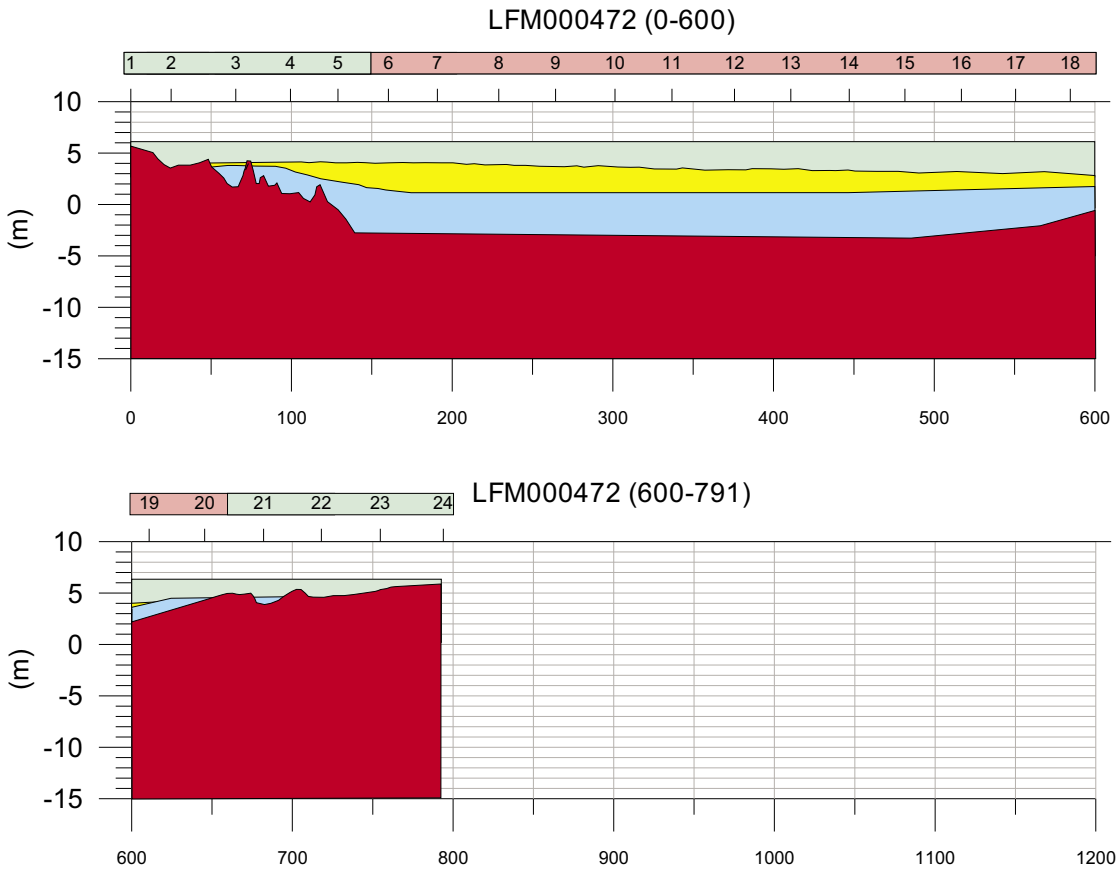

LFM000470 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000470 (600-744)
27 28 29 30 31
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200
Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

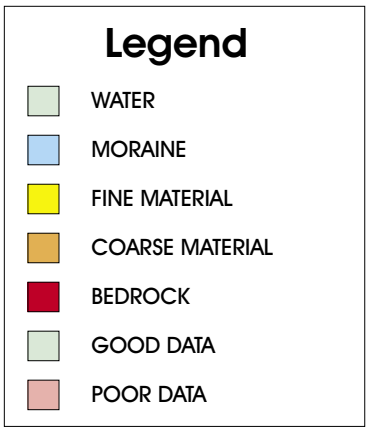

GEOSIGMA
LFM 471
Measurement date: 2003-02-21
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0014
SFM0015
SFM0041
SFM0016
SFM0018
SFM0017
1
5
1631700
1631900
1632100
1632300
1632500
6697000
6696800
6696600
6696400
6696200
0
100
200 m
N
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

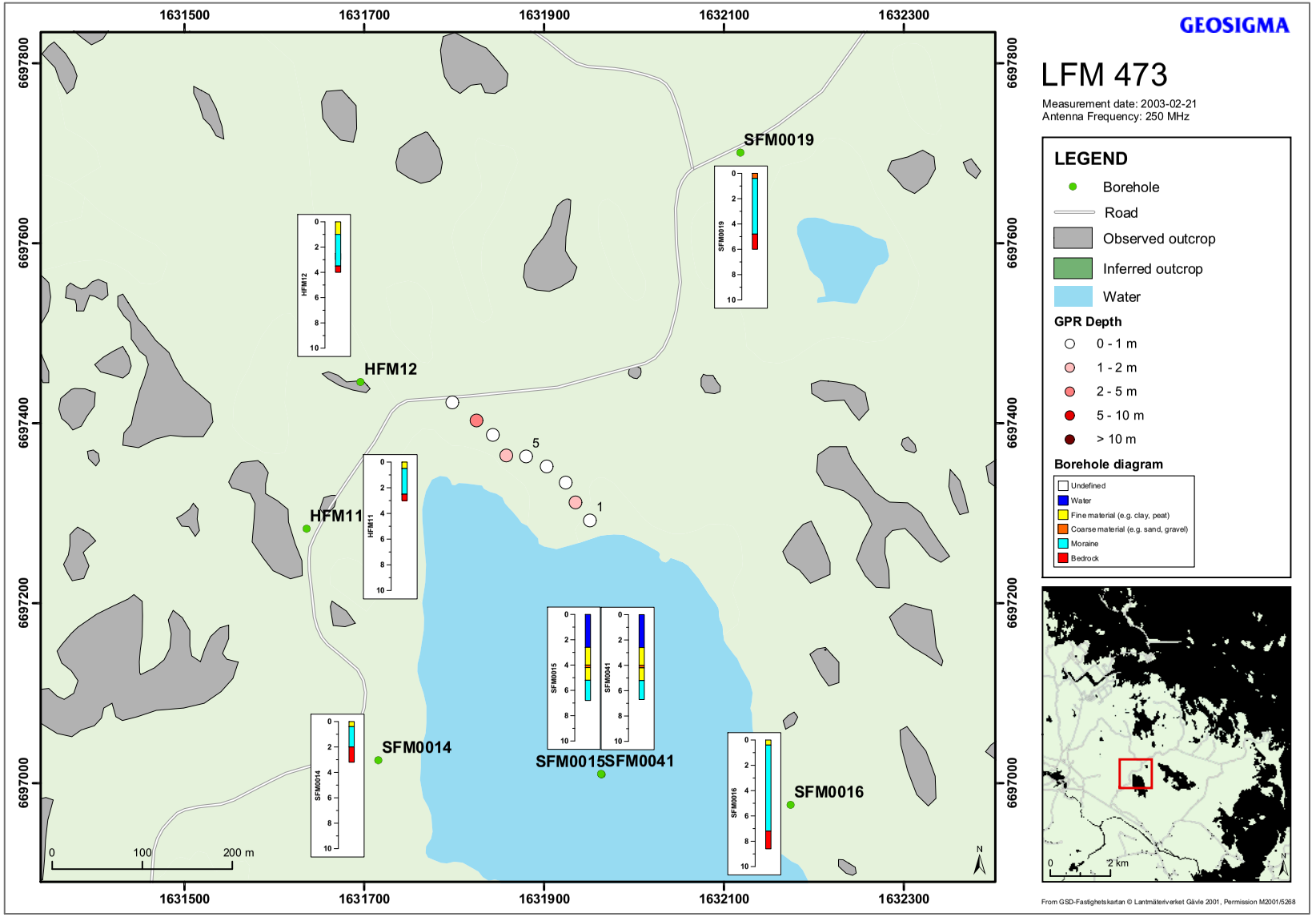

LFM000471 (0-183)
1 2 3 4 5 6 7 8 9
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

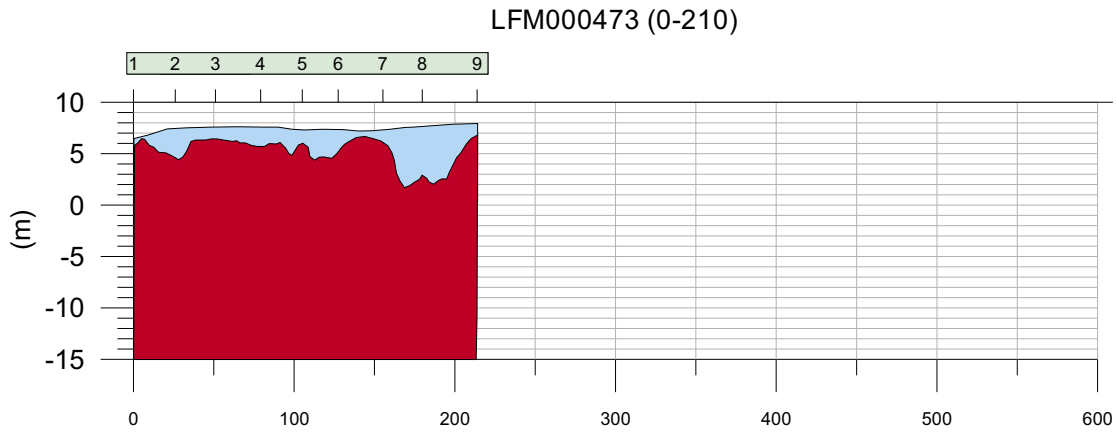

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

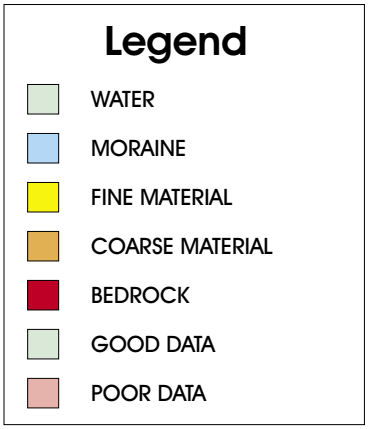

GEOSIGMA
LFM 472
Measurement date: 2003-02-21
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0016
SFM0017
SFM0018
SFM0015SFM0041
SFM0014
HFM12
HFM11
1
5
10
15
20
669640
669660
669680
669700
669720
669740
669760
1631300
1631500
1631700
1631900
1632100
1632300
1632500
0
100
200 m
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001. Permission M2001/5368

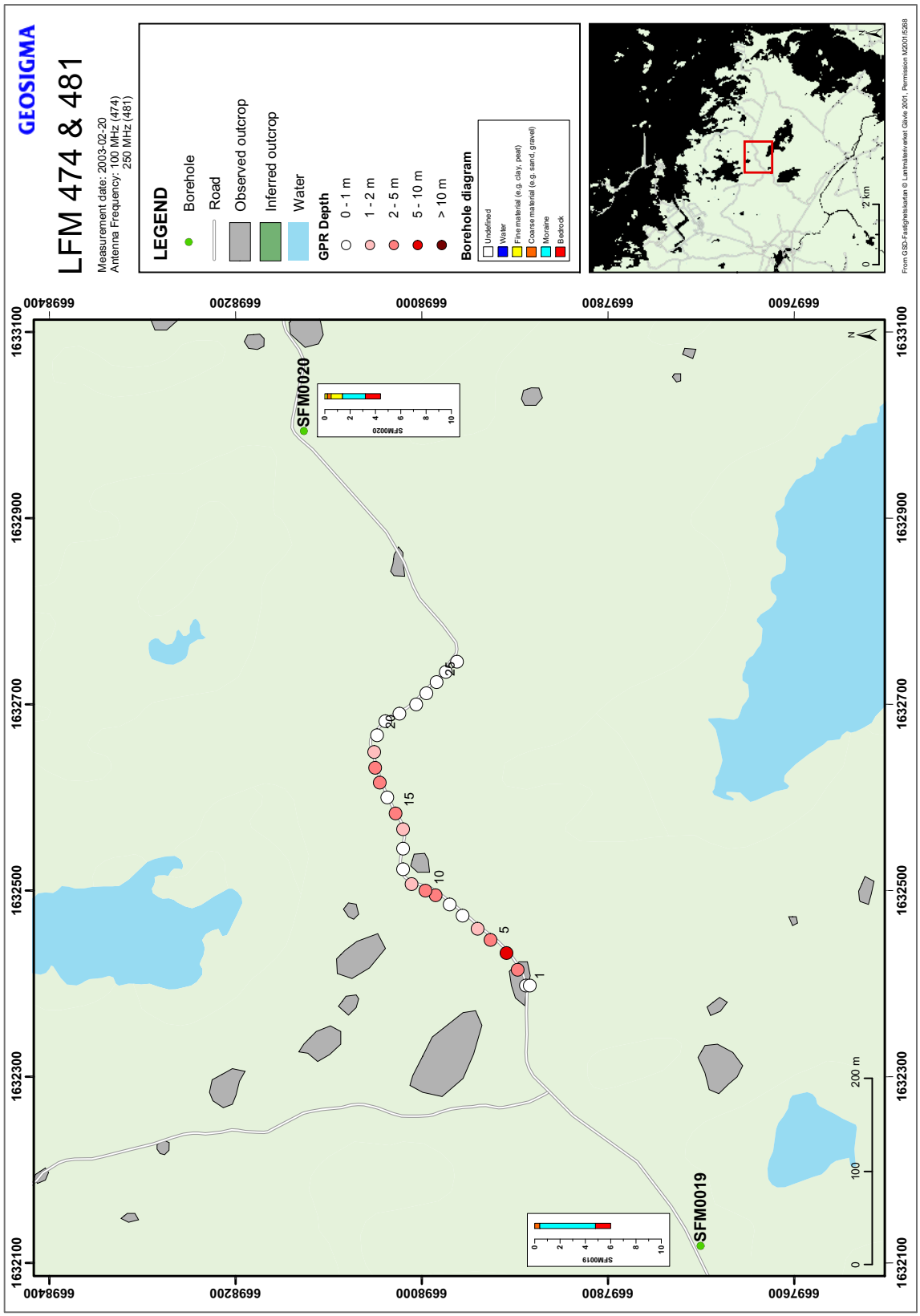

LFM000472 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000472 (600-791)
19 20 21 22 23 24
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200

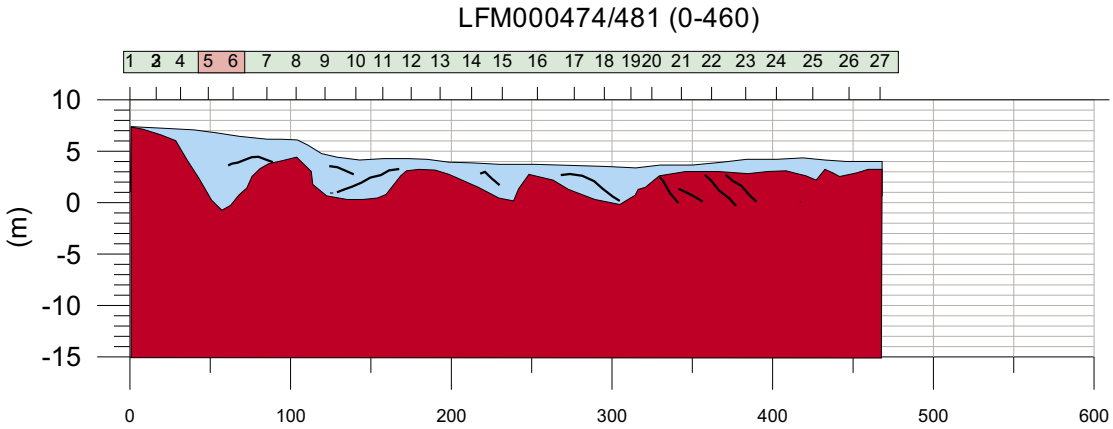

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

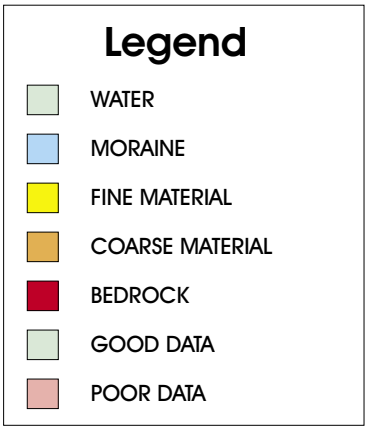

GEOSIGMA
LFM 473
Measurement date: 2003-02-21
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
1631500
1631700
1631900
1632100
1632300
6697800
6697600
6697400
6697200
6697000
SFM0019
HFM12
HFM11
SFM0014
SFM0015
SFM0041
SFM0016
5
1
0
100
200 m
N
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

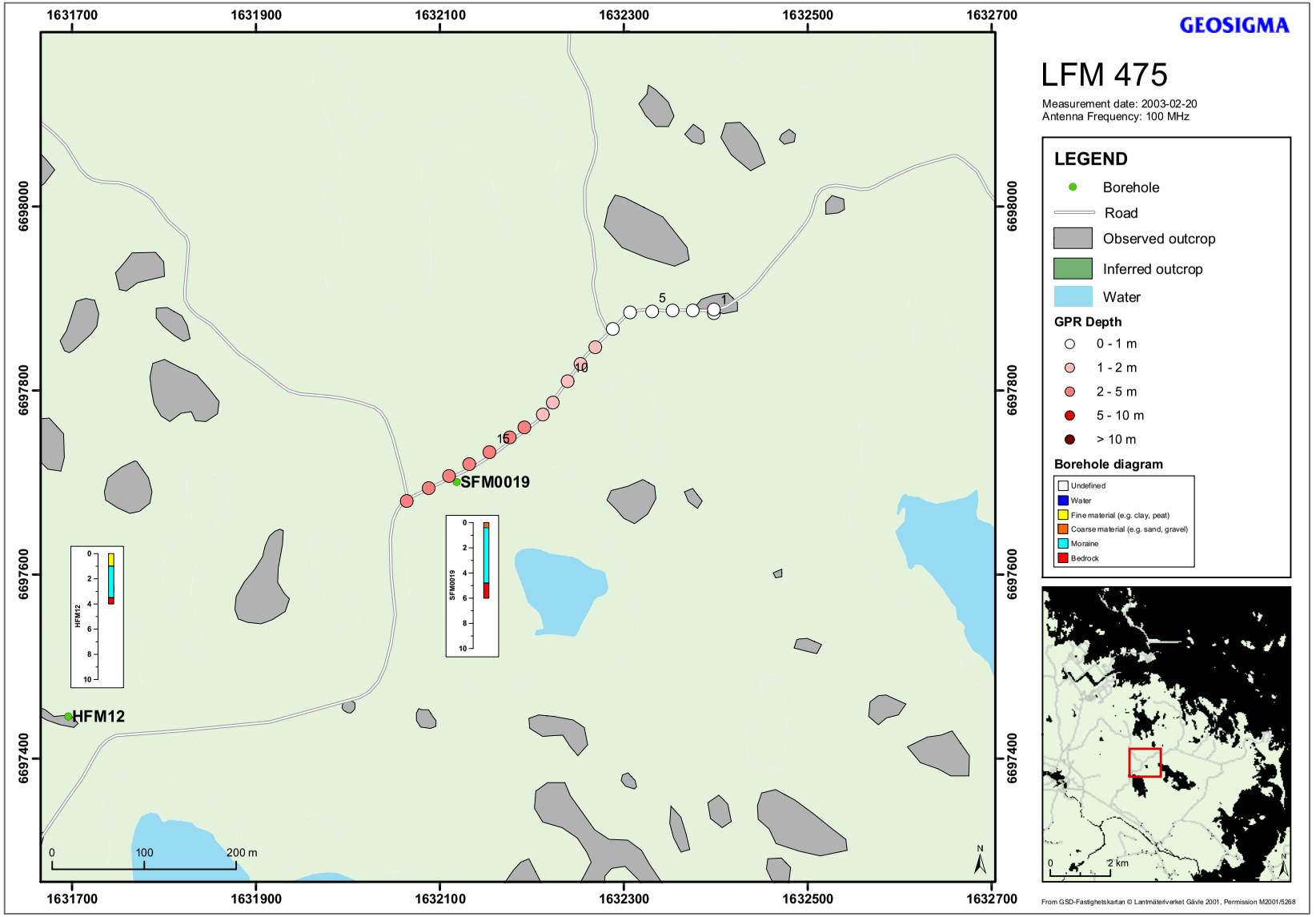

LFM000473 (0-210)
1 2 3 4 5 6 7 8 9
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 474 & 481
Measurement date: 2003-02-20
Antenna Frequency: 100 MHz (474)
250 MHz (481)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0020
SFM0019
1
5
10
15
20
25
669400
669600
669800
670000
670200
1632100
1632300
1632500
1632700
1632900
1633100
200 m
100
0
2 km
N


LFM000474/481 (0-460)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 1920 21 22 23 24 25 26 27
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 475
Measurement date: 2003-02-20
Antenna Frequency: 100 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
1631700
1631900
1632100
1632300
1632500
1632700
6698000
6697800
6697600
6697400
SFM0019
HFM12
1
5
10
15
0
100
200 m
N
0
2 km
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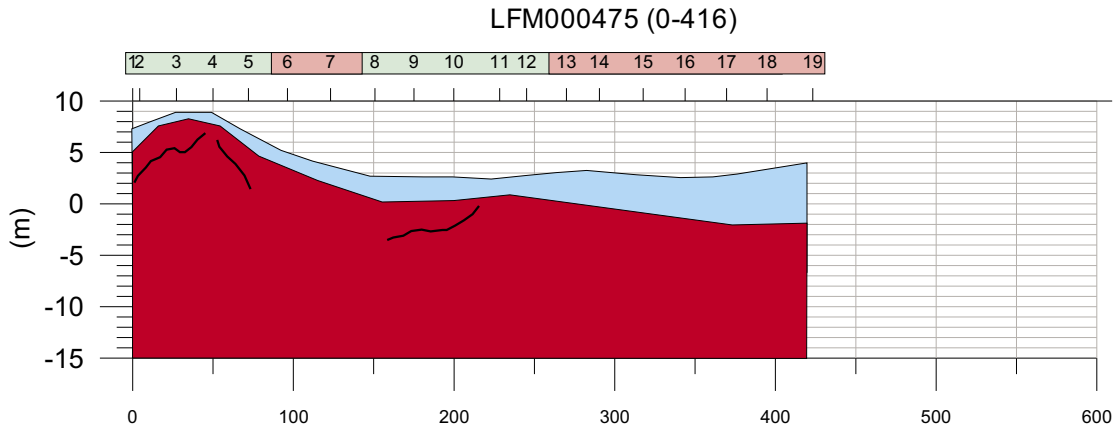
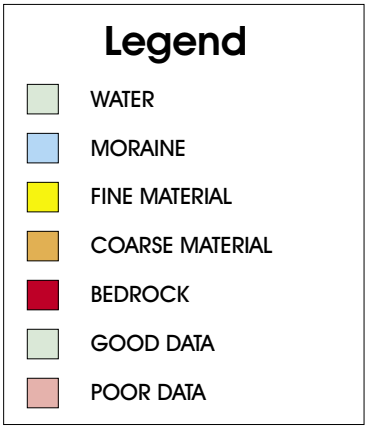
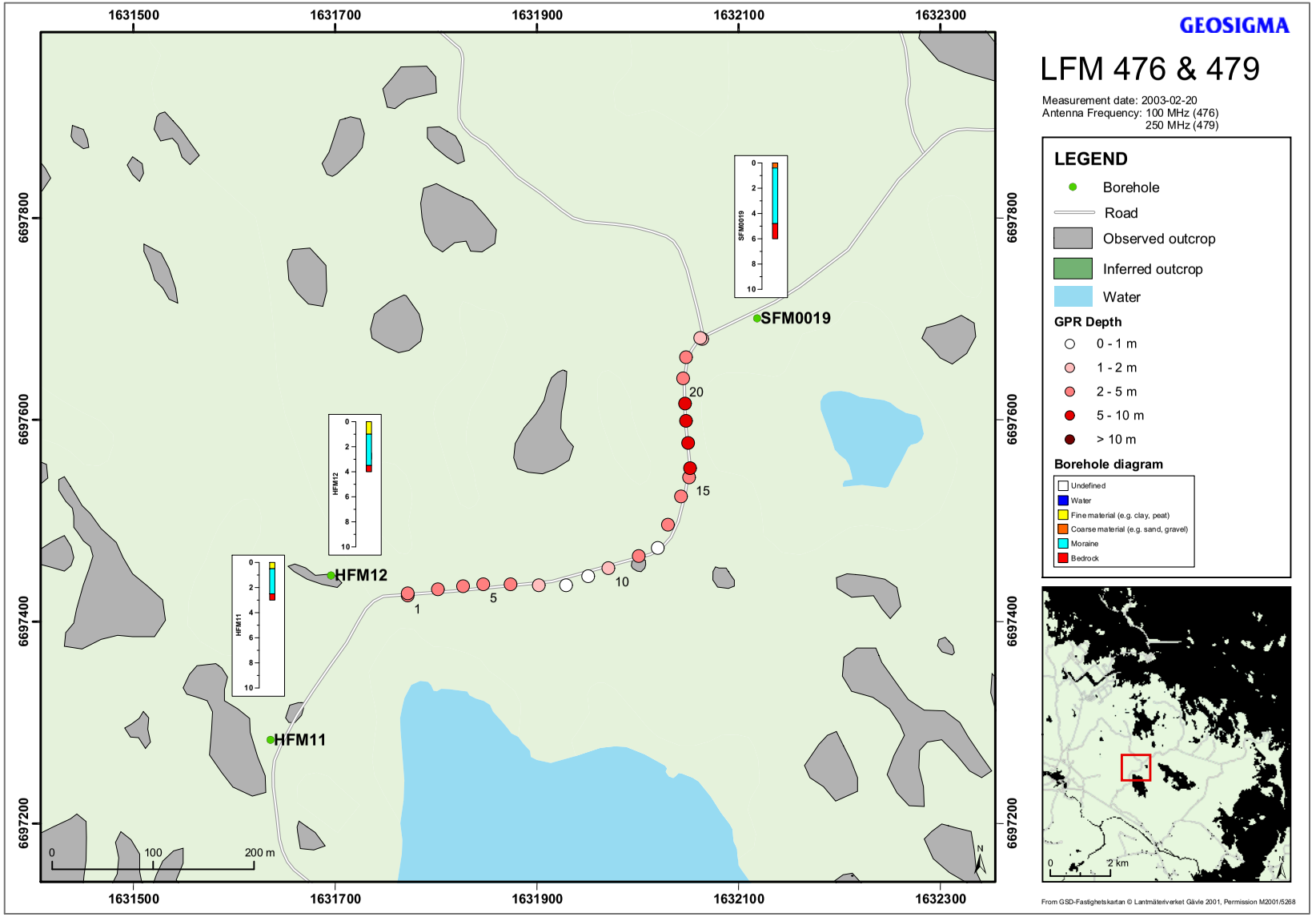
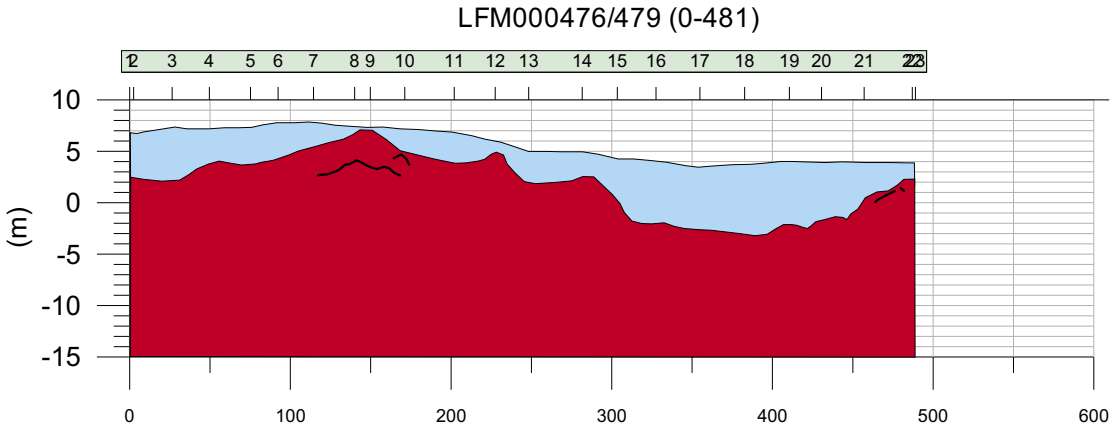
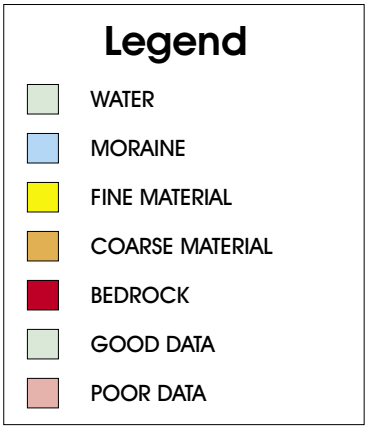
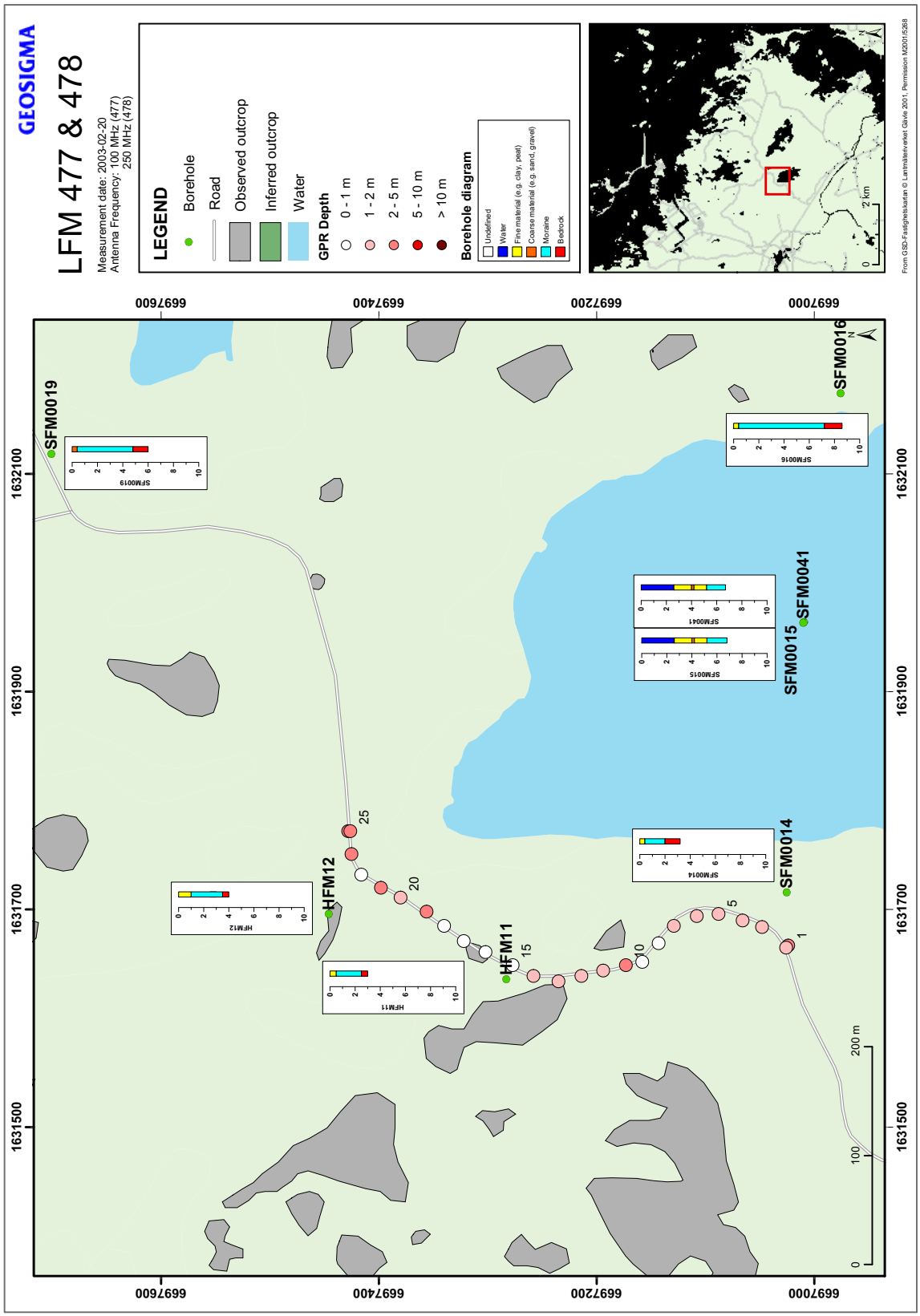

LFM000475 (0-416)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

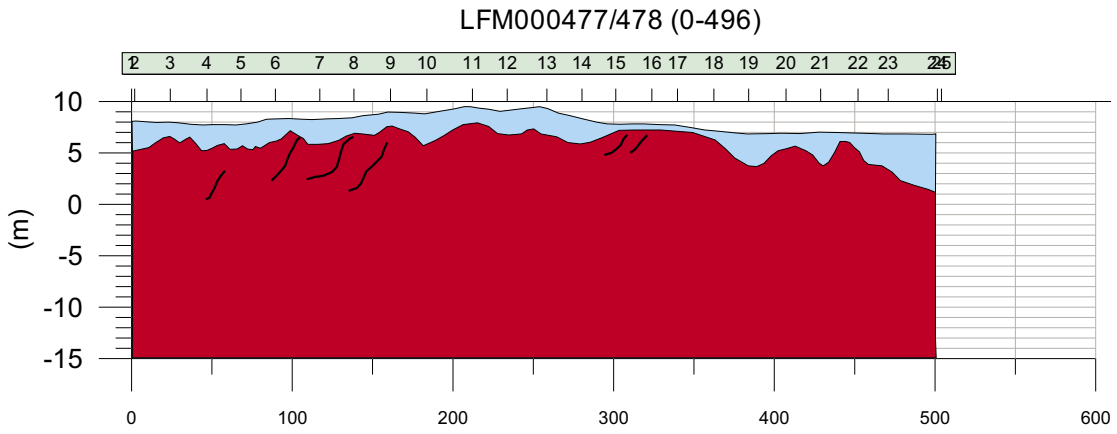

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

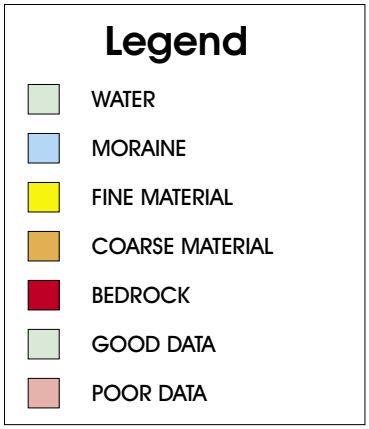

GEOSIGMA
LFM 476 & 479
Measurement date: 2003-02-20
Antenna Frequency: 100 MHz (476)
250 MHz (479)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0019
HFM12
HFM11
1
5
10
15
20
1631500
1631700
1631900
1632100
1632300
6697800
6697600
6697400
6697200
0
100
200 m
N
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

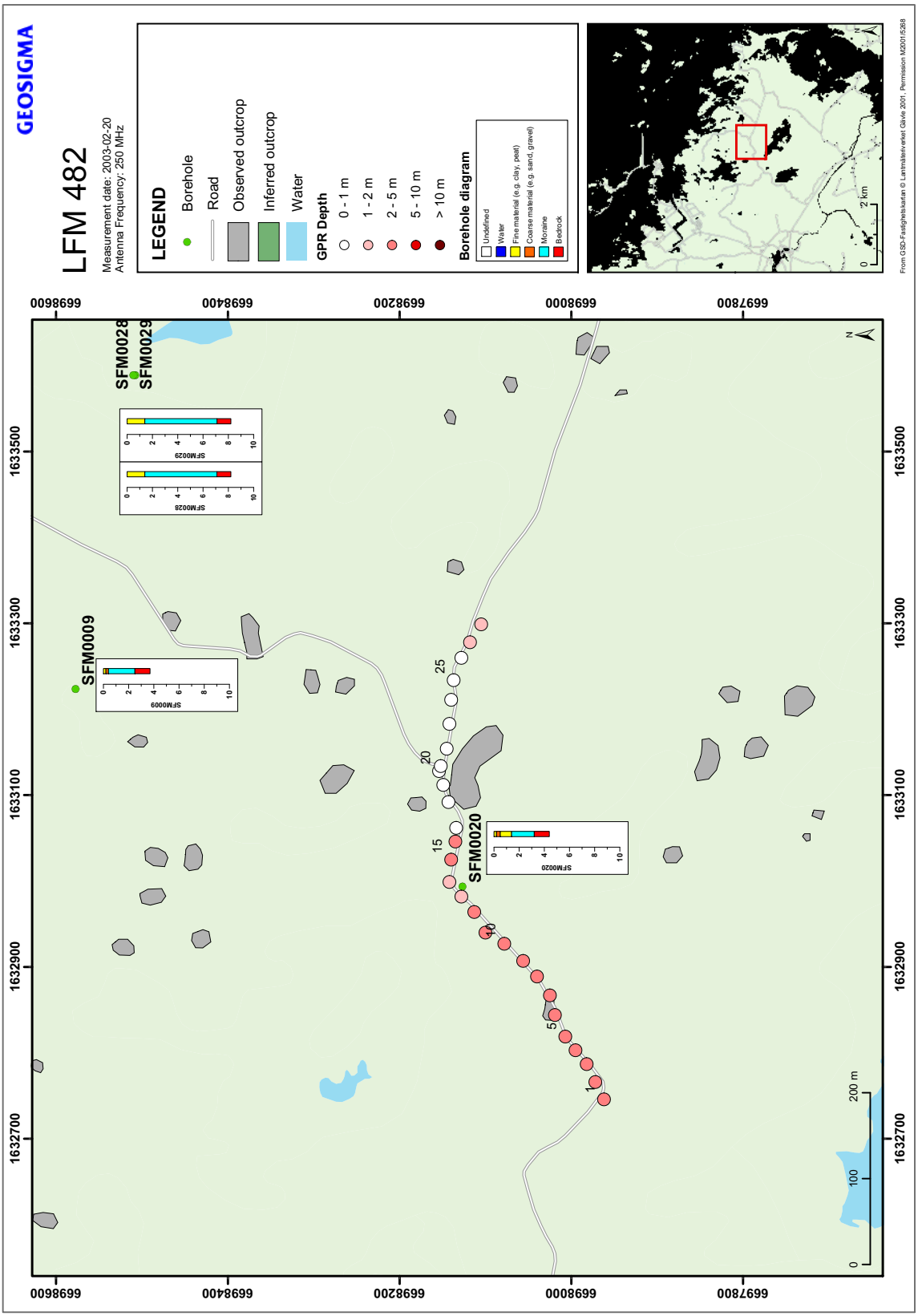

LFM000476/479 (0-481)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

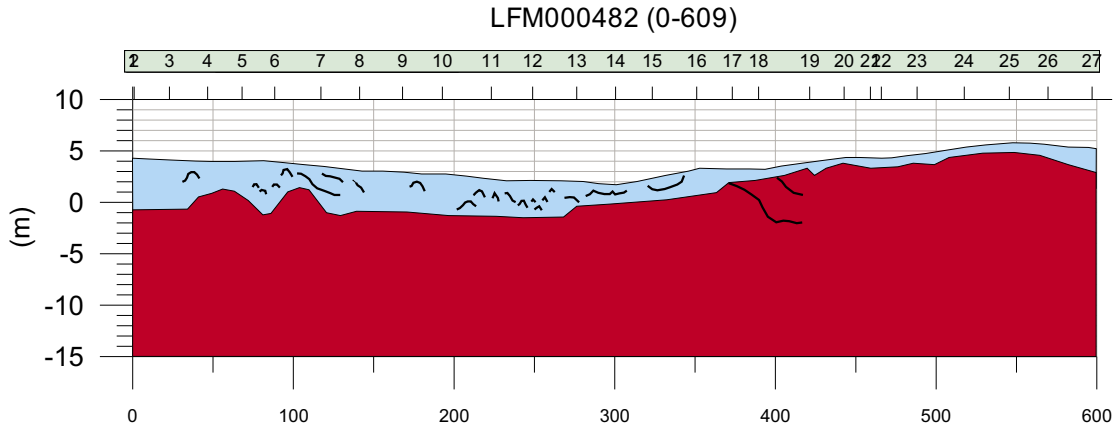

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

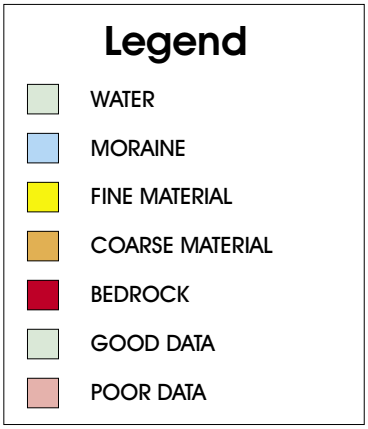

GEOSIGMA
LFM 477 & 478
Measurement date: 2003-02-20
Antenna Frequency: 100 MHz (477)
250 MHz (478)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001. Permission M2001/5268
669700
669720
669740
669760
1631500
1631700
1631900
1632100
SFM0019
SFM0016
SFM0041
SFM0015
SFM0014
HFM12
HFM11
0
100
200 m
2 km

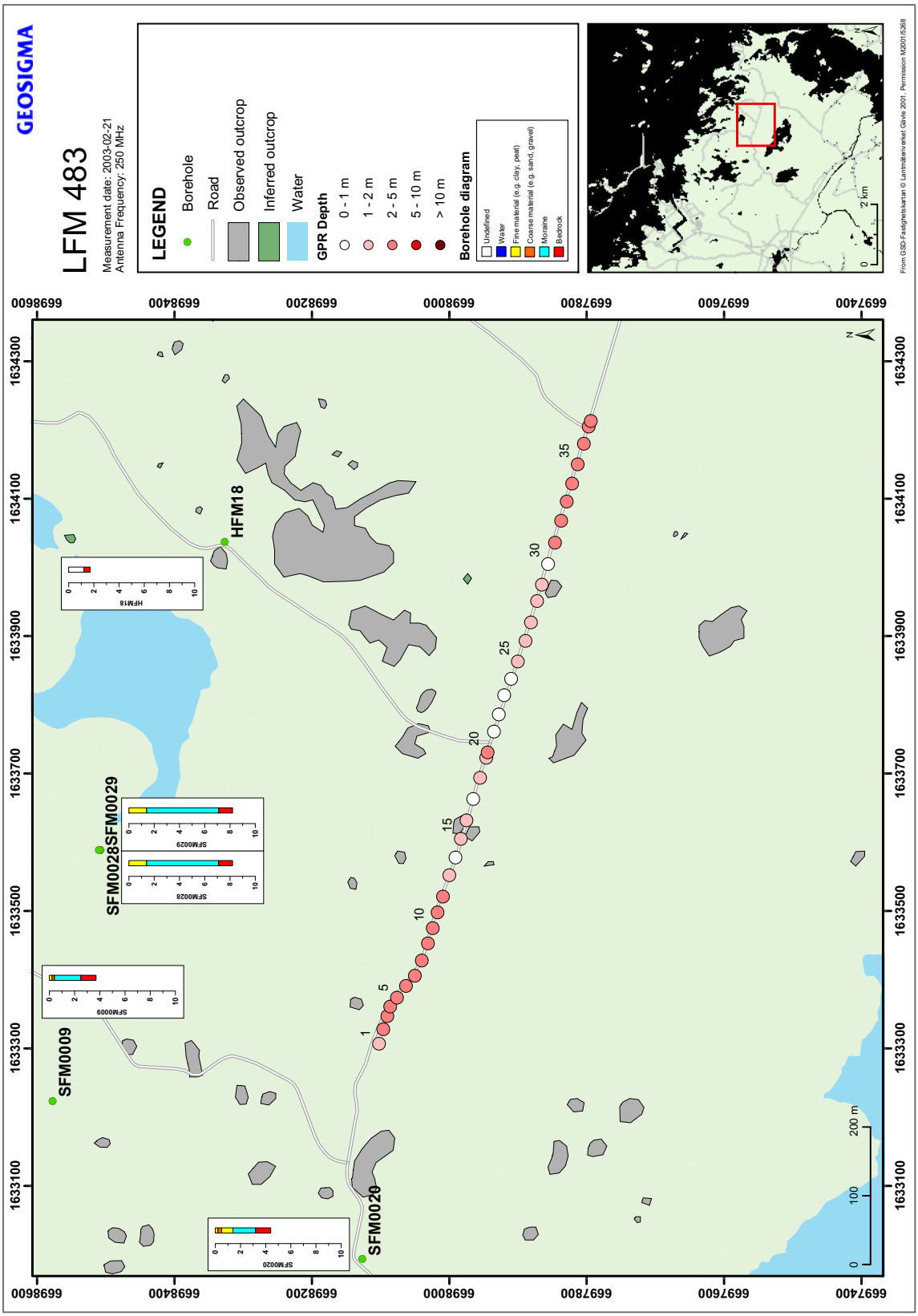

LFM000477/478 (0-496)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

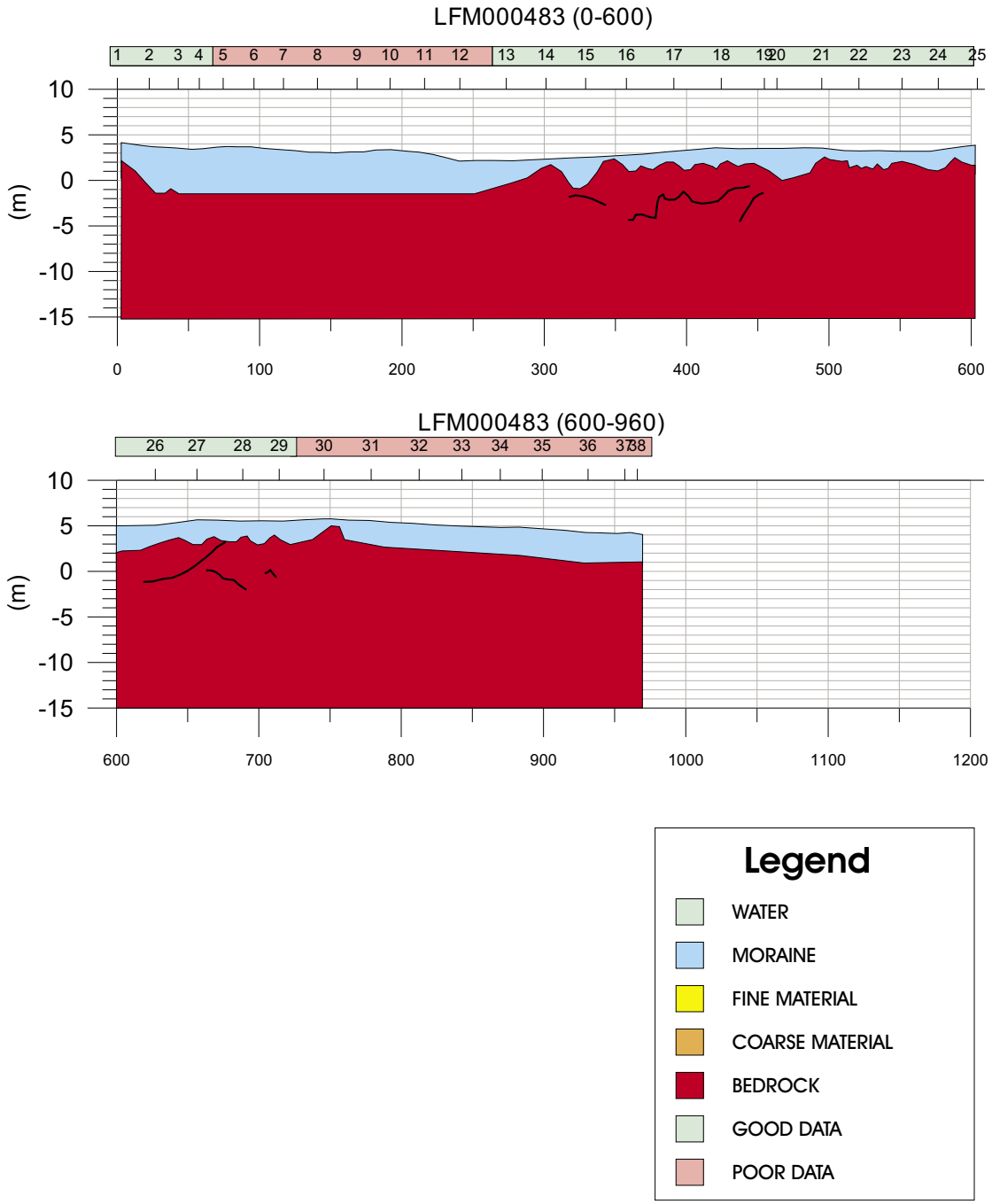

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

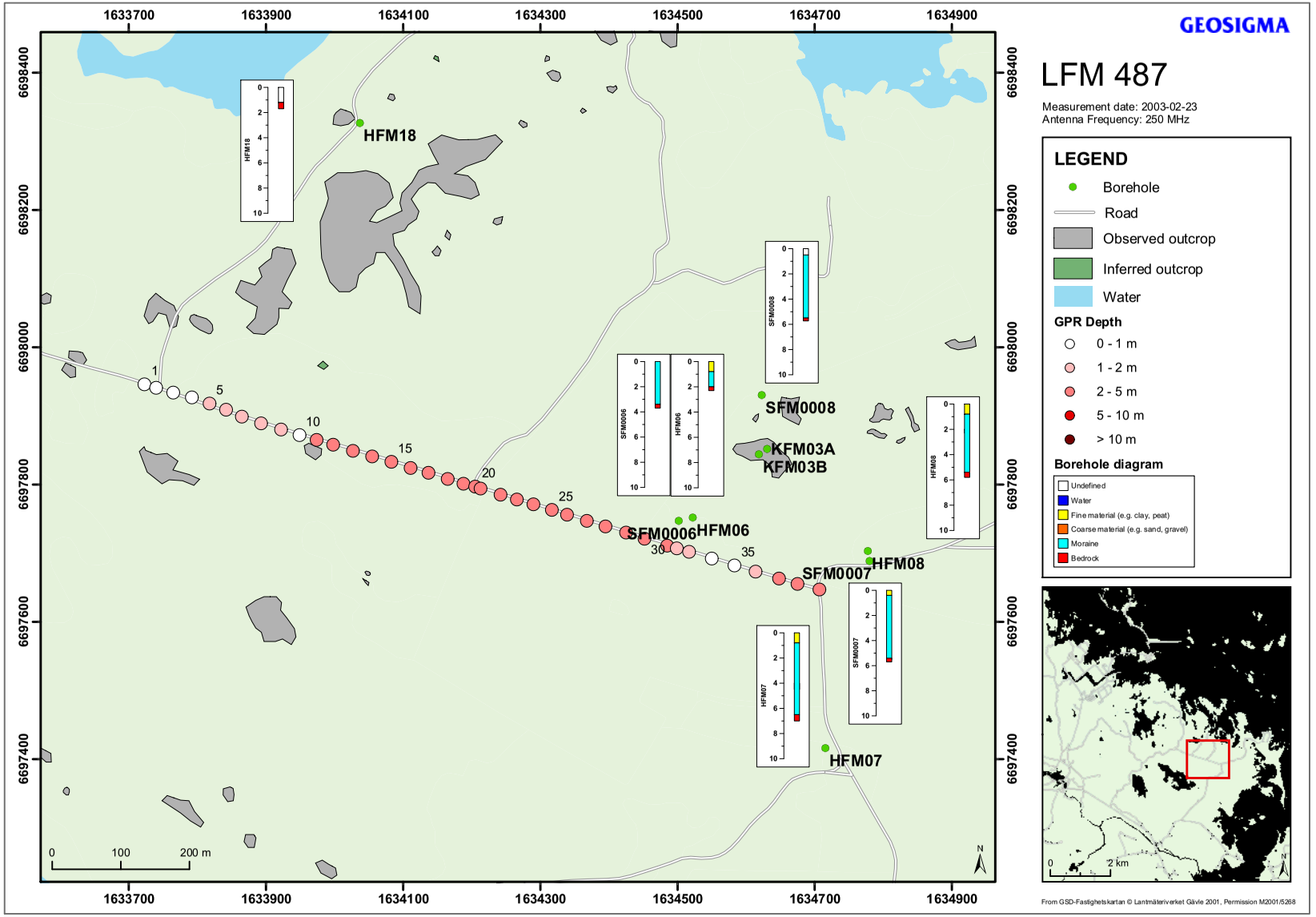

GEOSIGMA
LFM 482
Measurement date: 2003-02-20
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0028
SFM0029
SFM0009
SFM0020
669800
669820
669840
669860
669780
1633500
1633300
1633100
1632900
1632700
200 m
100
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001. Permission M2001/5368

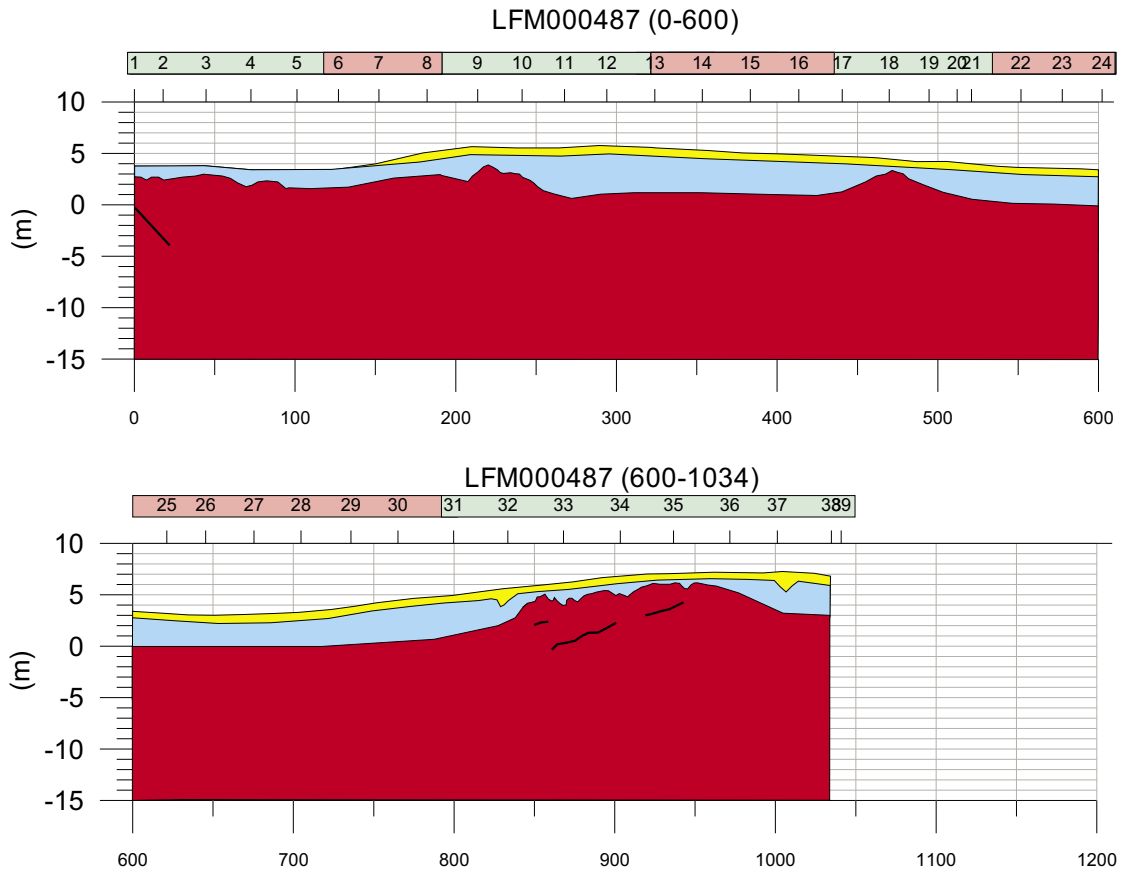

LFM000482 (0-609)
2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

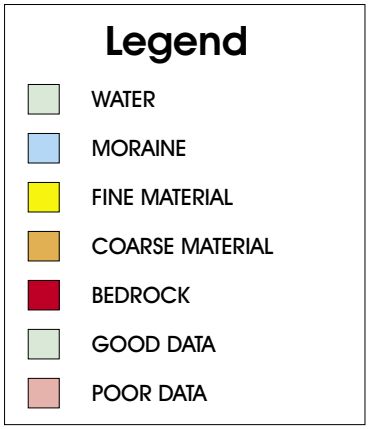

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

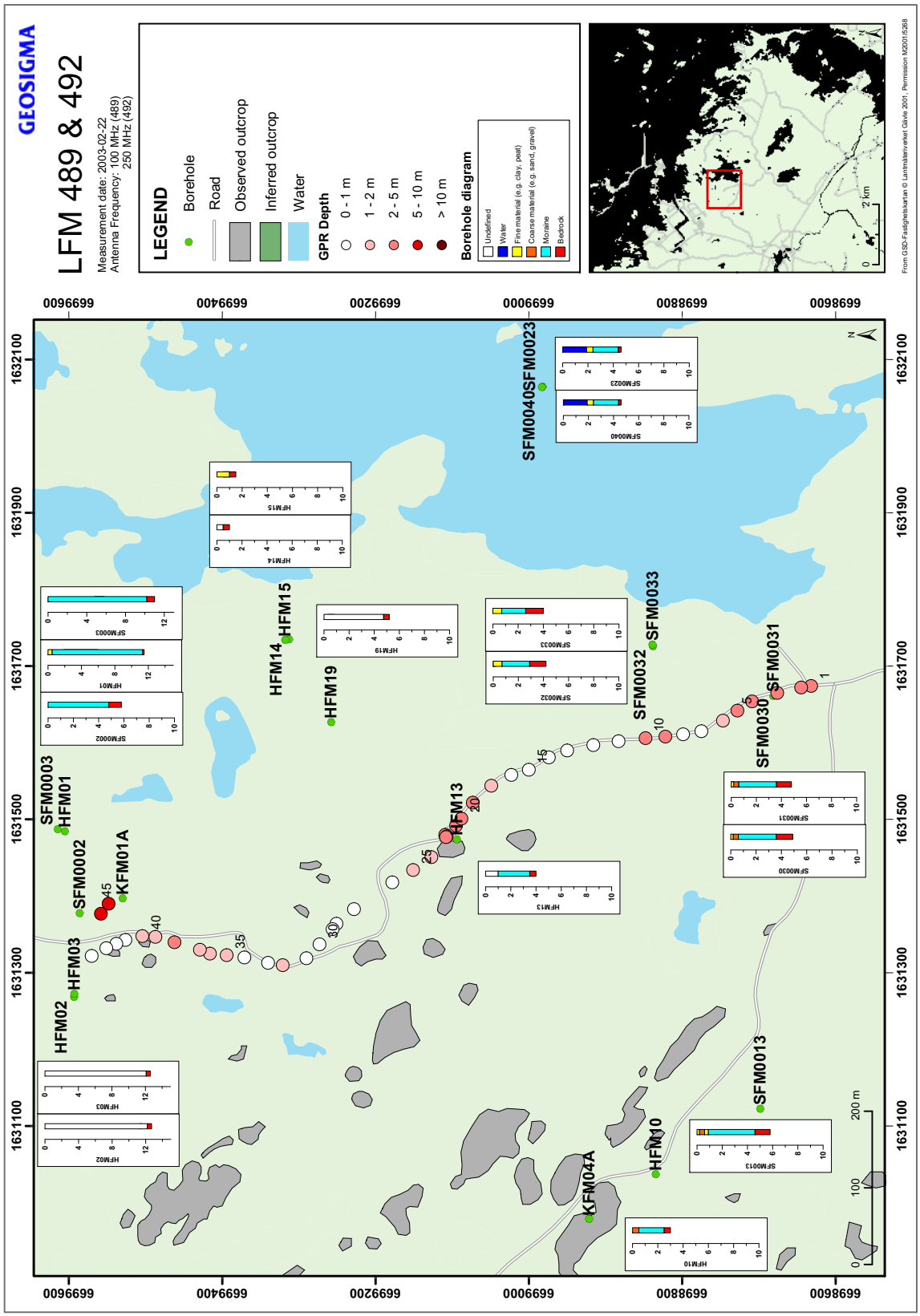

GEOSIGMA
LFM 483
Measurement date: 2003-02-21
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM18
SFM0028
SFM0029
SFM0009
SFM0020
1
5
10
15
20
25
30
35
669860
669840
669820
669800
669780
669760
669740
1634300
1634100
1633900
1633700
1633500
1633300
1633100
0
100
200 m
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001. Permission M2001/5268

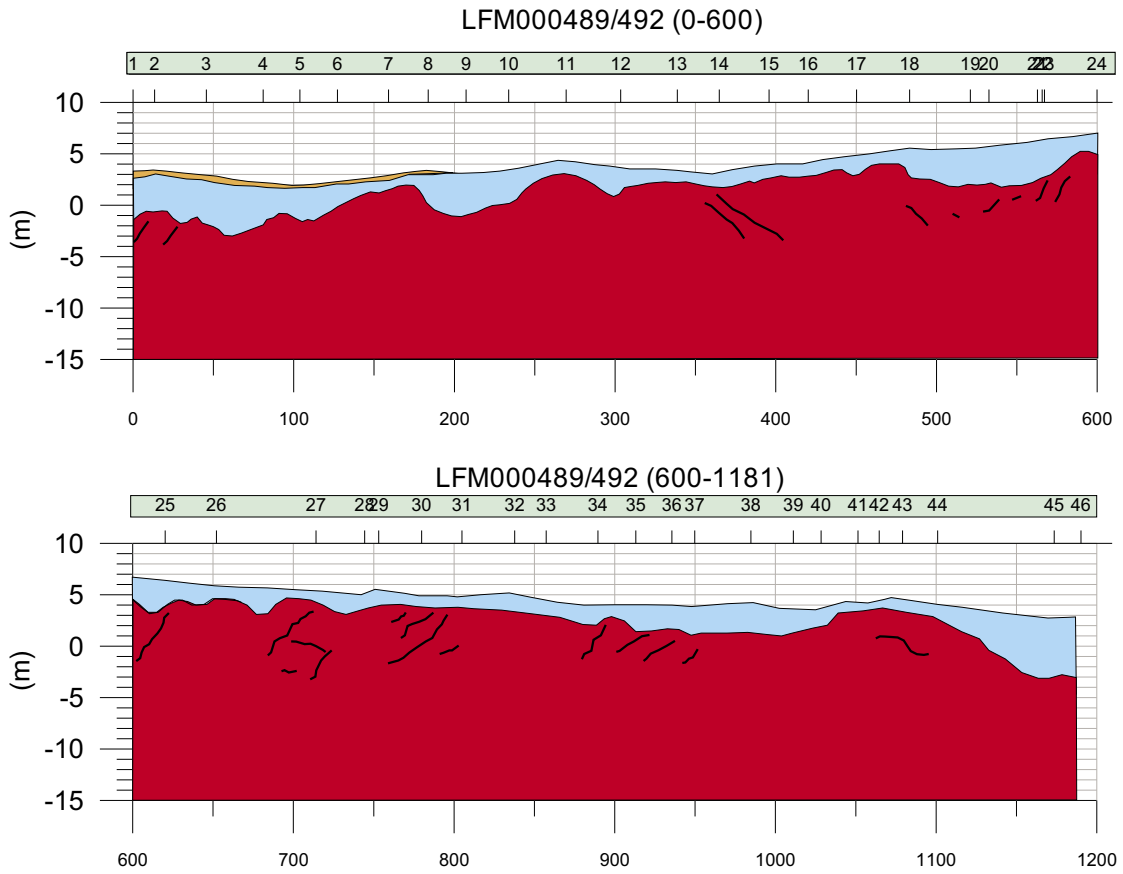

LFM000483 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000483 (600-960)
26 27 28 29 30 31 32 33 34 35 36 37 38
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200
Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

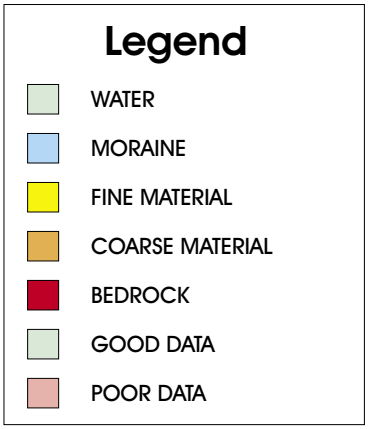

GEOSIGMA
LFM 487
Measurement date: 2003-02-23
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM18
SFM0008
KFM03A
KFM03B
SFM0006
HFM06
HFM08
SFM0007
HFM07
1633700
1633900
1634100
1634300
1634500
1634700
1634900
6698400
6698200
6698000
6697800
6697600
6697400
0
100
200 m
0
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

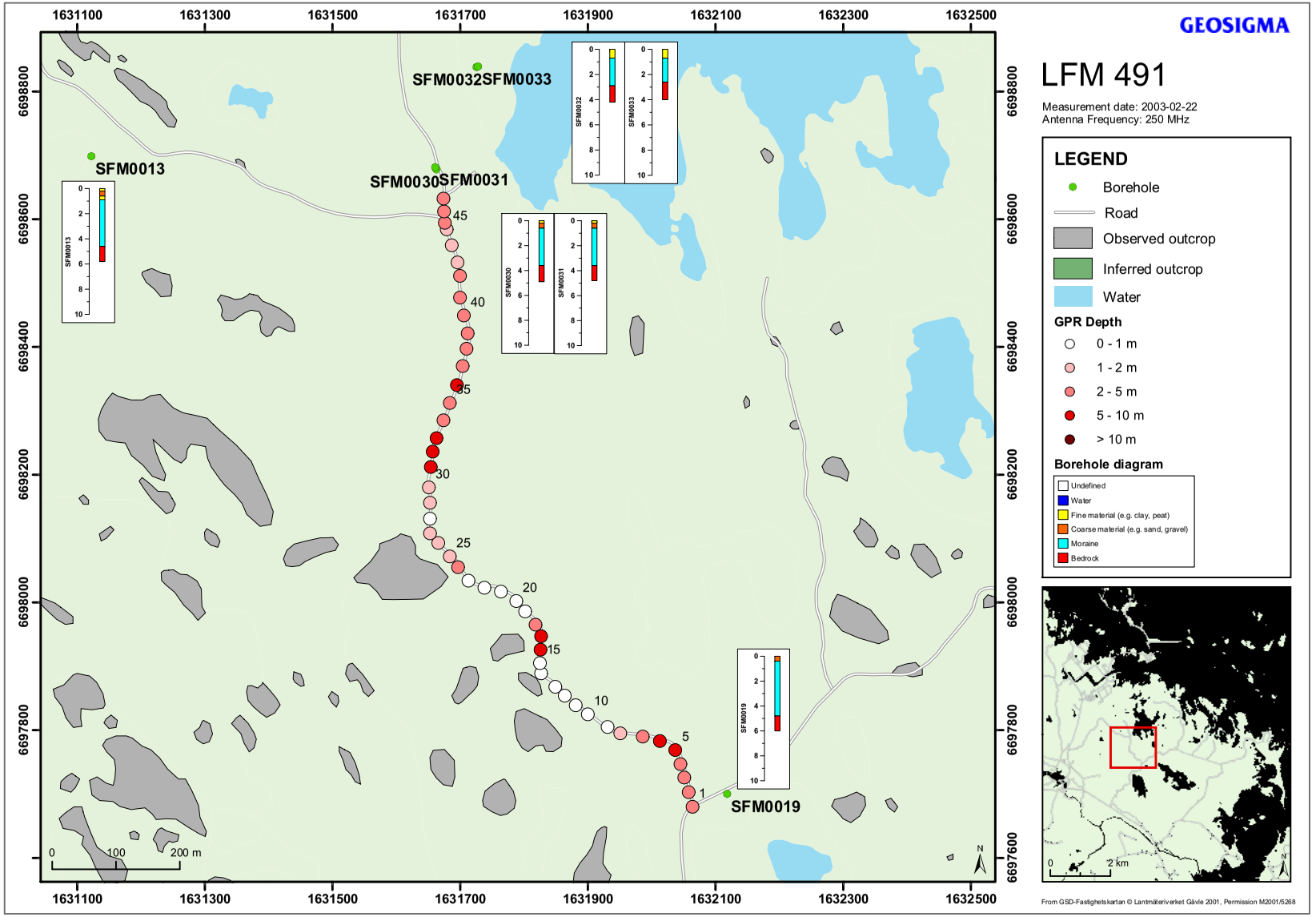

LFM000487 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000487 (600-1034)
25 26 27 28 29 30 31 32 33 34 35 36 37 38 39
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 489 & 492
Measurement date: 2003-02-22
Antenna Frequency: 100 MHz (489)
250 MHz (492)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001. Permission M2001/5368
SFM0040
SFM0023
SFM0033
SFM0032
SFM0031
SFM0030
SFM0013
SFM0003
SFM0002
HFM01
KFM01A
HFM02
HFM03
HFM04A
HFM10
HFM13
HFM14
HFM15
HFM19
6698600
6699400
6699200
6699000
6698800
6698600
1632100
1631900
1631700
1631500
1631300
1631100
200 m
100
0
2 km
0


LFM000489/492 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000489/492 (600-1181)
25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 491
Measurement date: 2003-02-22
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0013
SFM0030
SFM0031
SFM0032
SFM0033
SFM0019
1631100
1631300
1631500
1631700
1631900
1632100
1632300
1632500
6698800
6698600
6698400
6698200
6698000
6697800
6697600
0
100
200 m
2 km
N
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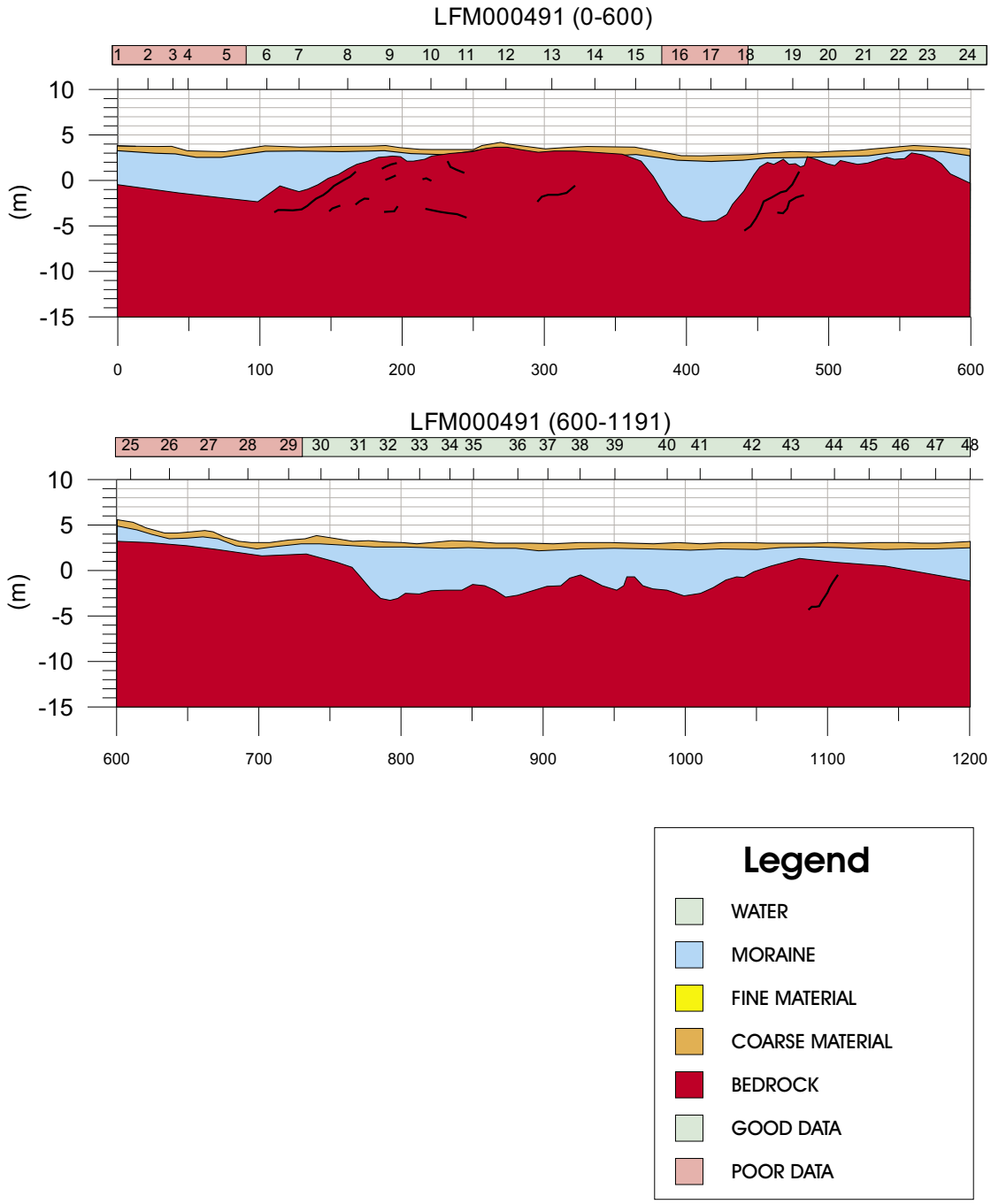
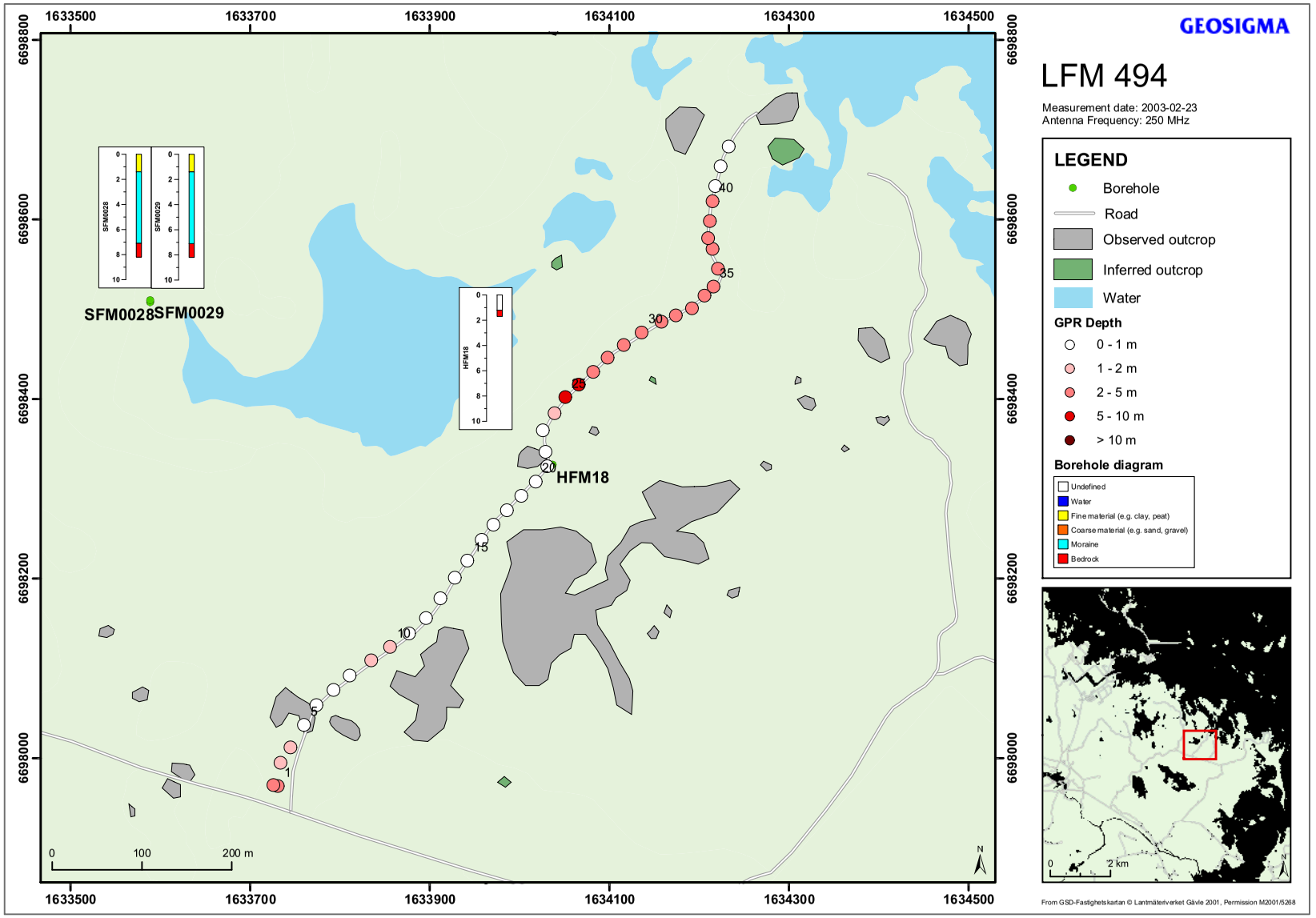
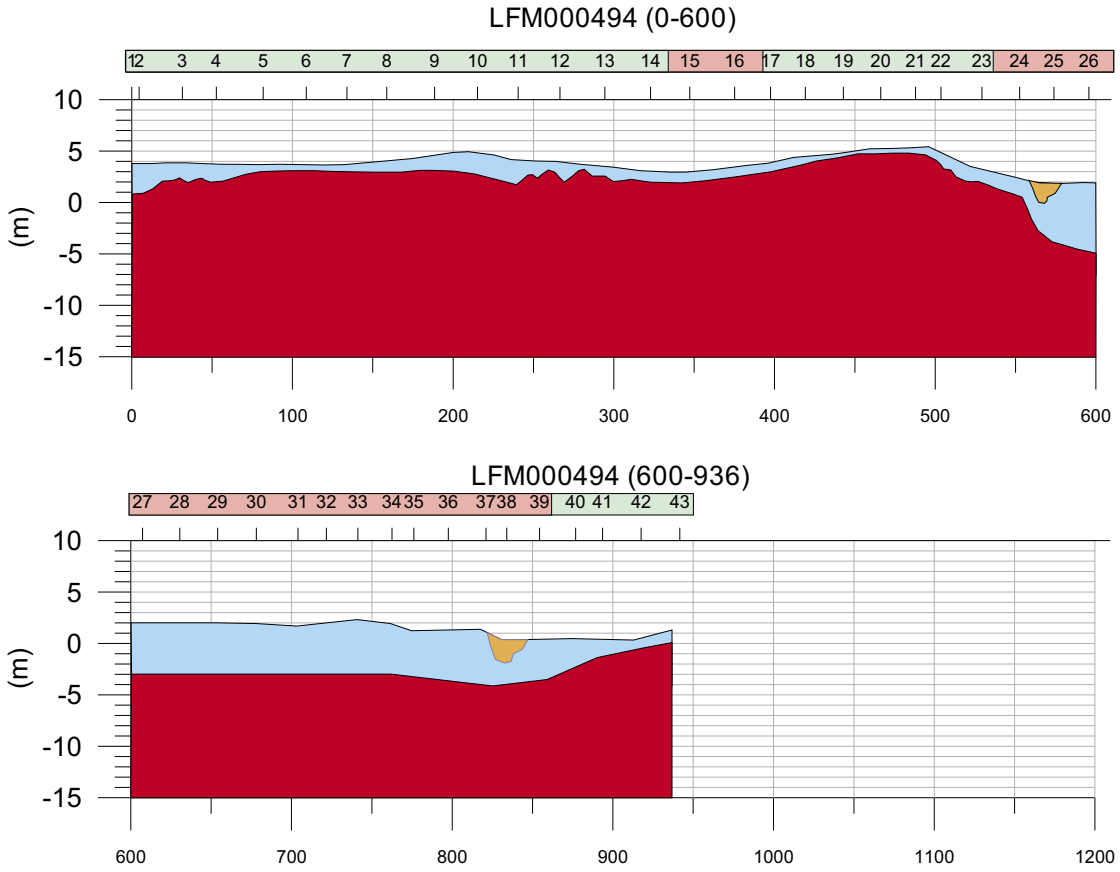
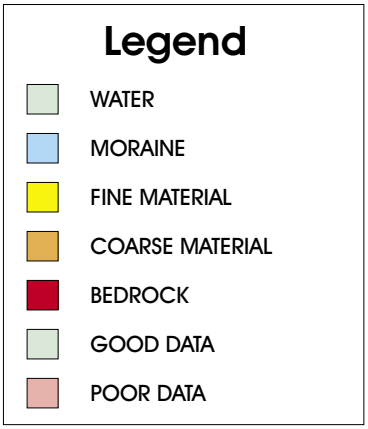
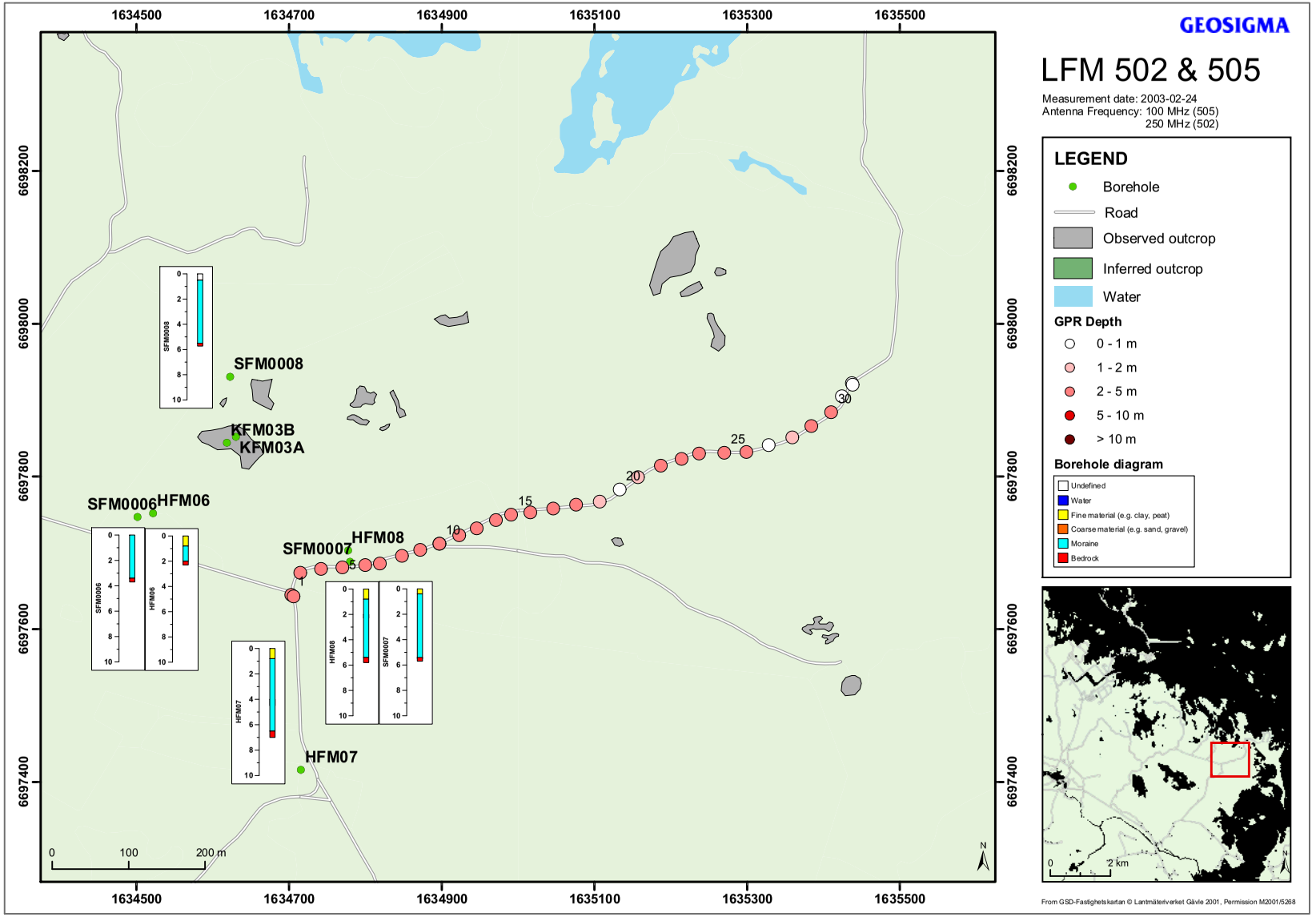
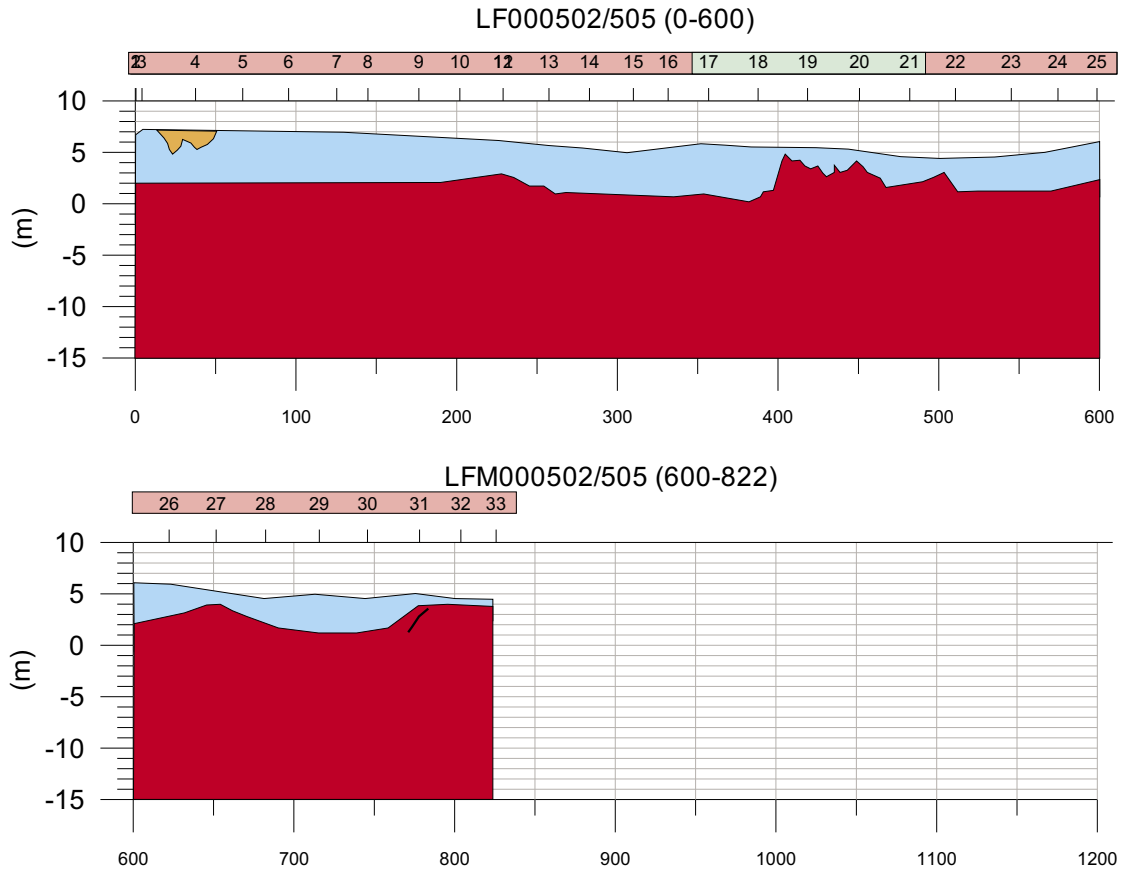

LFM000491 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000491 (600-1191)
25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200
Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

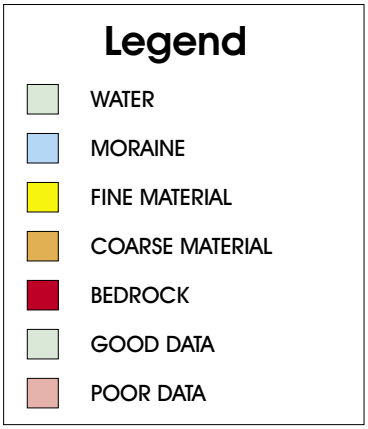

GEOSIGMA
LFM 494
Measurement date: 2003-02-23
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0028
SFM0029
HFM18
1633500
1633700
1633900
1634100
1634300
1634500
6698800
6698600
6698400
6698200
6698000
0
100
200 m
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

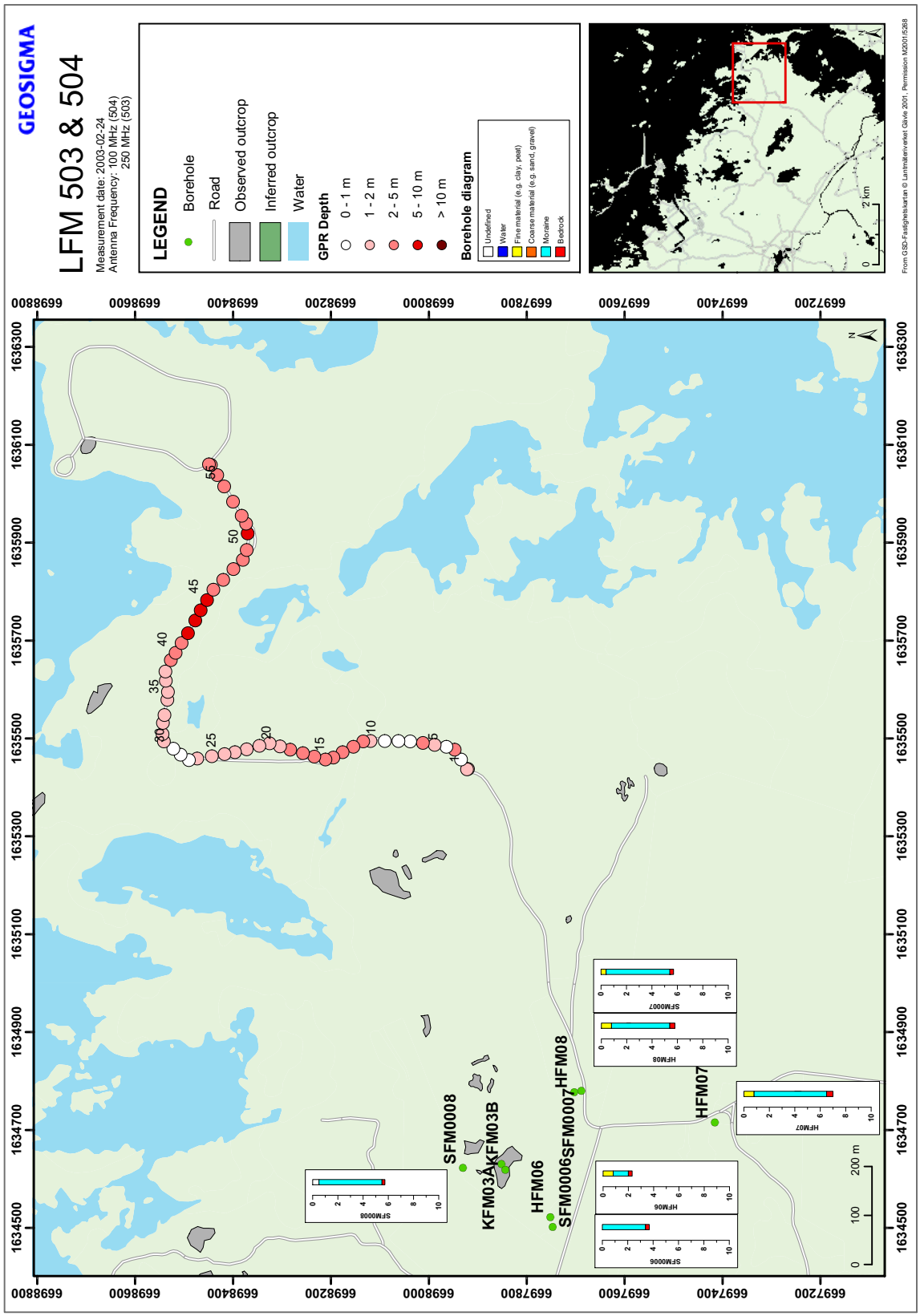

LFM000494 (0-600)
12 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600
LFM000494 (600-936)
27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43
10
5
0
-5
-10
-15
(m)
600
700
800
900
1000
1100
1200

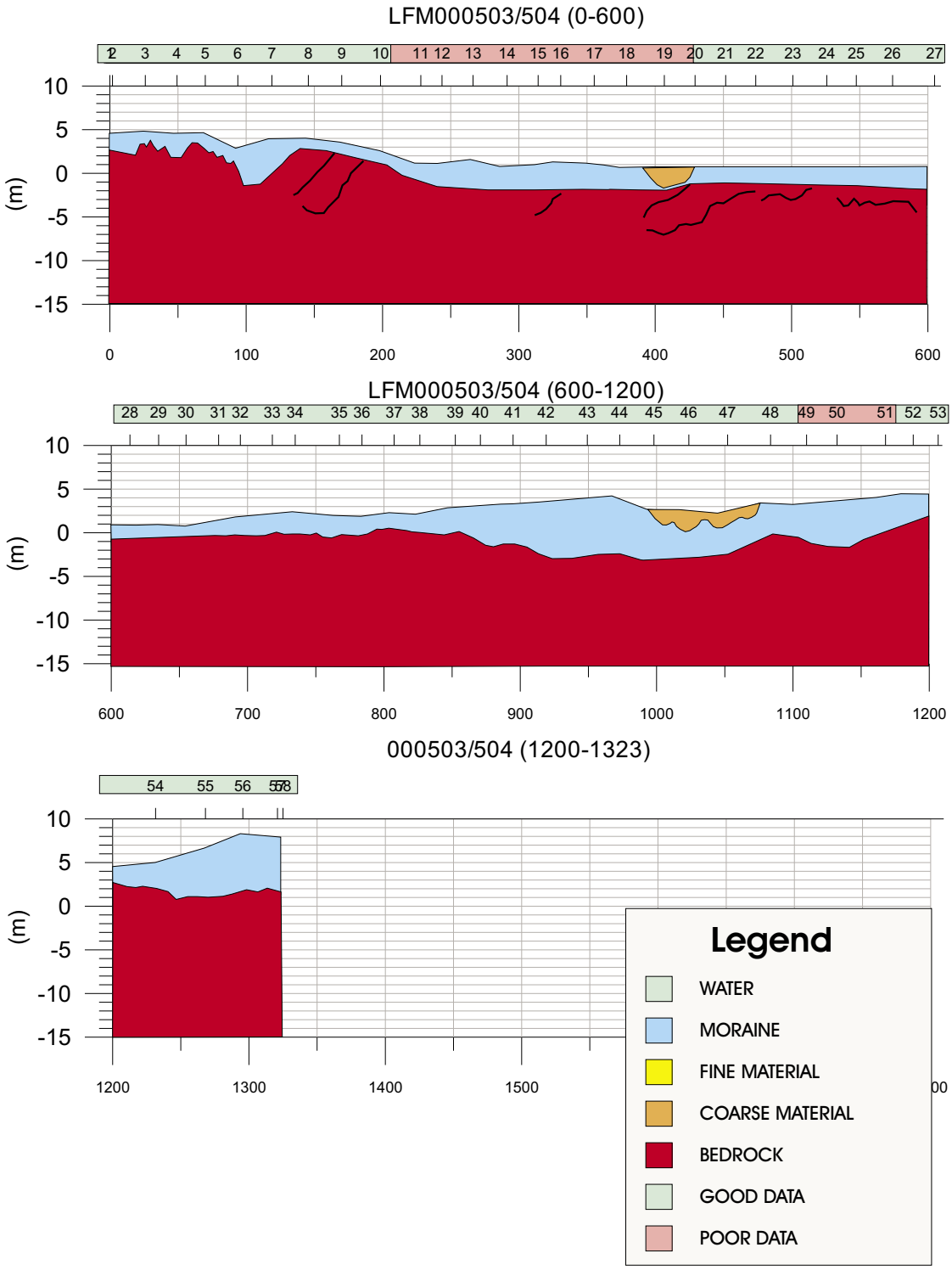

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

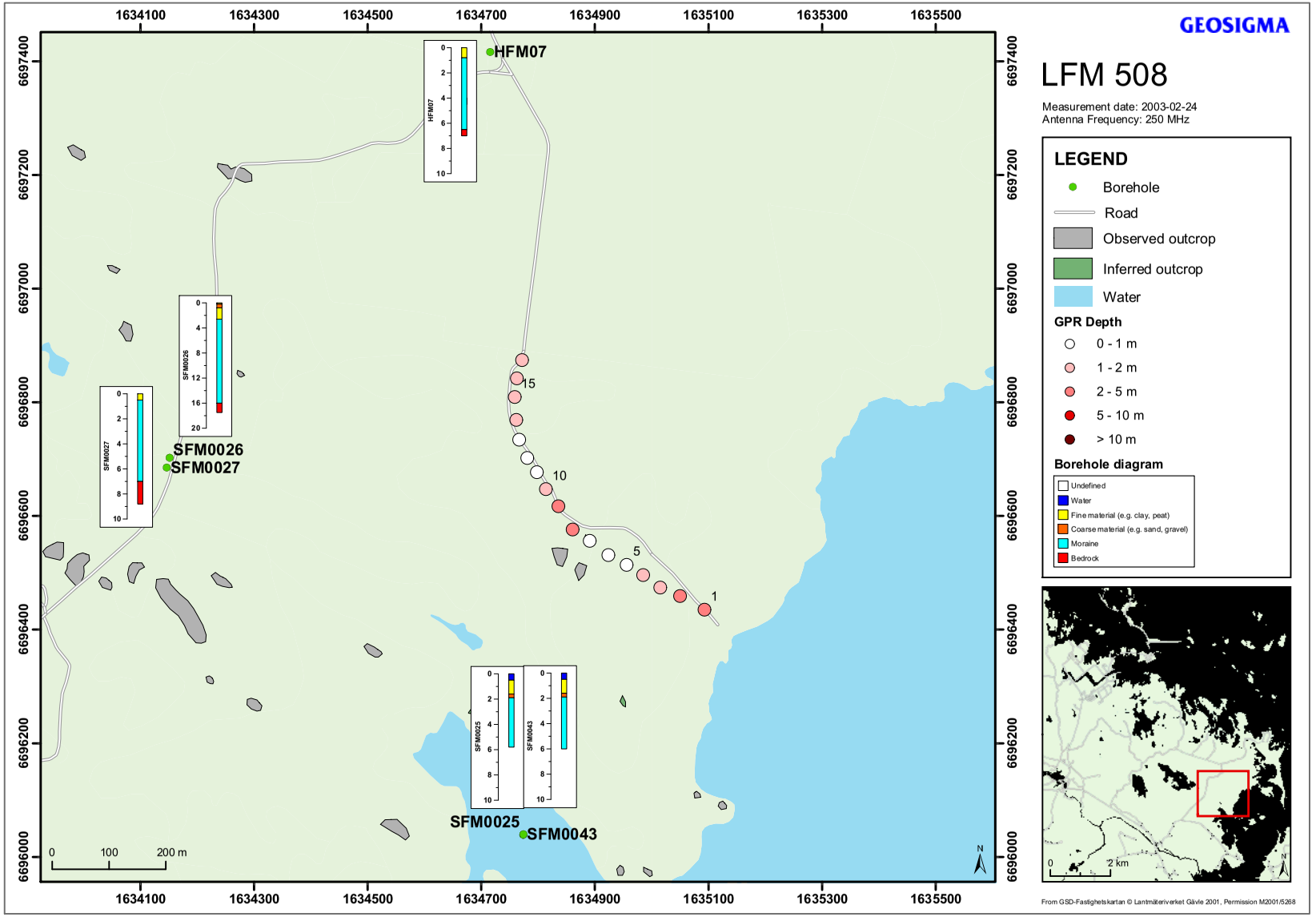

GEOSIGMA
LFM 502 & 505
Measurement date: 2003-02-24
Antenna Frequency: 100 MHz (505)
250 MHz (502)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0008
KFM03B
KFM03A
SFM0006
HFM06
SFM0007
HFM08
HFM07
1634500
1634700
1634900
1635100
1635300
1635500
6698200
6698000
6697800
6697600
6697400
0
100
200 m
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268


LF000502/505 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000502/505 (600-822)
26 27 28 29 30 31 32 33
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

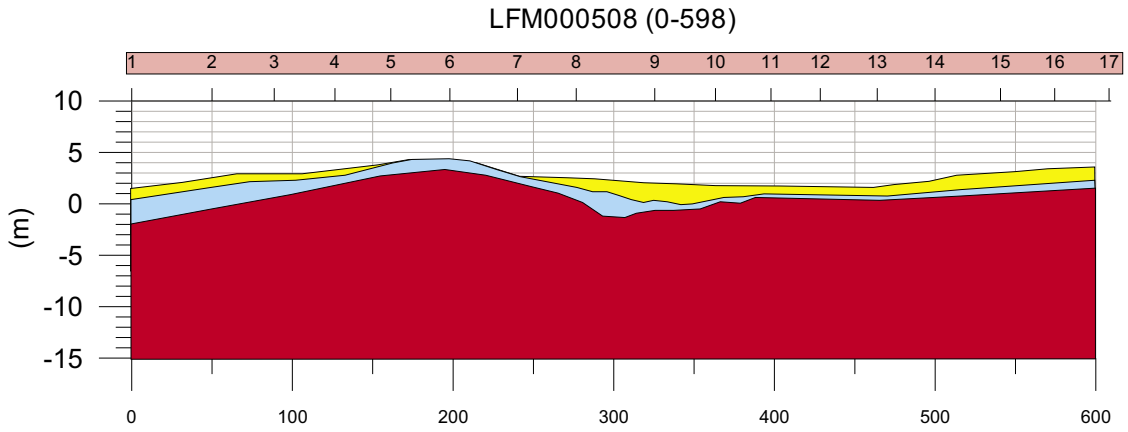

GEOSIGMA
LFM 503 & 504
Measurement date: 2003-02-24
Antenna Frequency: 100 MHz (504)
250 MHz (503)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001. Permission M2001/5368
2 km
200 m
100
0
N
SFM0008
KFM03A
KFM03B
HFM06
SFM0006
SFM0007
HFM08
HFM07

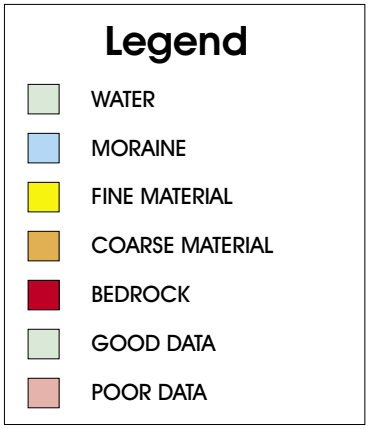

LFM000503/504 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000503/504 (600-1200)
28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200
000503/504 (1200-1323)
54 55 56 57 58
10
5
0
-5
-10
-15
(m)
1200 1300 1400 1500
Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

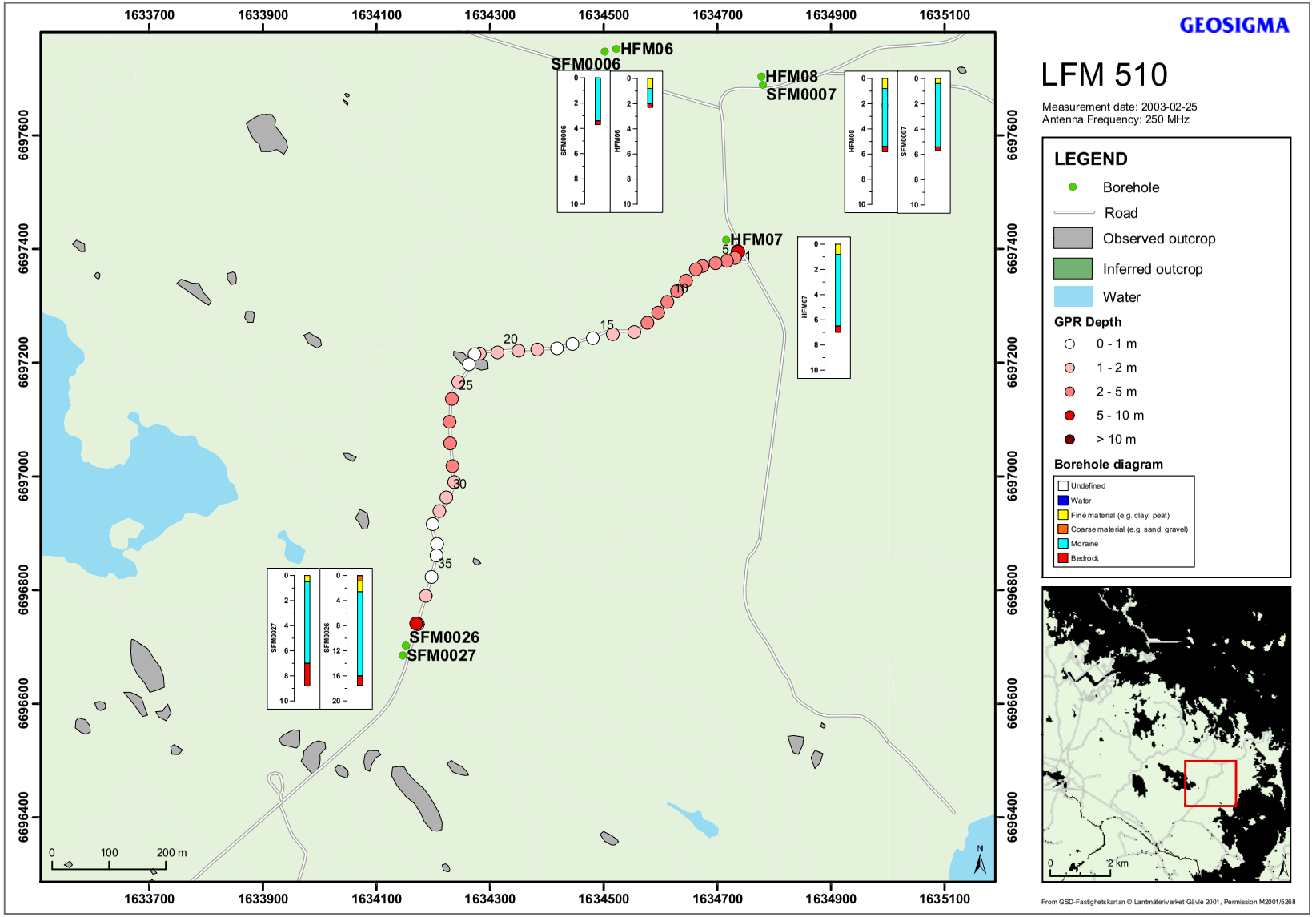

GEOSIGMA
LFM 508
Measurement date: 2003-02-24
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM07
SFM0026
SFM0027
SFM0025
SFM0043
1
5
10
15
1634100
1634300
1634500
1634700
1634900
1635100
1635300
1635500
6697400
6697200
6697000
6696800
6696600
6696400
6696200
6696000
0
100
200 m
0
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001. Permission M2001/5268

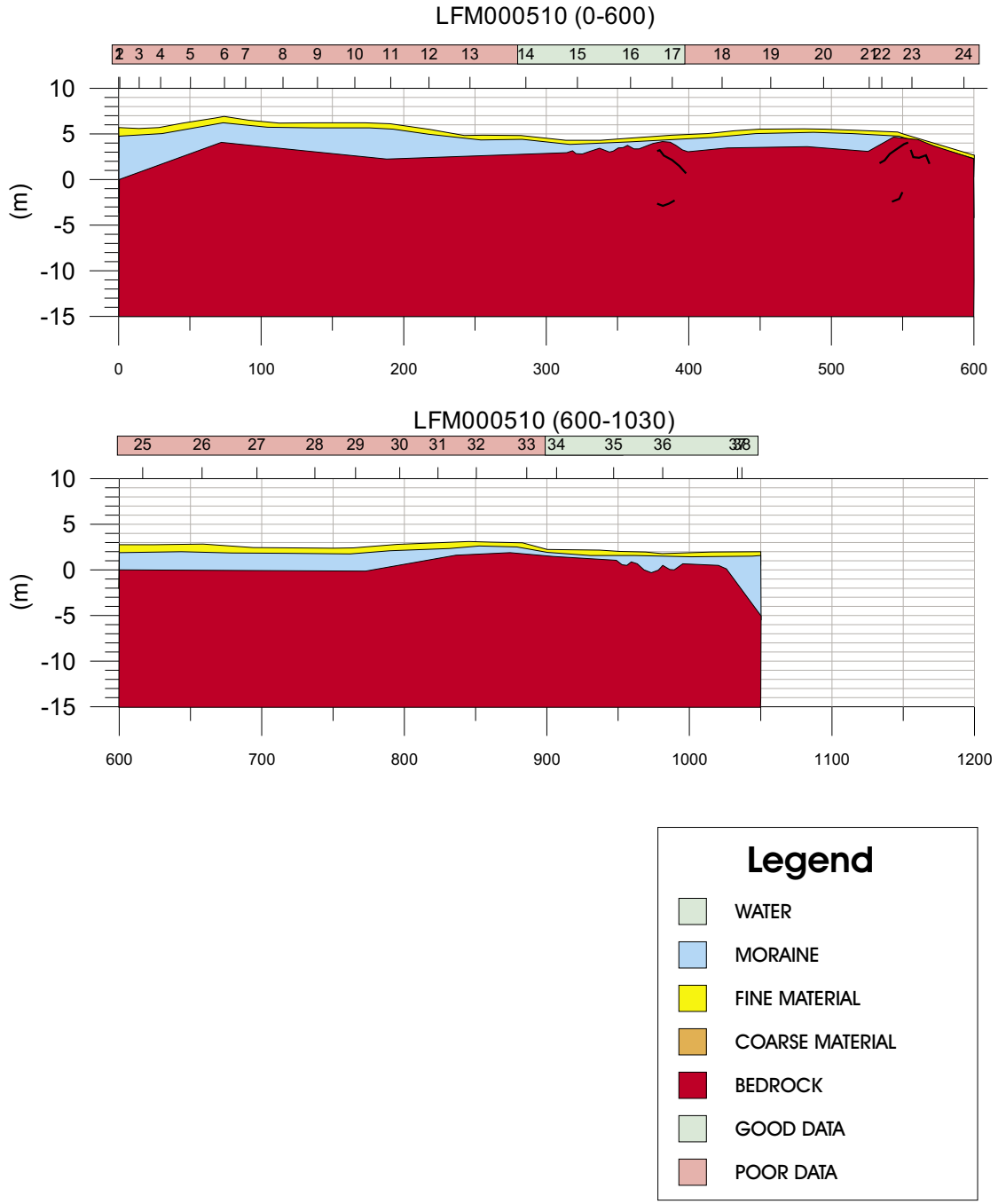
LFM000508

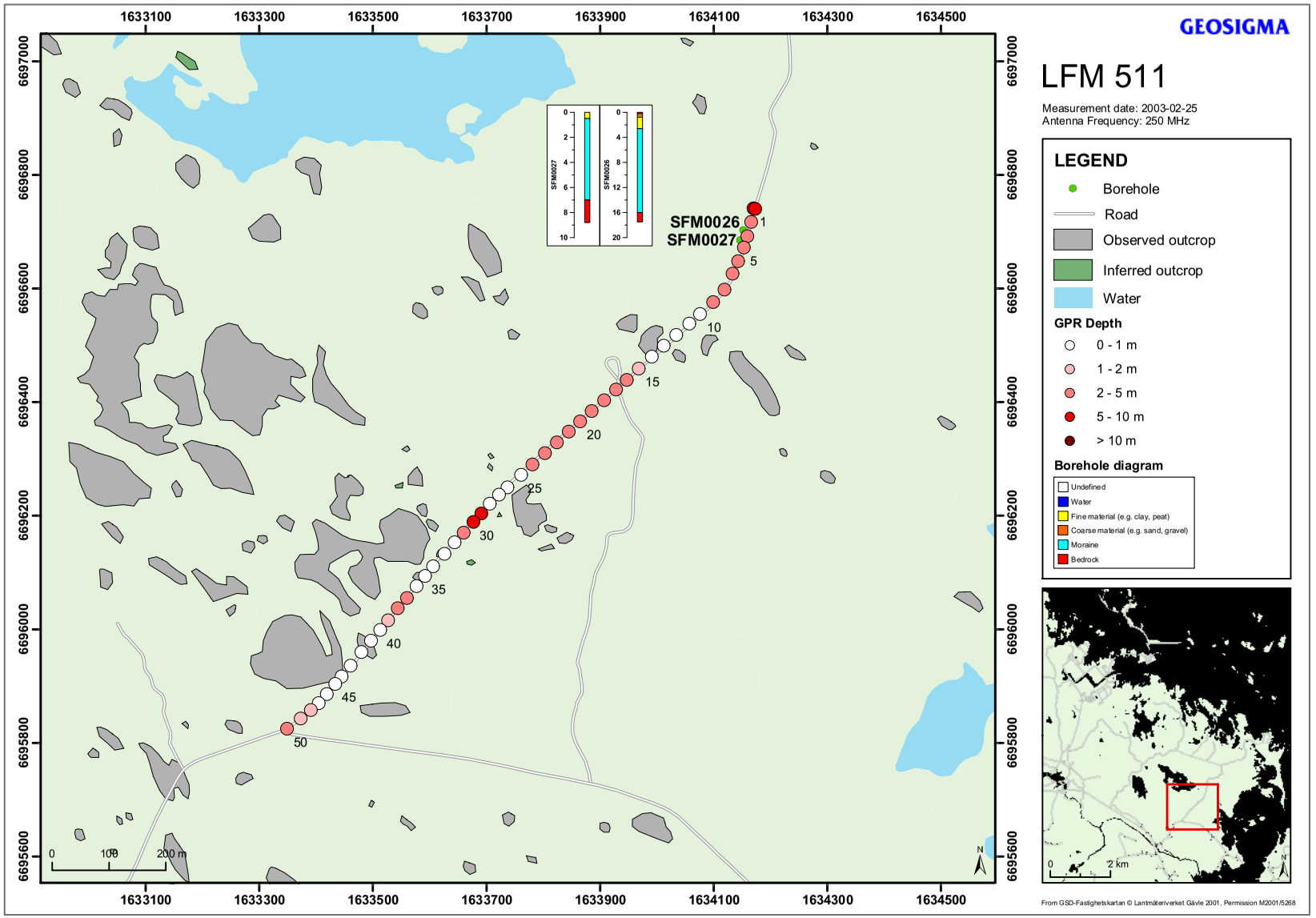
GEOSIGMA

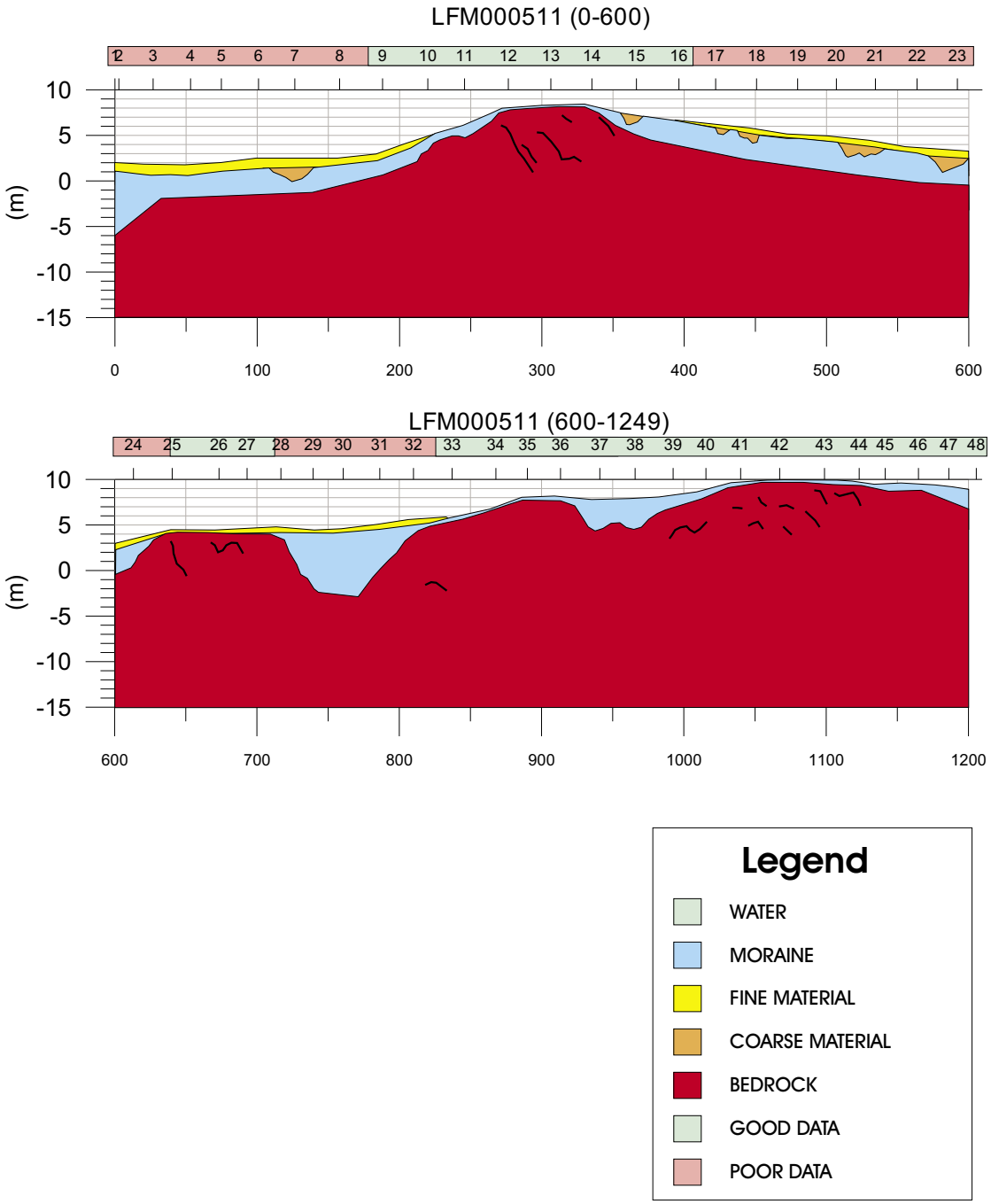


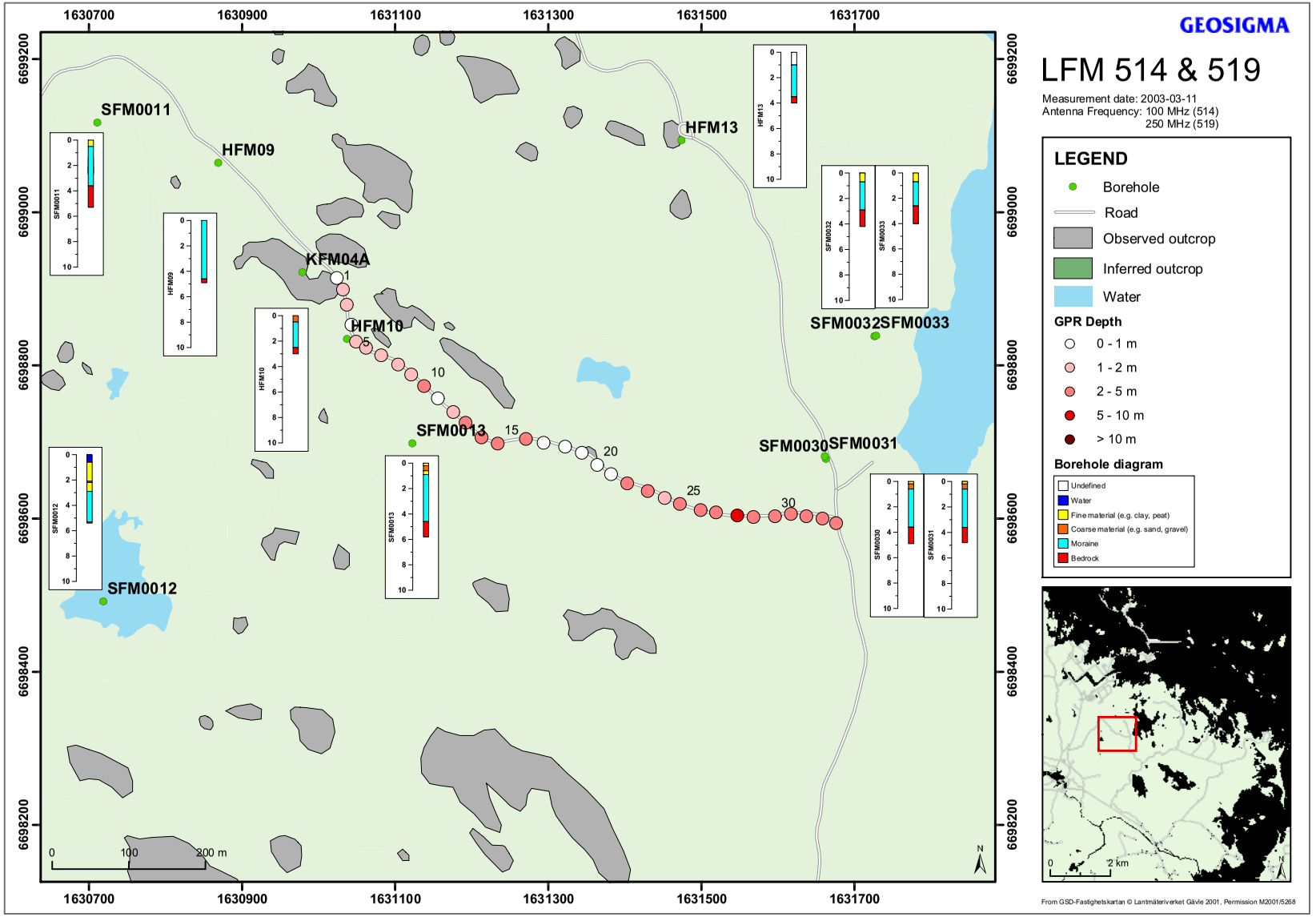



GEOSIGMA
LFM 510
Measurement date: 2003-02-25
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM06
SFM0006
HFM08
SFM0007
HFM07
SFM0026
SFM0027
1633700
1633900
1634100
1634300
1634500
1634700
1634900
1635100
6697600
6697400
6697200
6697000
6696800
6696600
6696400
0
100
200 m
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

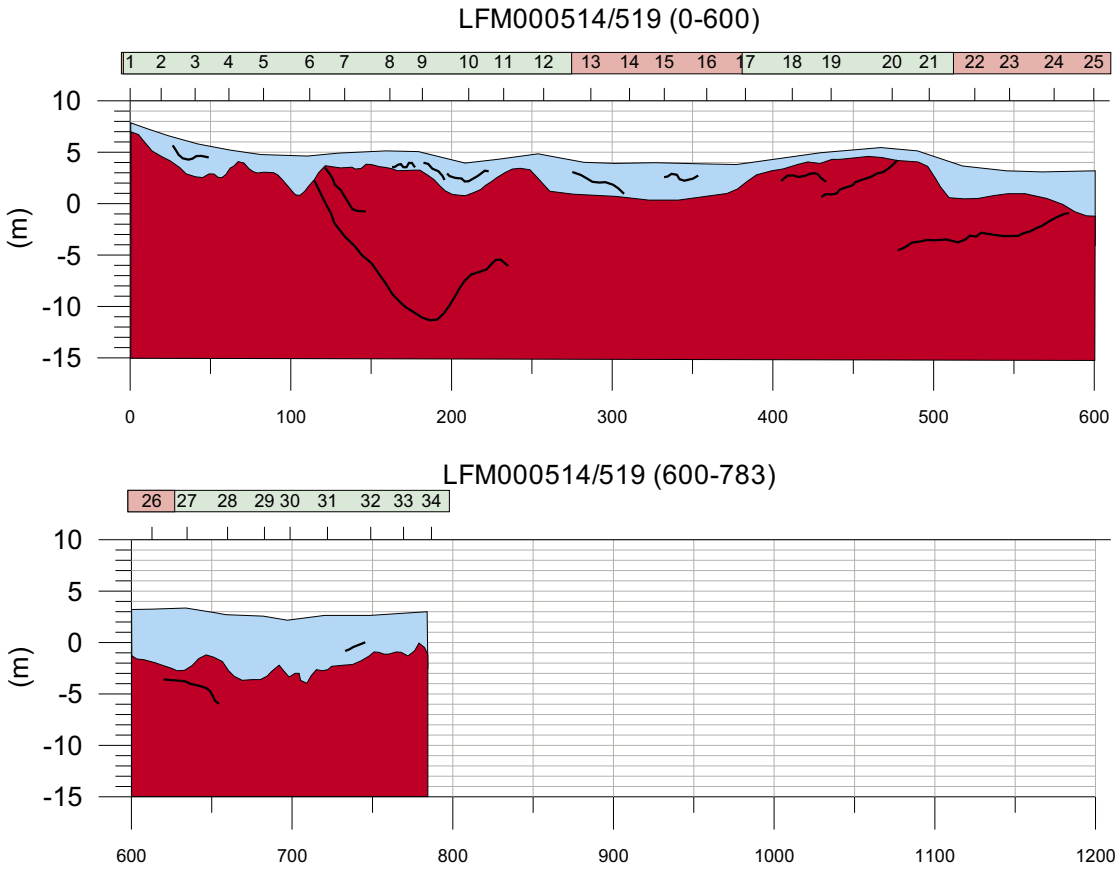

LFM000510 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000510 (600-1030)
25 26 27 28 29 30 31 32 33 34 35 36 37 38
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200
Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

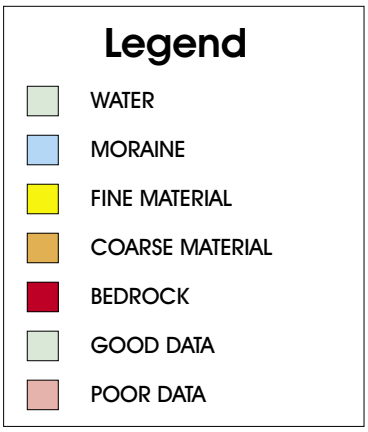

GEOSIGMA
LFM 511
Measurement date: 2003-02-25
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0026
SFM0027
1633100
1633300
1633500
1633700
1633900
1634100
1634300
1634500
6697000
6696800
6696600
6696400
6696200
6696000
6695800
6695600
0
100
200 m
0
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

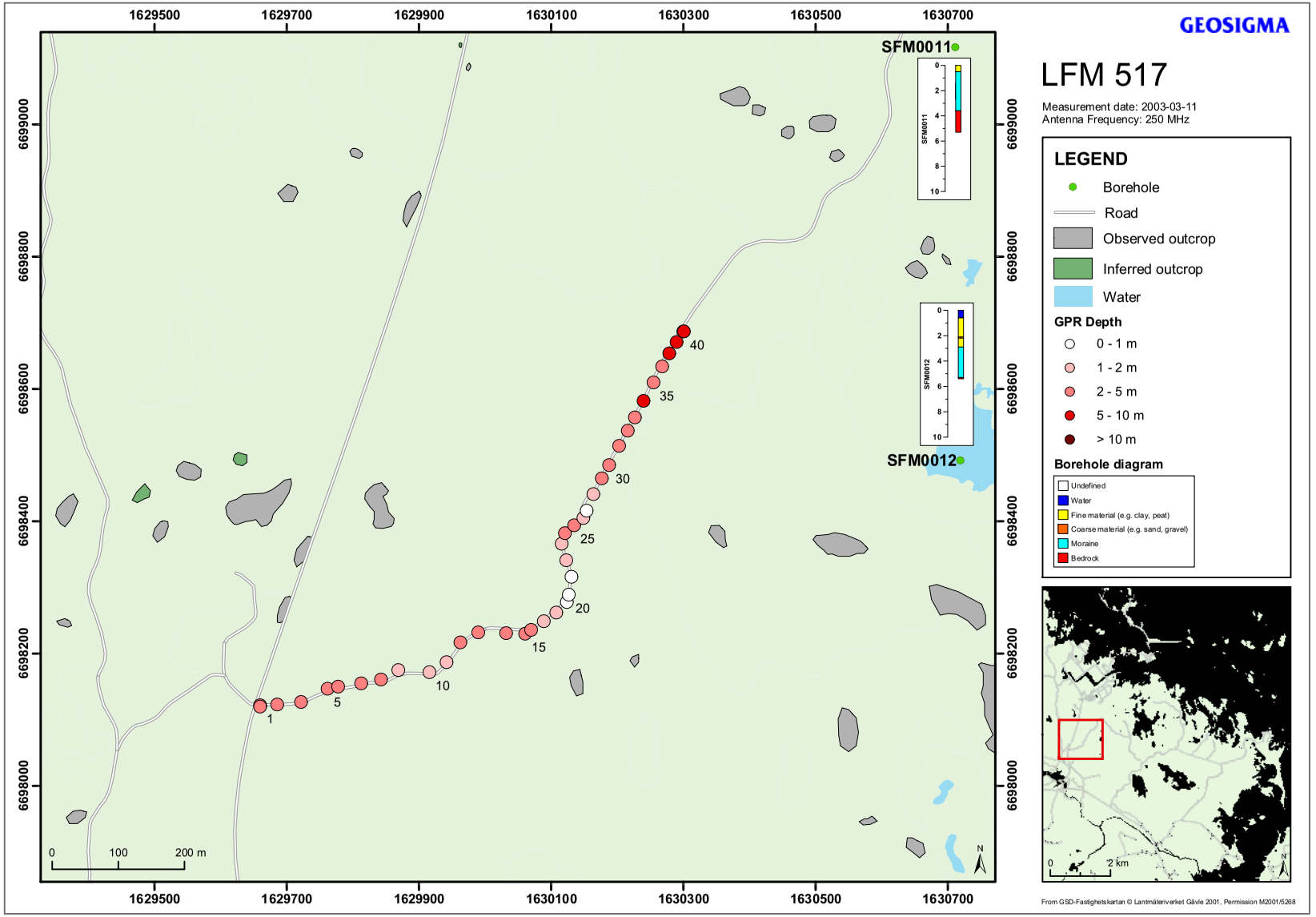

LFM000511 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000511 (600-1249)
24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200
Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 514 & 519
Measurement date: 2003-03-11
Antenna Frequency: 100 MHz (514)
250 MHz (519)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0011
HFM09
HFM13
KFM04A
HFM10
SFM0013
SFM0032
SFM0033
SFM0030
SFM0031
SFM0012
1630700
1630900
1631100
1631300
1631500
1631700
6699200
6699000
6698800
6698600
6698400
6698200
0
100
200 m
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

LFM000514/519 GEOSIGMA

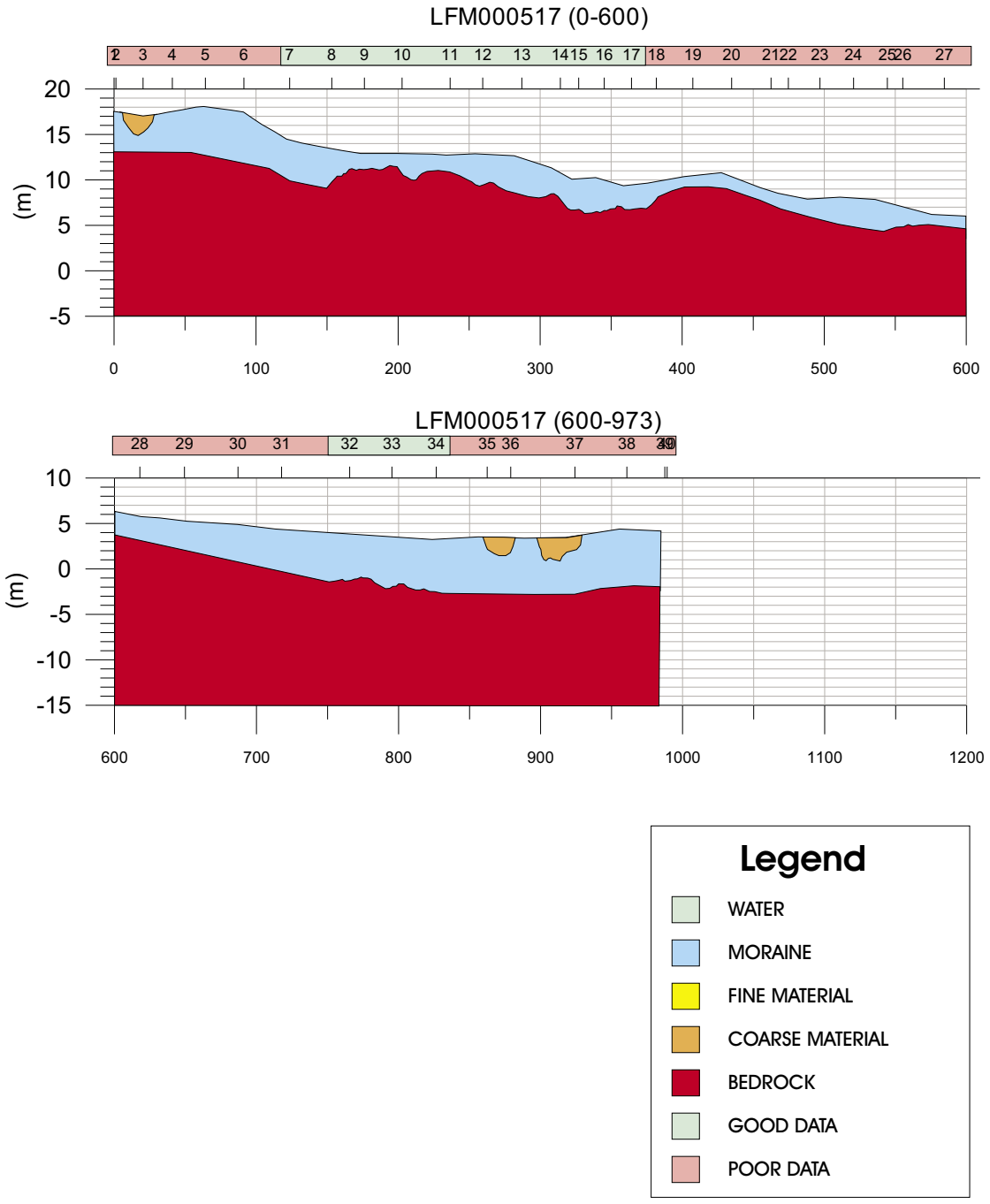


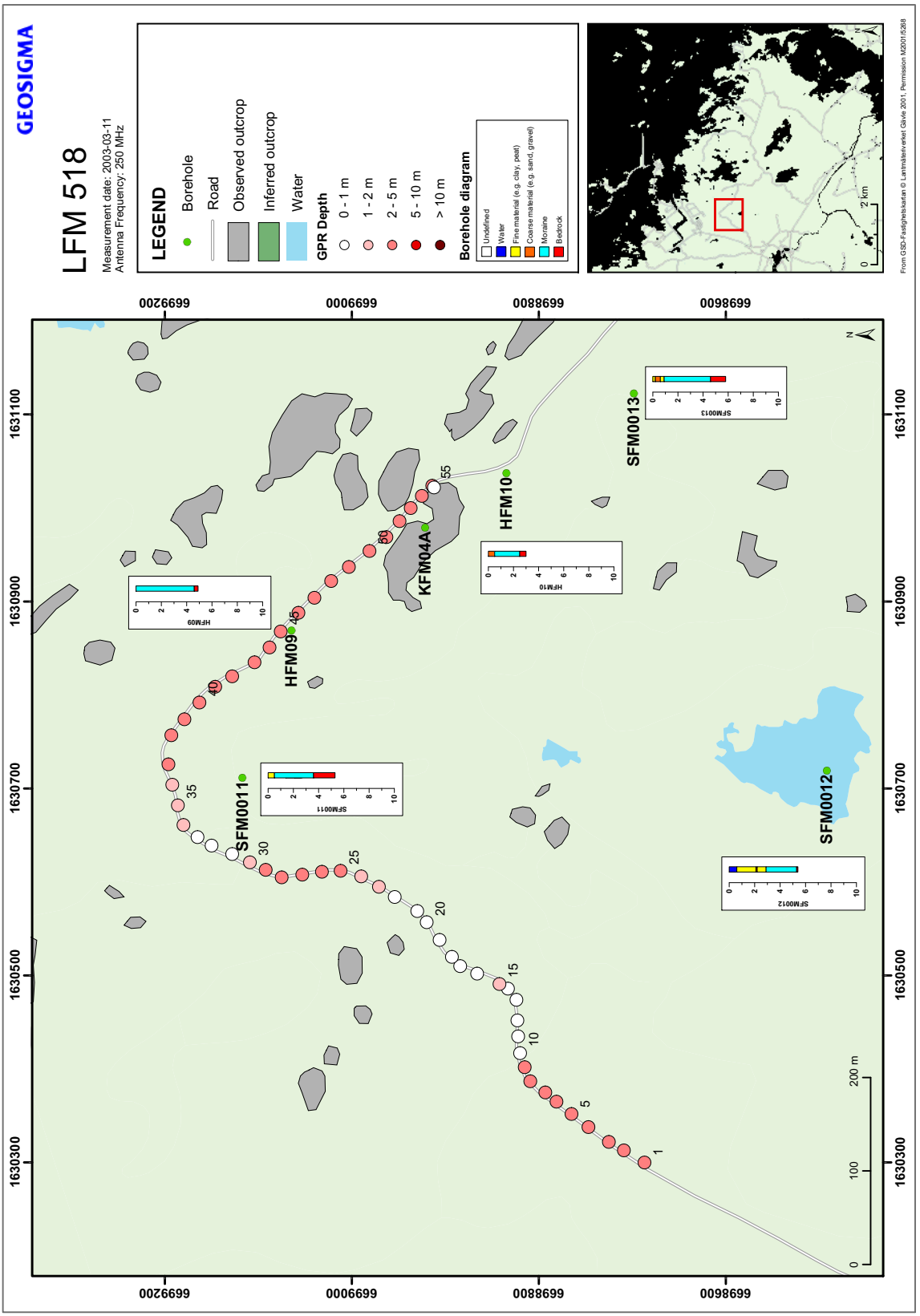



GEOSIGMA
LFM 517
Measurement date: 2003-03-11
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0011
SFM0012
1629500
1629700
1629900
1630100
1630300
1630500
1630700
6699000
6698800
6698600
6698400
6698200
6698000
0
100
200 m
0
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001. Permission M2001/5268

LFM000517

GEOSIGMA




GEOSIGMA
LFM 518
Measurement date: 2003-03-11
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
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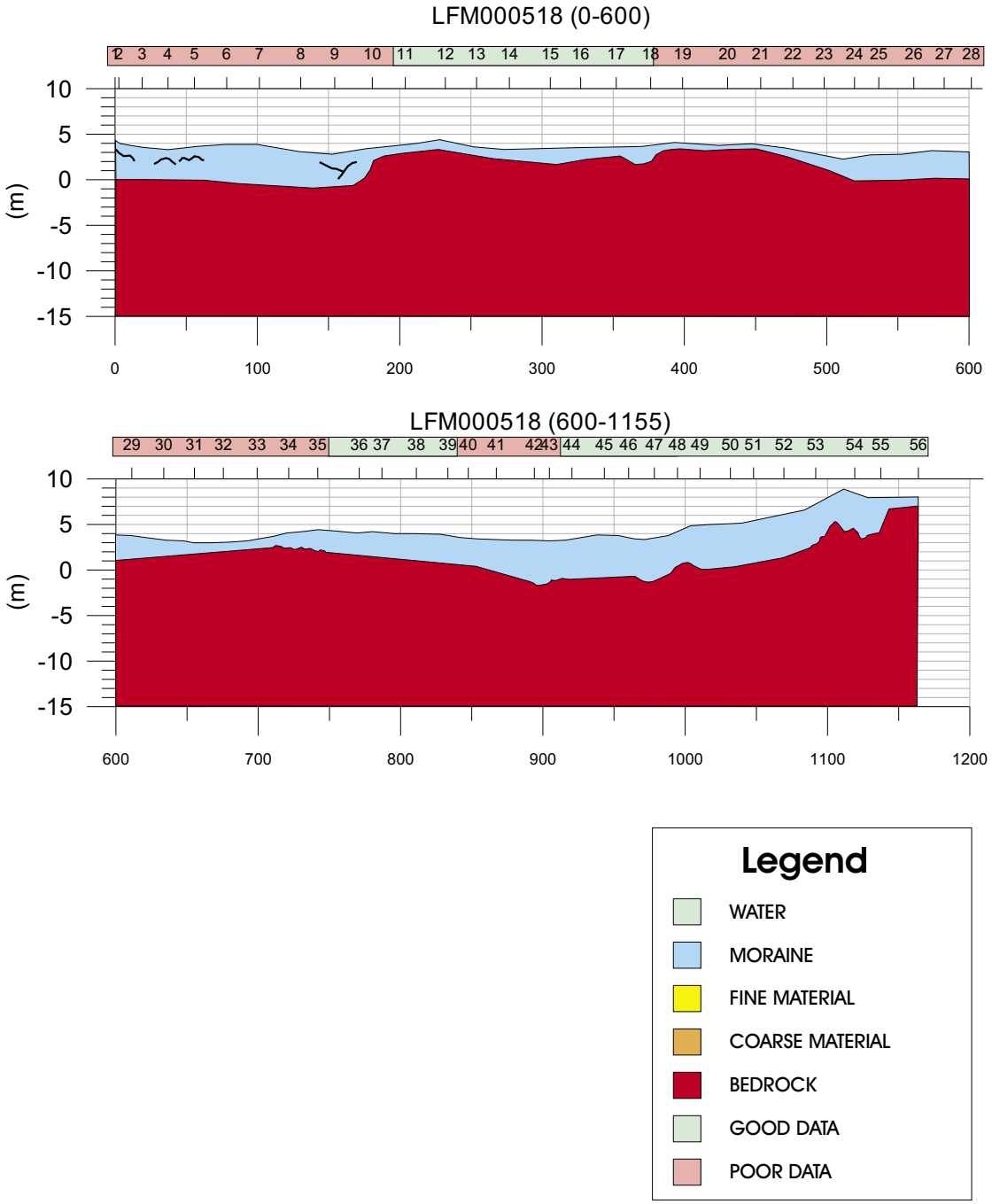
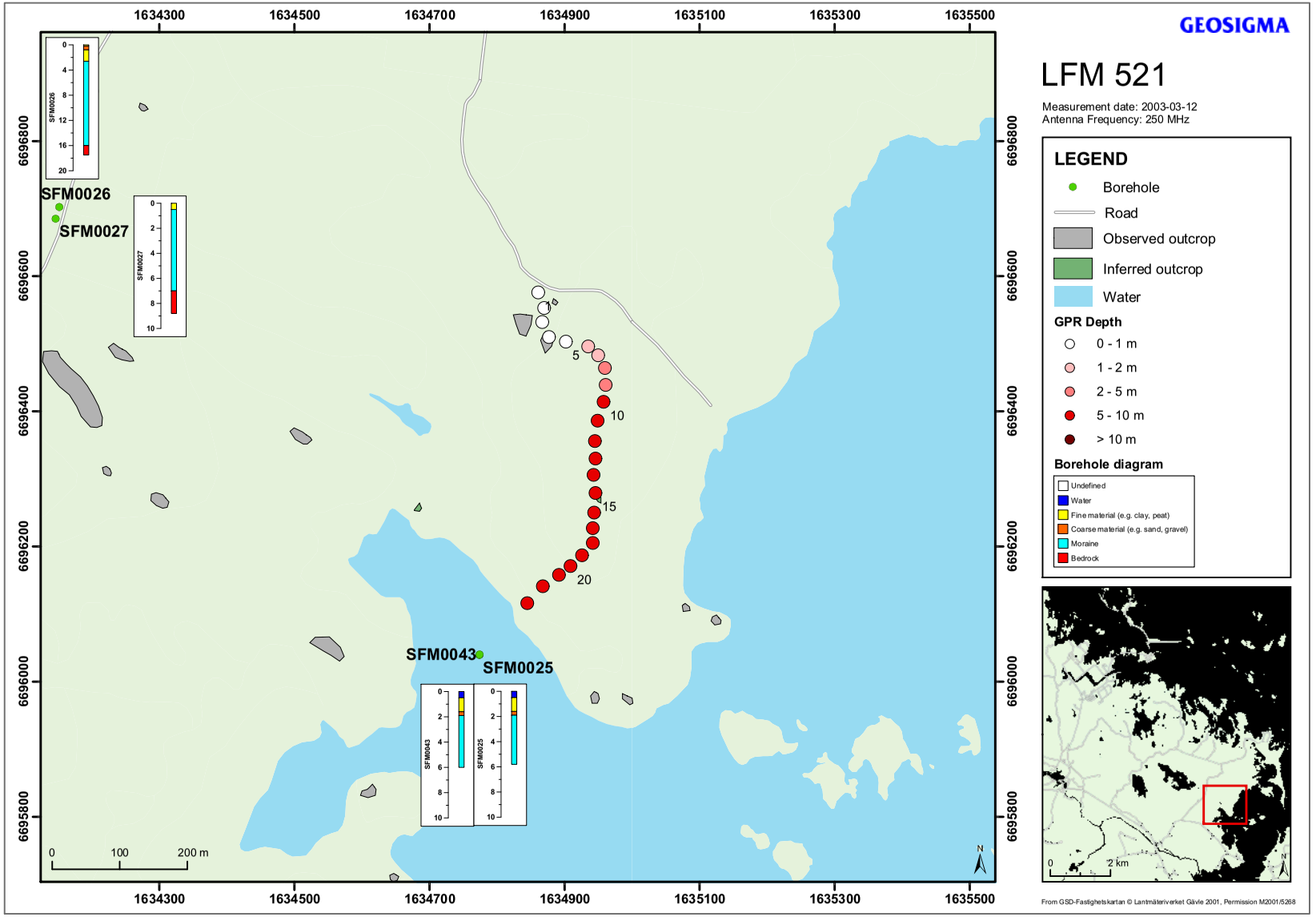
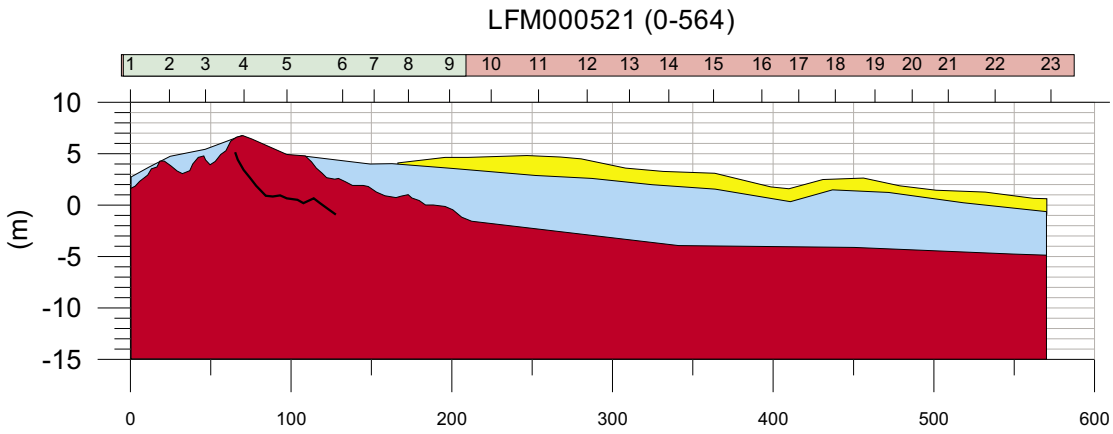
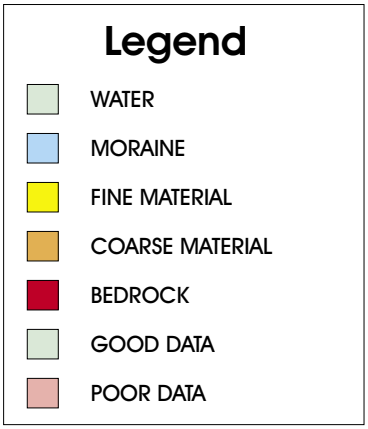
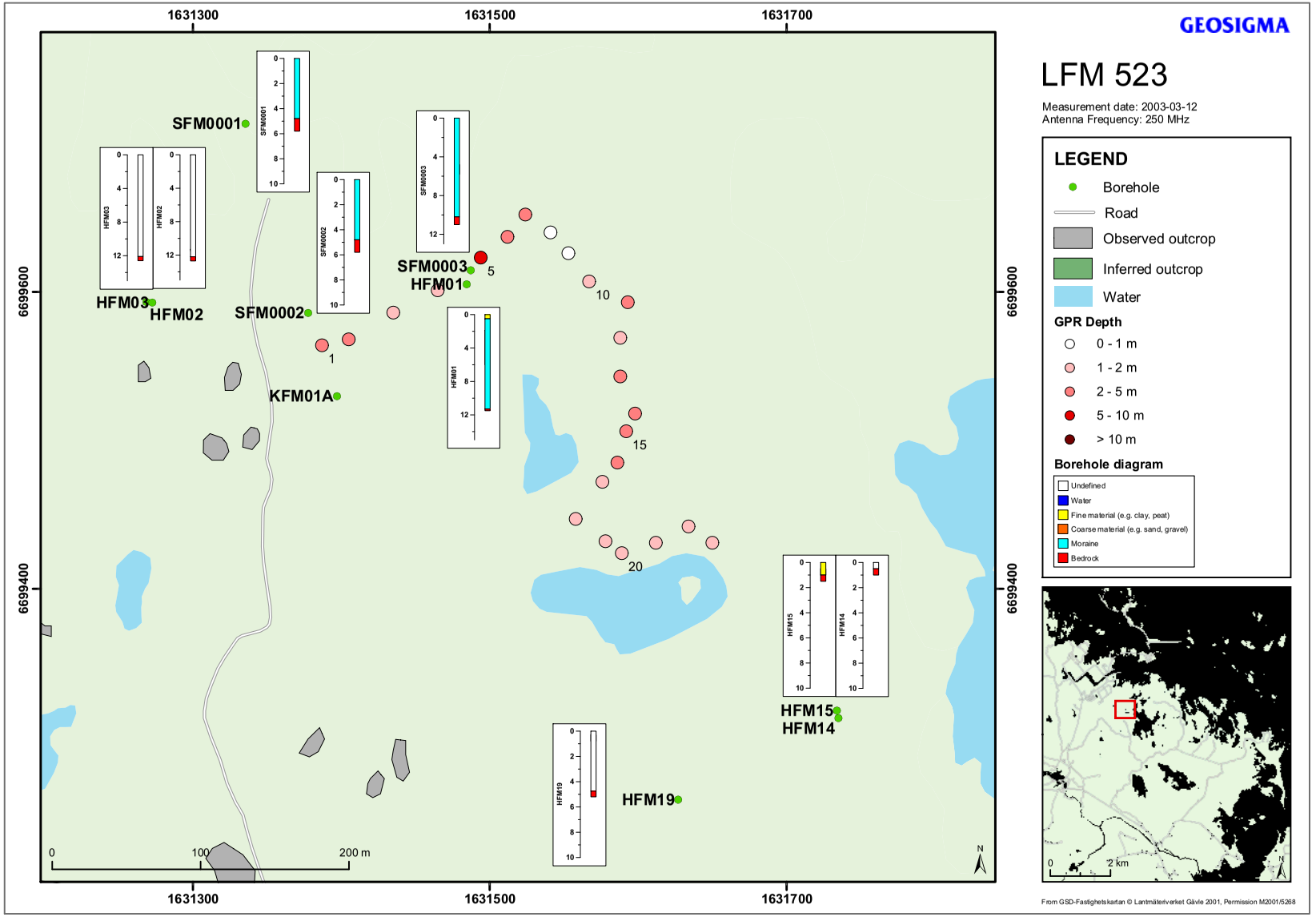
2 km
SFM0011
SFM0012
SFM0013
HFM09
HFM10
KFM04A
200 m
100
0
1630300
1630500
1630700
1630900
1631100
6698200
6698400
6698600
6698800
6699000
6699200

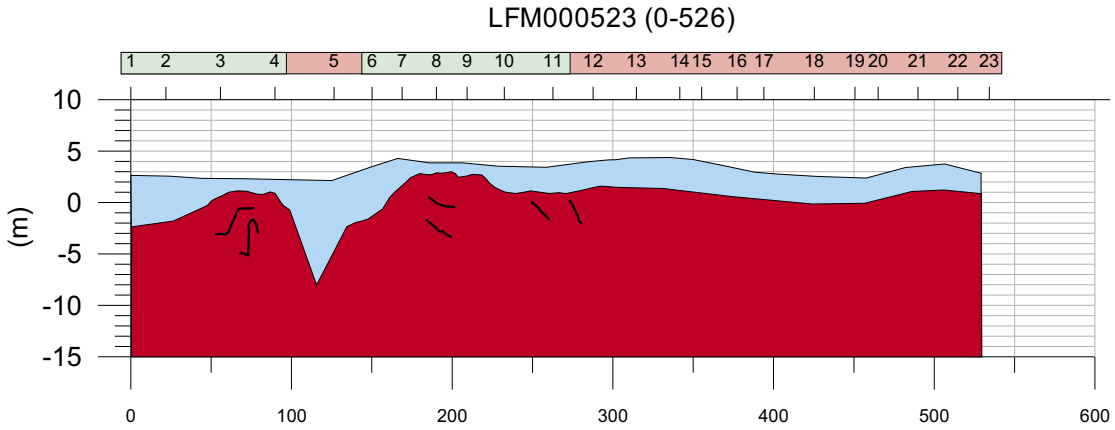

LFM000518 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600
LFM000518 (600-1155)
29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56
10
5
0
-5
-10
-15
(m)
600
700
800
900
1000
1100
1200
Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

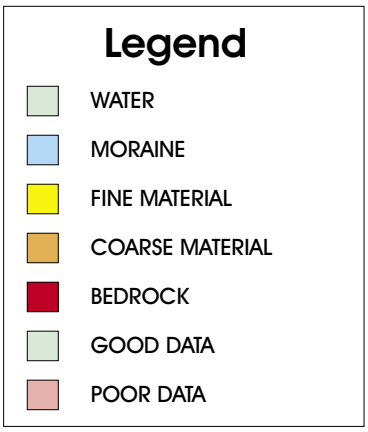

GEOSIGMA
LFM 521
Measurement date: 2003-03-12
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0026
SFM0027
SFM0043
SFM0025
1634300
1634500
1634700
1634900
1635100
1635300
1635500
6696800
6696600
6696400
6696200
6696000
6695800
0
100
200 m
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

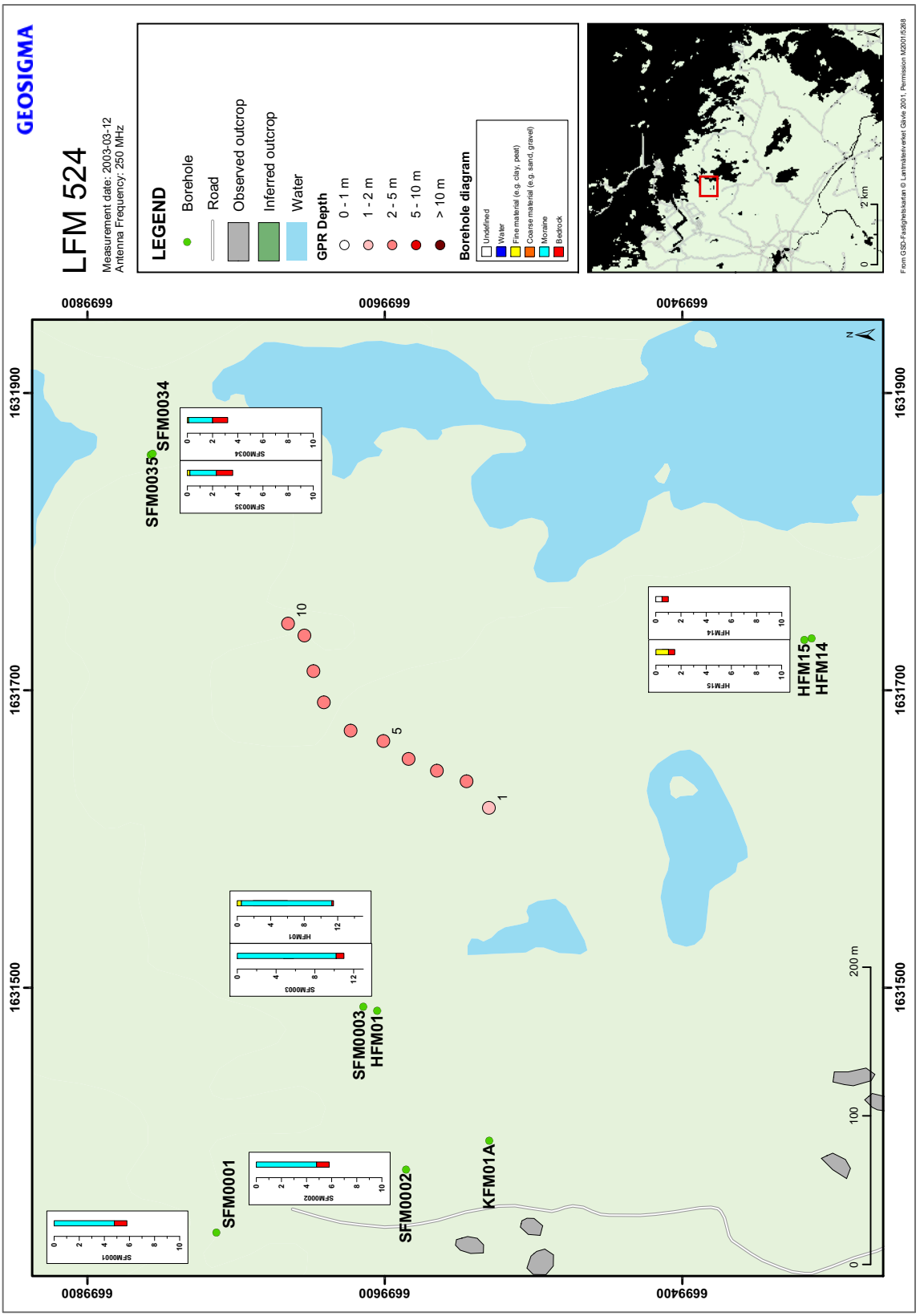

LFM000521 (0-564)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

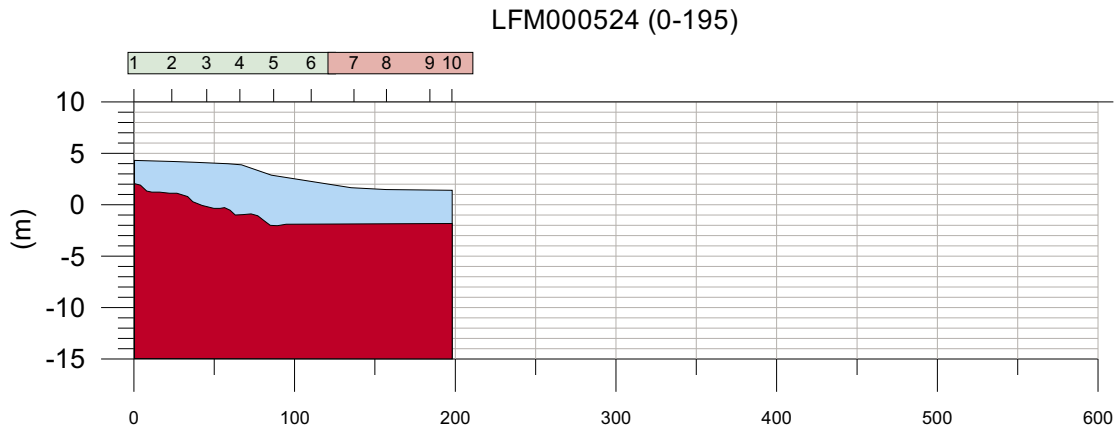

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

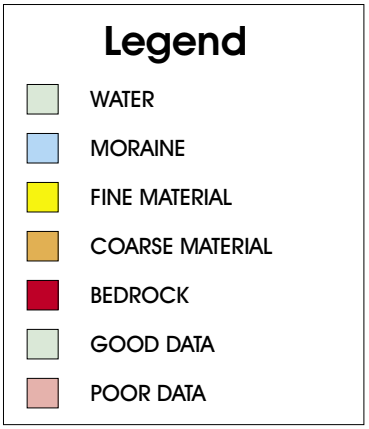

GEOSIGMA
LFM 523
Measurement date: 2003-03-12
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
1631300
1631500
1631700
6699600
6699400
SFM0001
HFM03
HFM02
SFM0002
SFM0003
HFM01
KFM01A
HFM15
HFM14
HFM19
1
5
10
15
20
0
100
200 m
N
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

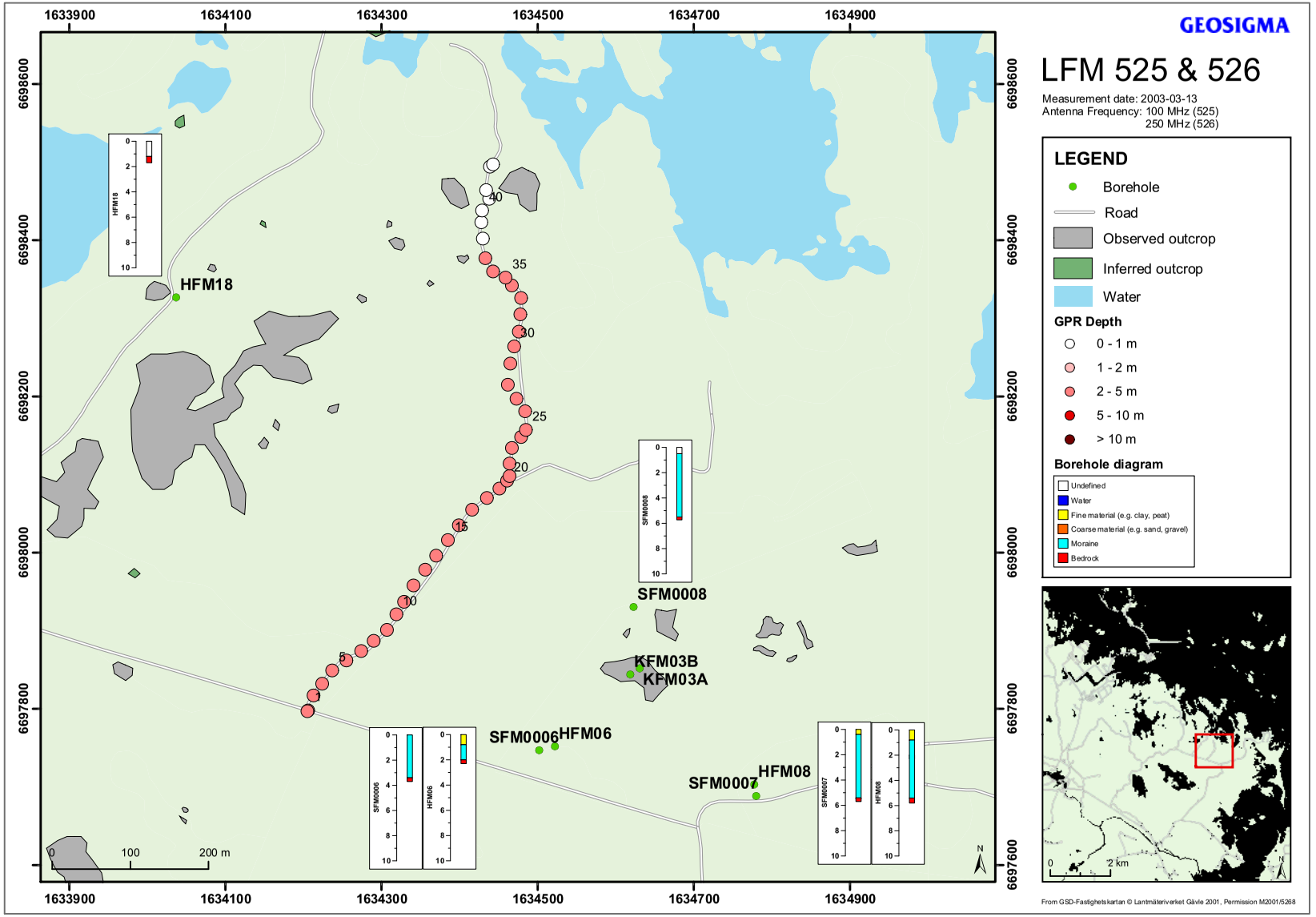

LFM000523 (0-526)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

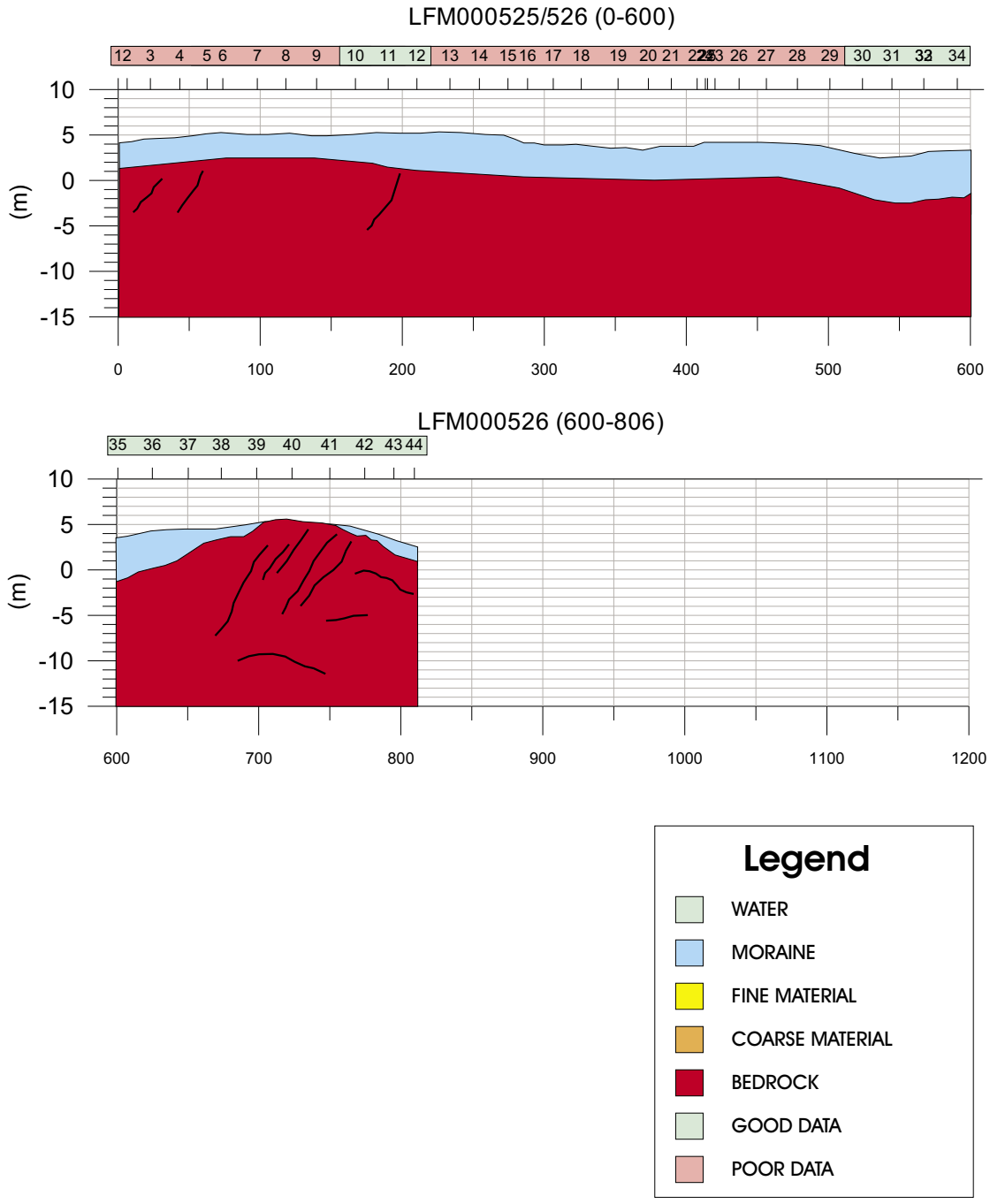

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

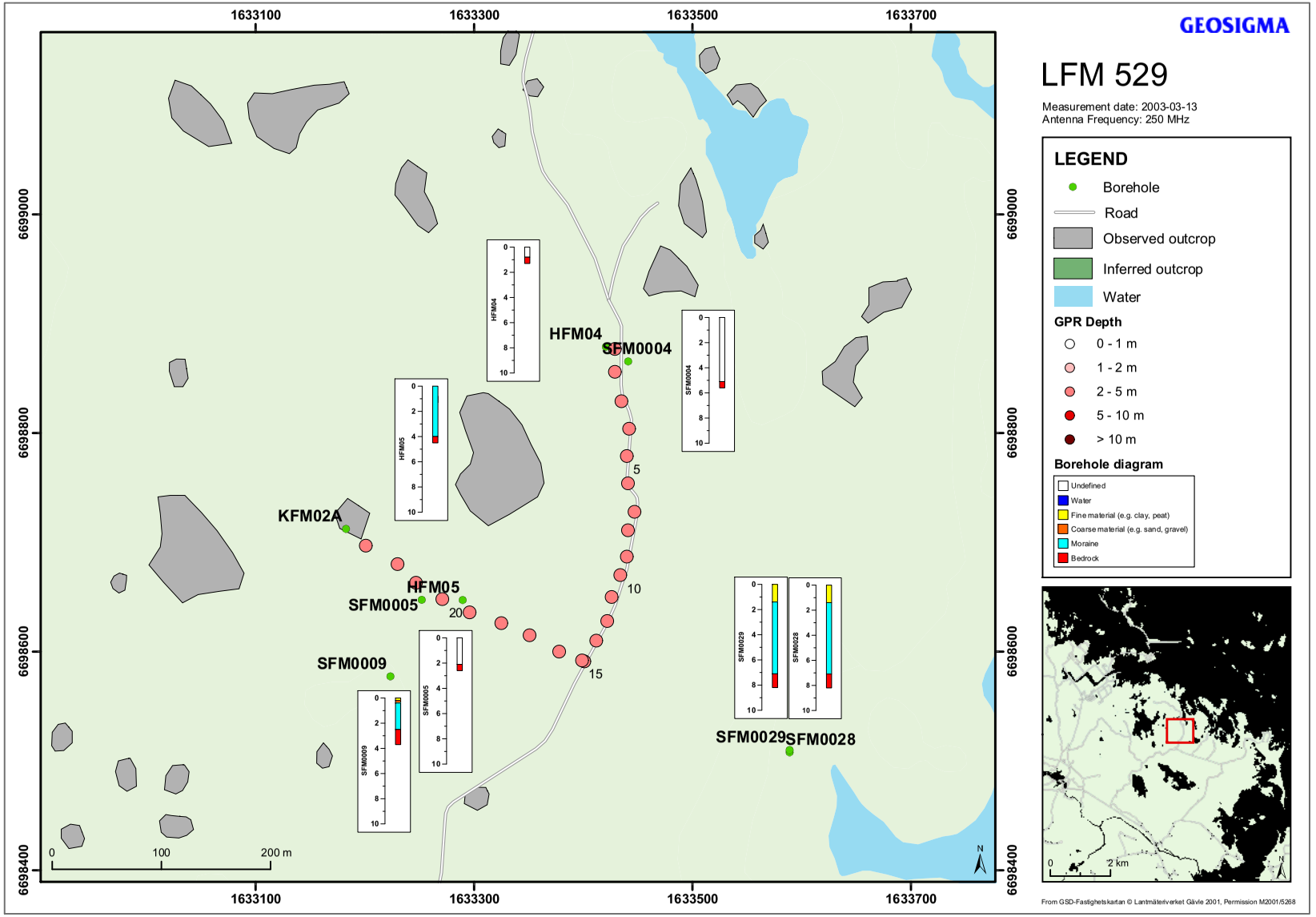

GEOSIGMA
LFM 524
Measurement date: 2003-03-12
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001. Permission M2001/5268
6699800
6699600
6699400
1631900
1631700
1631500
SFM0035
SFM0034
SFM0003
HFM01
SFM0001
SFM0002
KFM01A
HFM15
HFM14
10
5
1
200 m
100
0

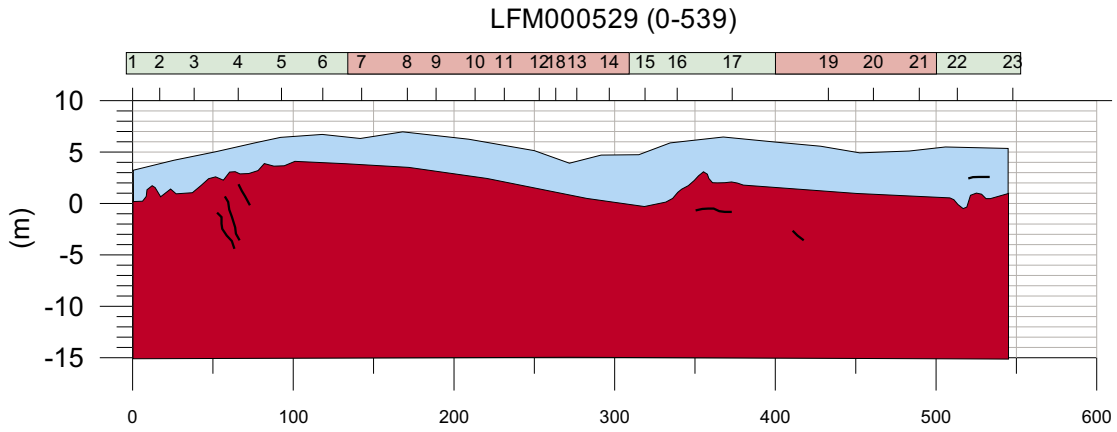

LFM000524 (0-195)
1 2 3 4 5 6 7 8 9 10
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

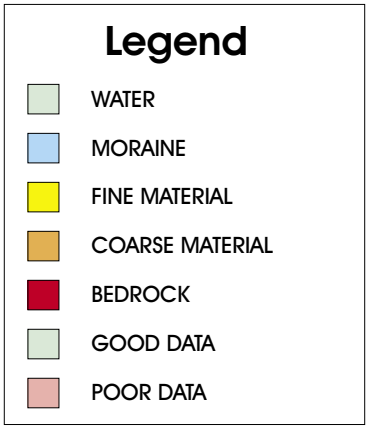

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

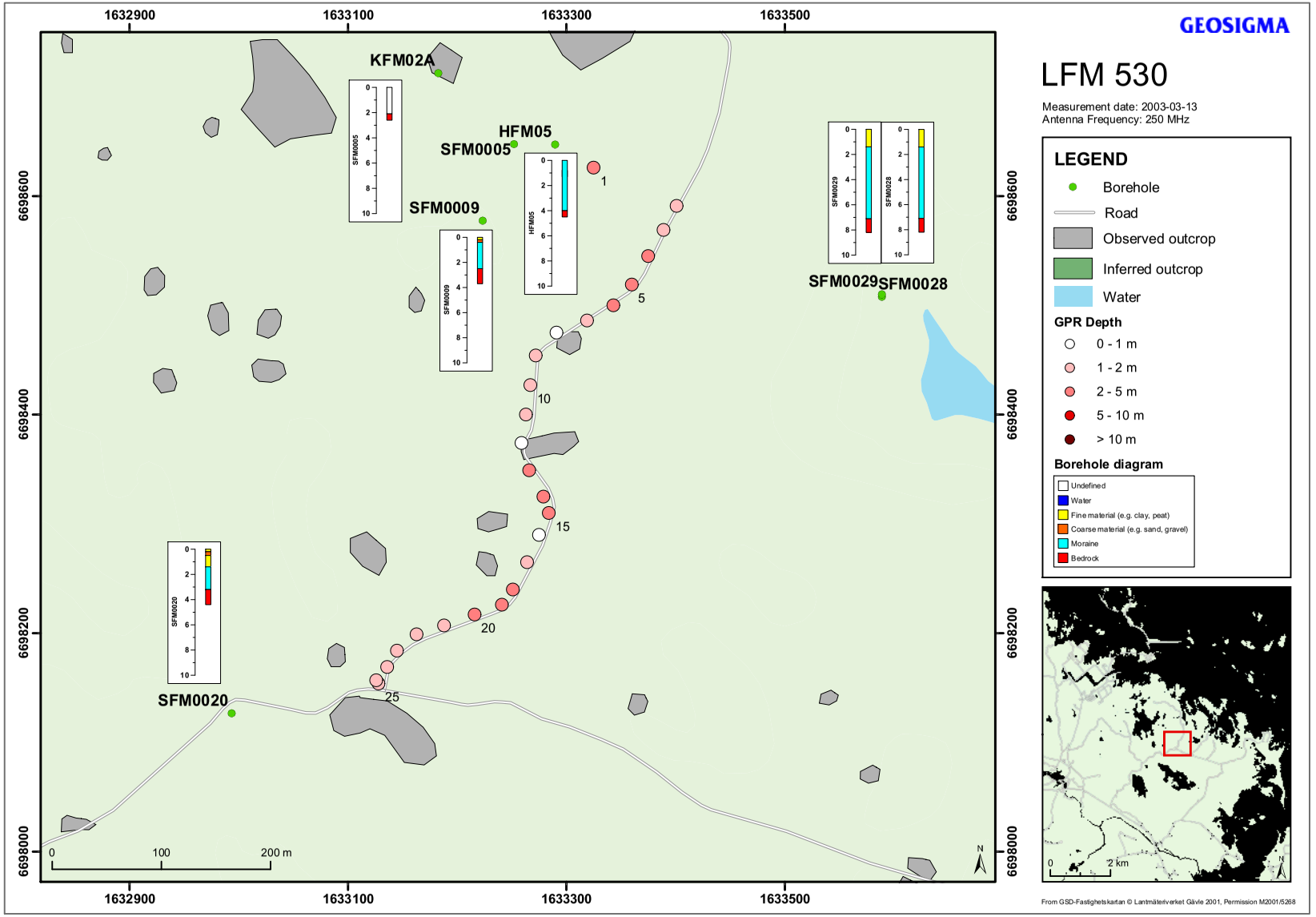

GEOSIGMA
LFM 525 & 526
Measurement date: 2003-03-13
Antenna Frequency: 100 MHz (525)
250 MHz (526)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM18
SFM0008
KFM03B
KFM03A
SFM0006
HFM06
SFM0007
HFM08
1633900
1634100
1634300
1634500
1634700
1634900
6698600
6698400
6698200
6698000
6697800
6697600
0
100
200 m
0
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

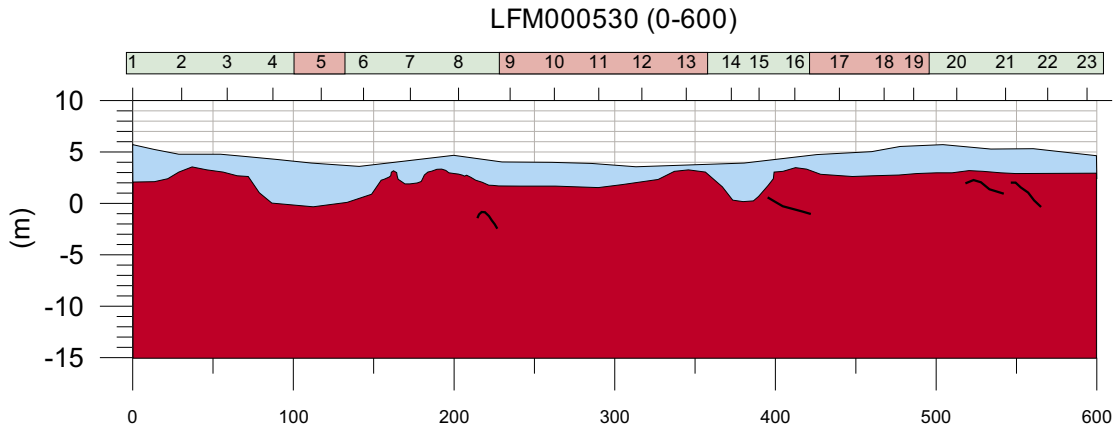

LFM000525/526 (0-600)
LFM000526 (600-806)
(m)
Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA

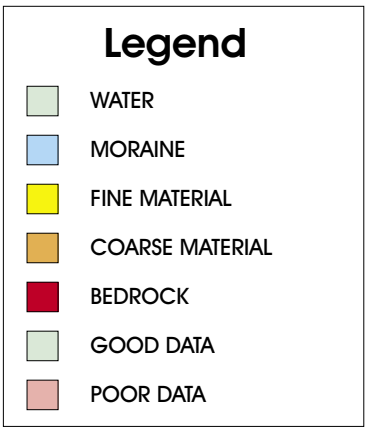

GEOSIGMA
LFM 529
Measurement date: 2003-03-13
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
1633100
1633300
1633500
1633700
6699000
6698800
6698600
6698400
HFM04
SFM0004
KFM02A
HFM05
SFM0005
SFM0009
SFM0029
SFM0028
5
10
15
20
0
100
200 m
N
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

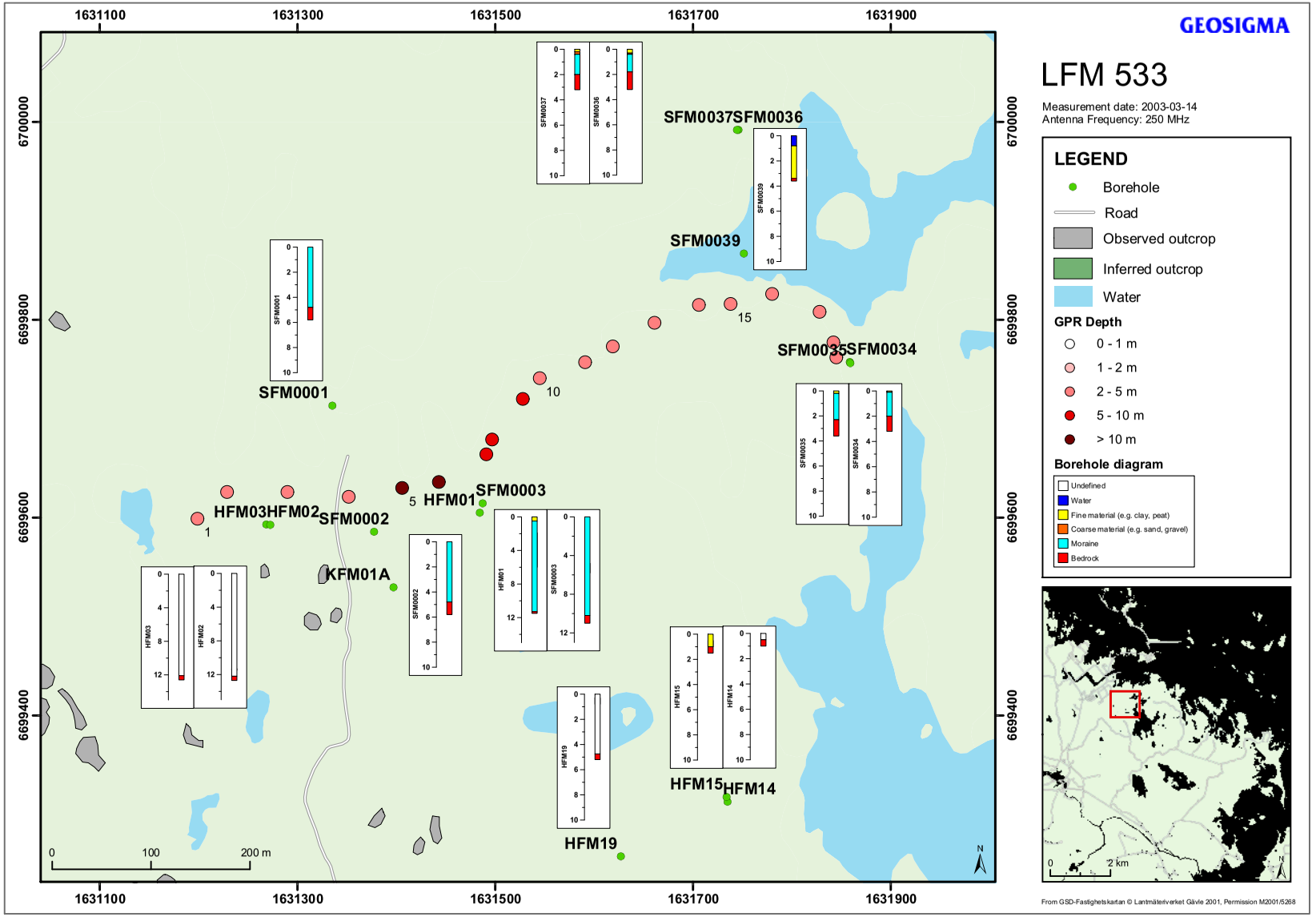

LFM000529 (0-539)
1 2 3 4 5 6 7 8 9 10 11 12 18 13 14 15 16 17 19 20 21 22 23
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 530
Measurement date: 2003-03-13
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
KFM02A
HFM05
SFM0005
SFM0009
SFM0029
SFM0028
SFM0020
1
5
10
15
20
25
1632900
1633100
1633300
1633500
6698600
6698400
6698200
6698000
0
100
200 m
N
0
2 km
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

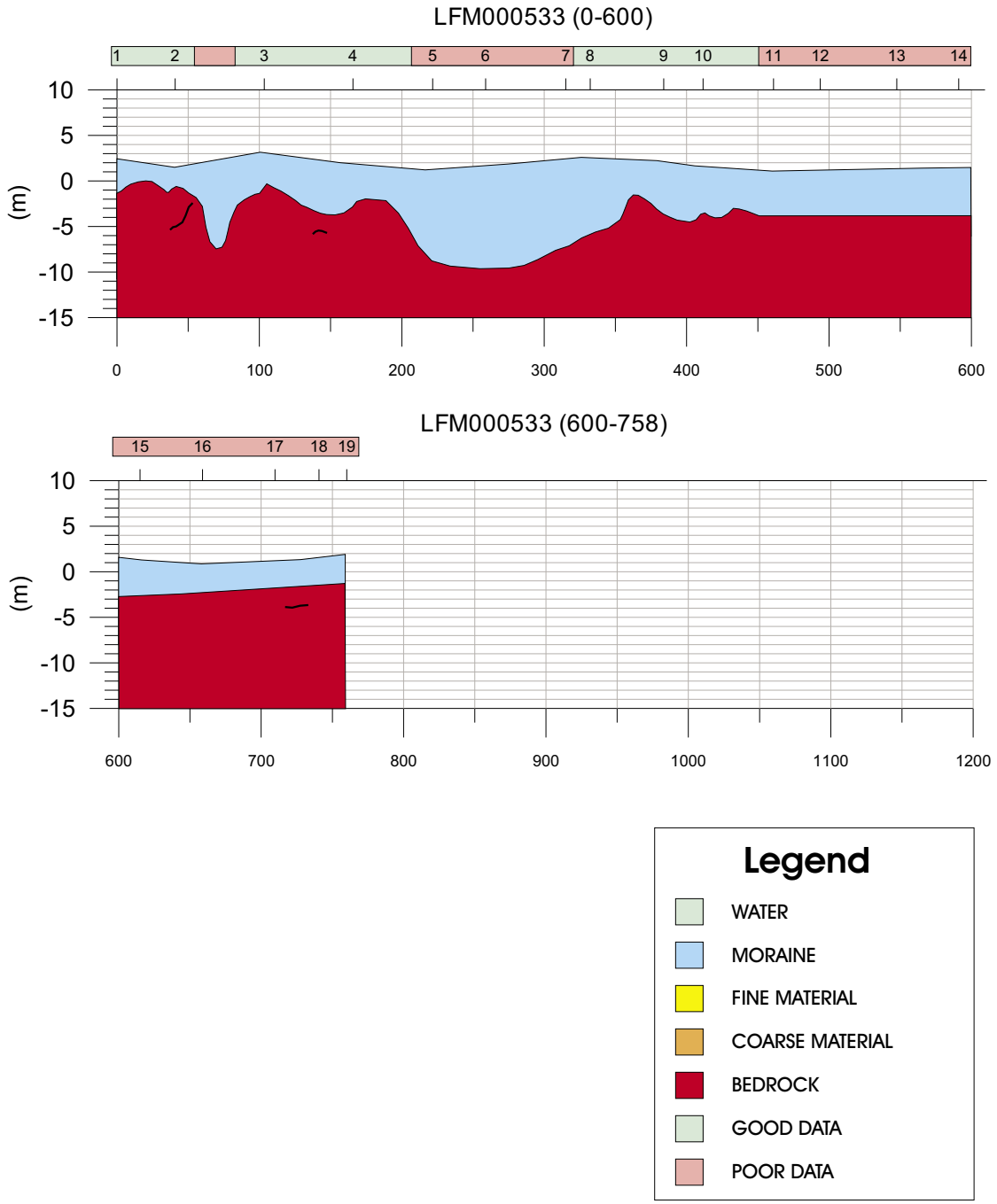

LFM000530 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600

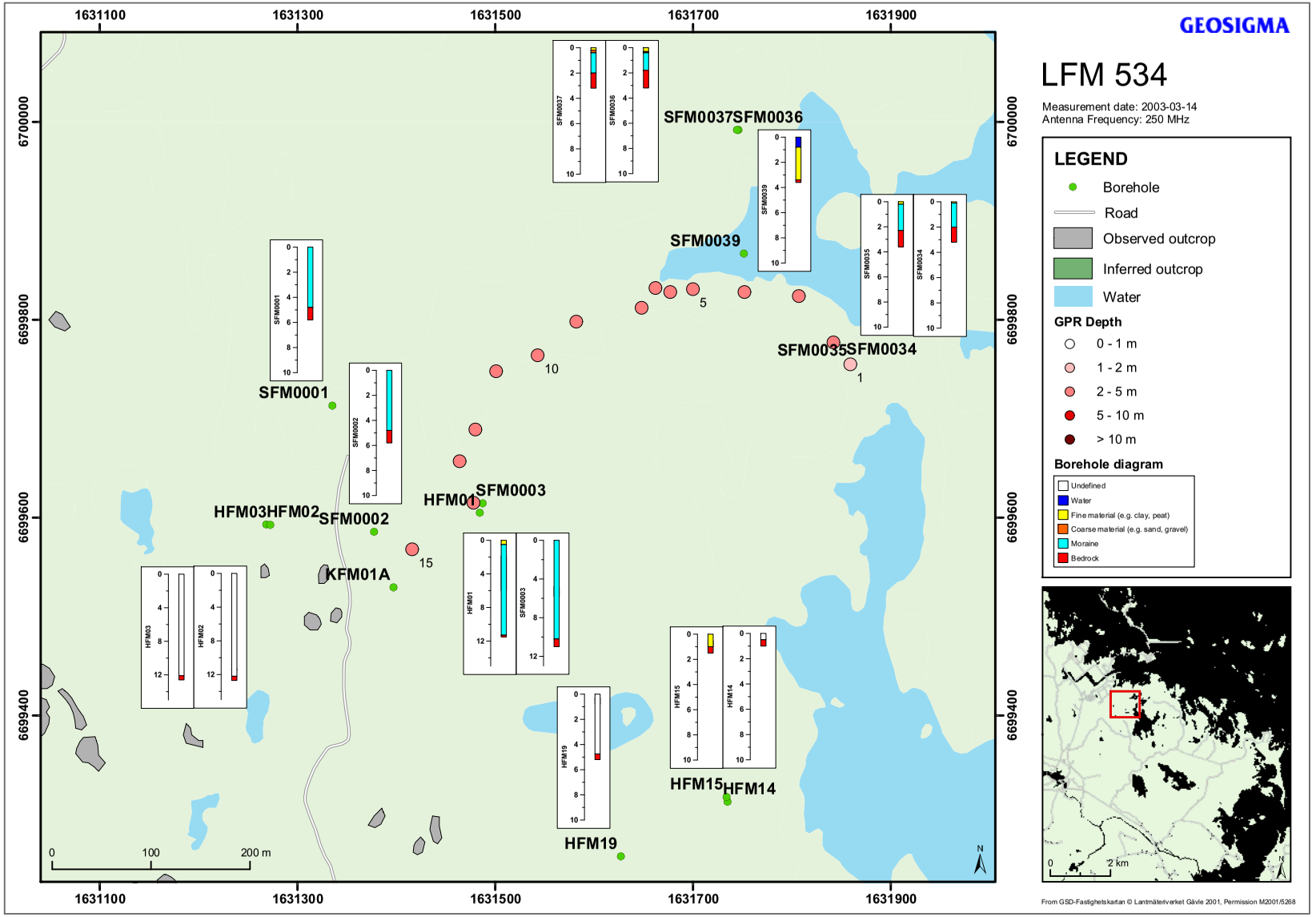

Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 533
Measurement date: 2003-03-14
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
1631100
1631300
1631500
1631700
1631900
6700000
6699800
6699600
6699400
SFM0037
SFM0036
SFM0039
SFM0001
SFM0035
SFM0034
HFM01
SFM0003
HFM03
HFM02
SFM0002
KFM01A
HFM19
HFM15
HFM14
0
100
200 m
0
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268

LFM000533

GEOSIGMA




GEOSIGMA
LFM 534
Measurement date: 2003-03-14
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
1631100
1631300
1631500
1631700
1631900
6700000
6699800
6699600
6699400
SFM0037SFM0036
SFM0039
SFM0035SFM0034
SFM0001
SFM0002
HFM01
SFM0003
HFM03HFM02
KFM01A
HFM19
HFM15HFM14
0
100
200 m
0
2 km
N
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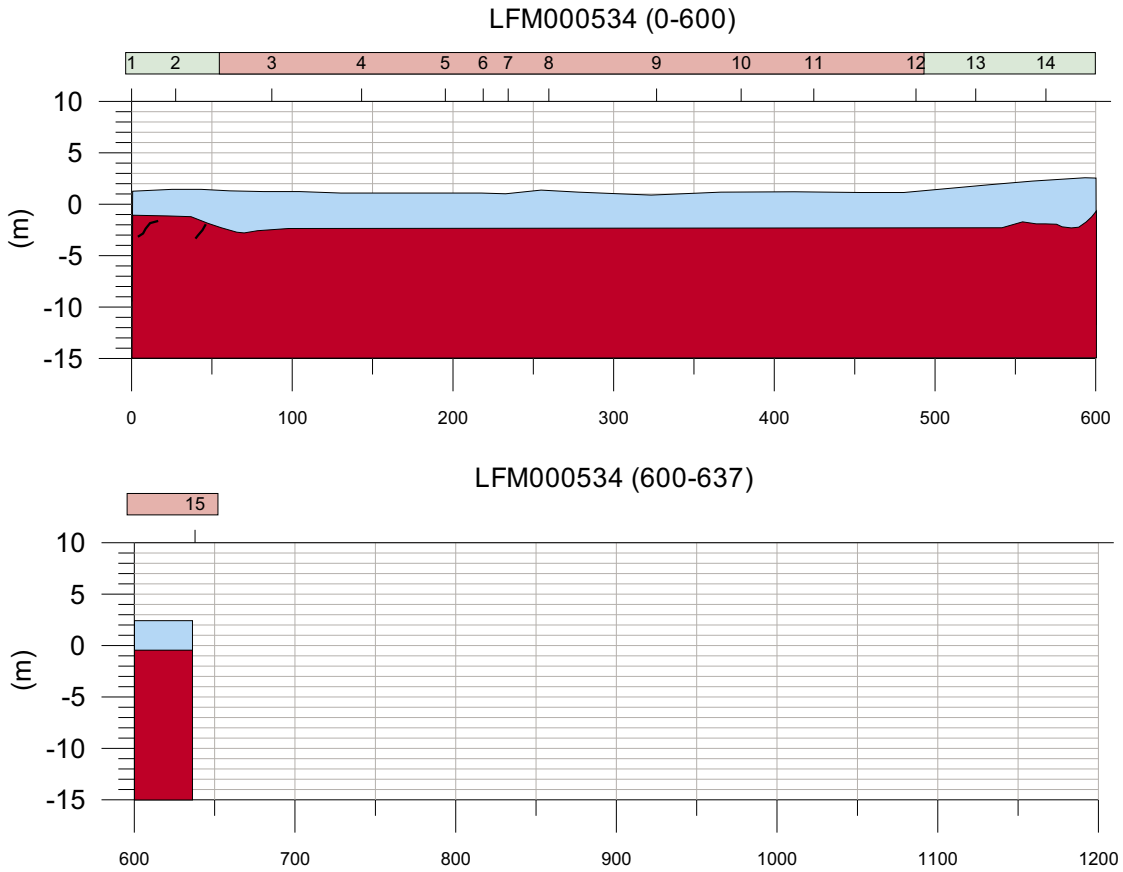
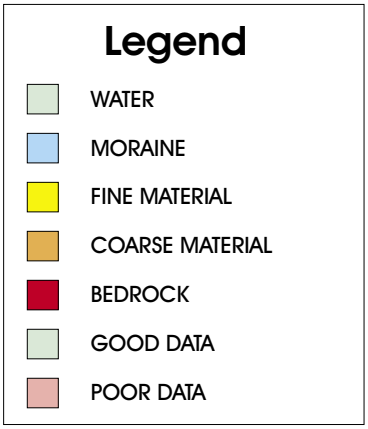
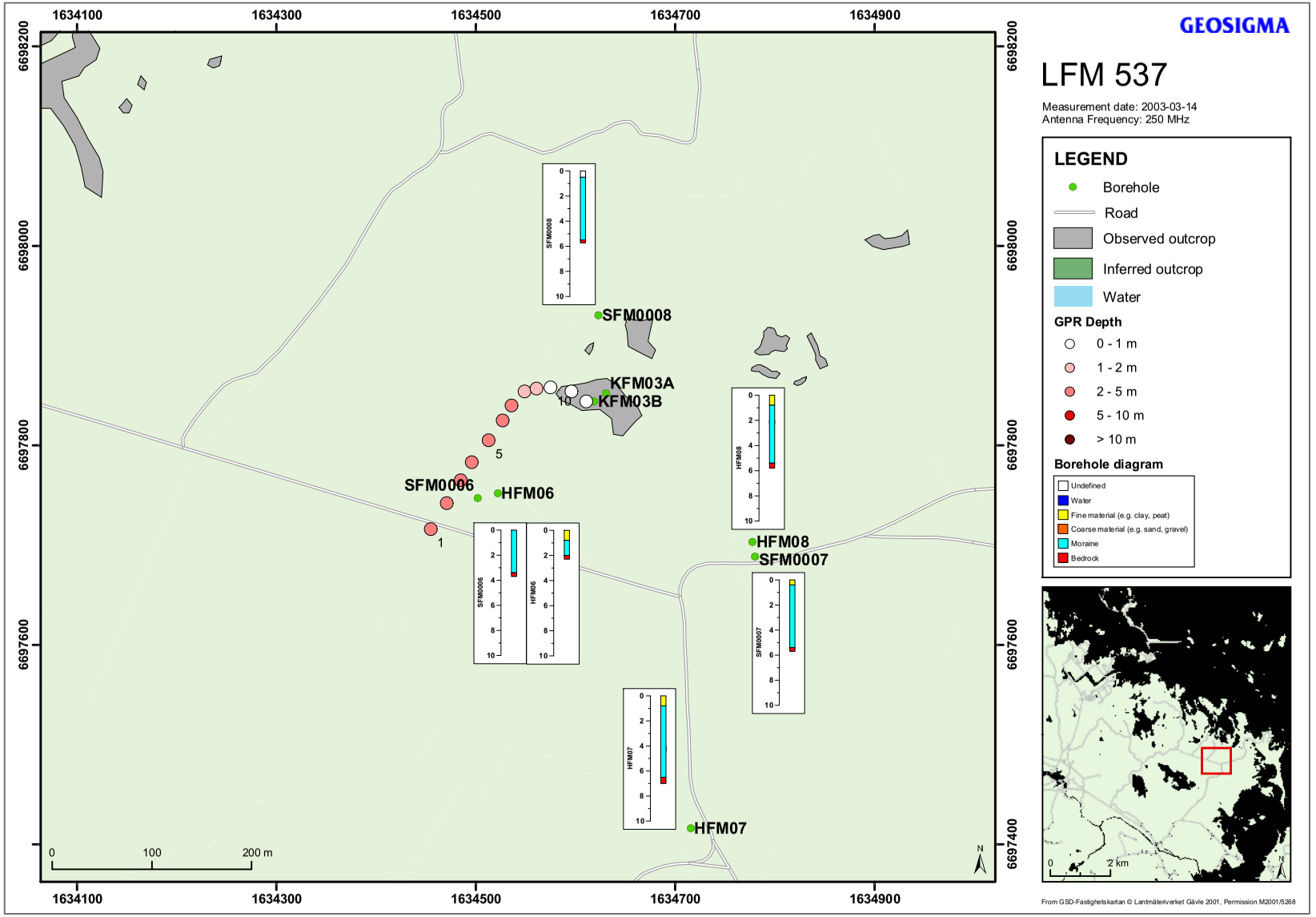
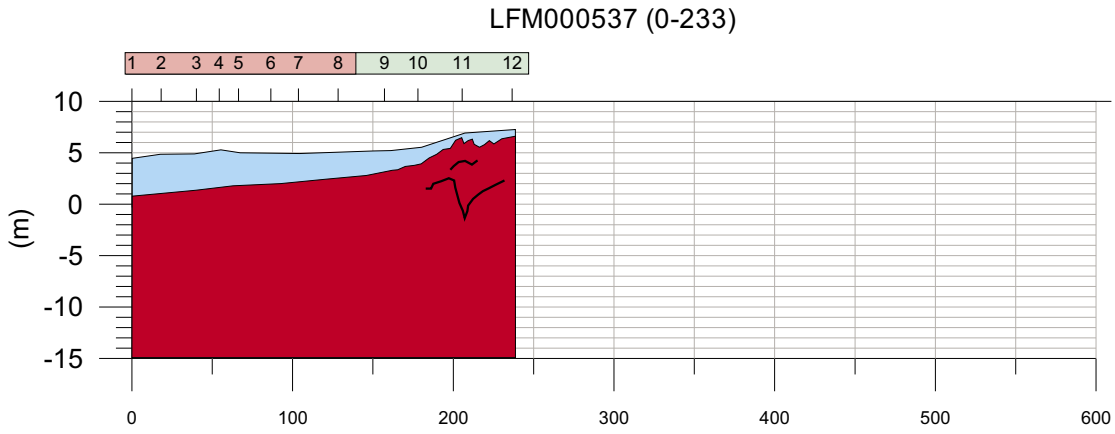
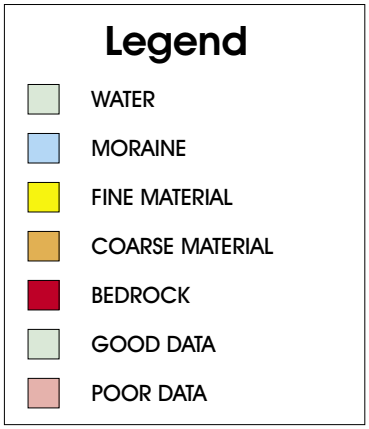
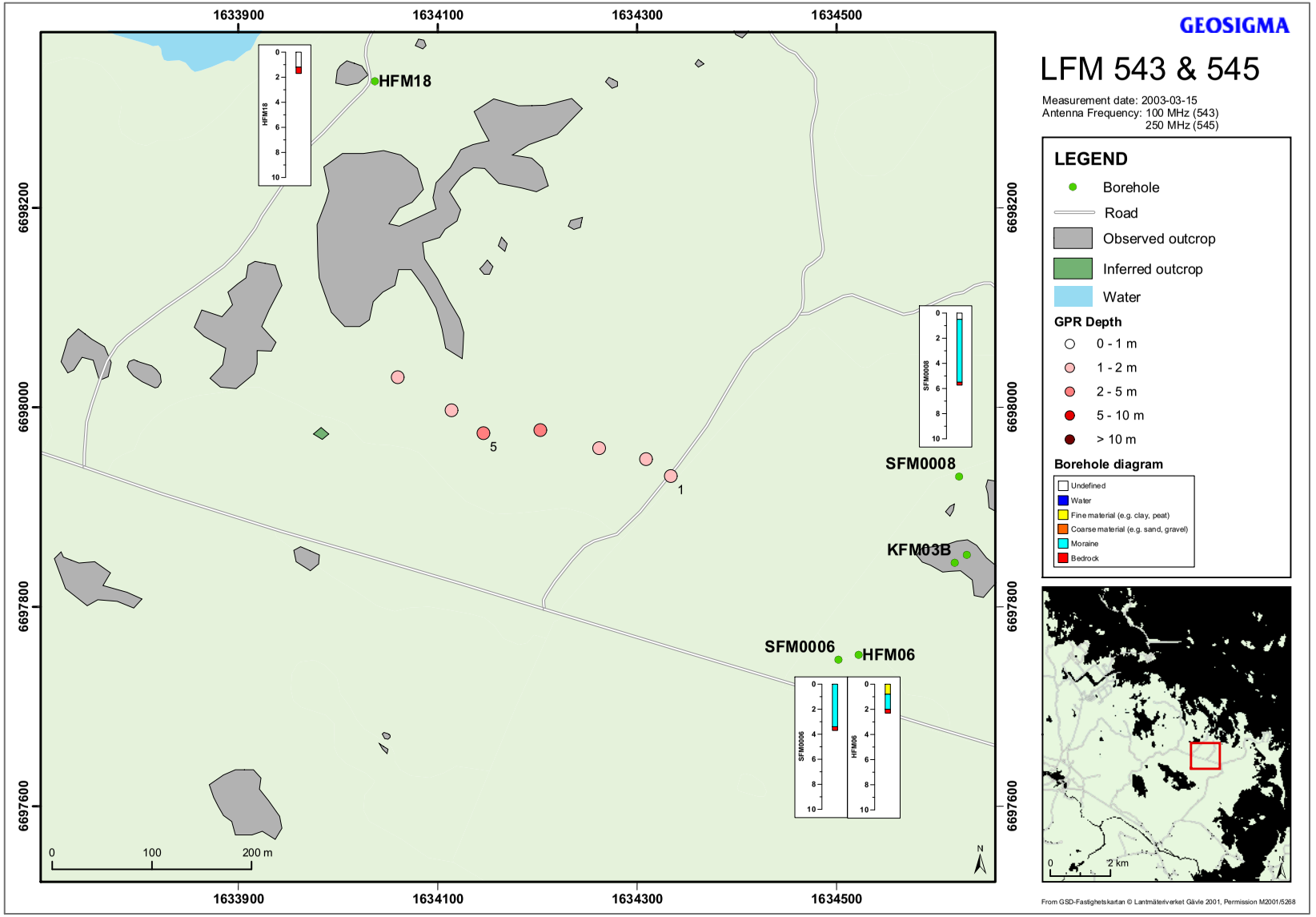

LFM000534 (0-600)
1 2 3 4 5 6 7 8 9 10 11 12 13 14
10
5
0
-5
-10
-15
(m)
0 100 200 300 400 500 600
LFM000534 (600-637)
15
10
5
0
-5
-10
-15
(m)
600 700 800 900 1000 1100 1200


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 537
Measurement date: 2003-03-14
Antenna Frequency: 250 MHz
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0008
KFM03A
KFM03B
SFM0006
HFM06
HFM08
SFM0007
HFM07
1634100
1634300
1634500
1634700
1634900
6698200
6698000
6697800
6697600
6697400
0
100
200 m
0
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268


LFM000537 (0-233)
1 2 3 4 5 6 7 8 9 10 11 12
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 543 & 545
Measurement date: 2003-03-15
Antenna Frequency: 100 MHz (543)
250 MHz (545)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM18
SFM0008
KFM03B
SFM0006
HFM06
1
5
1633900
1634100
1634300
1634500
6698200
6698000
6697800
6697600
0
100
200 m
2 km
N
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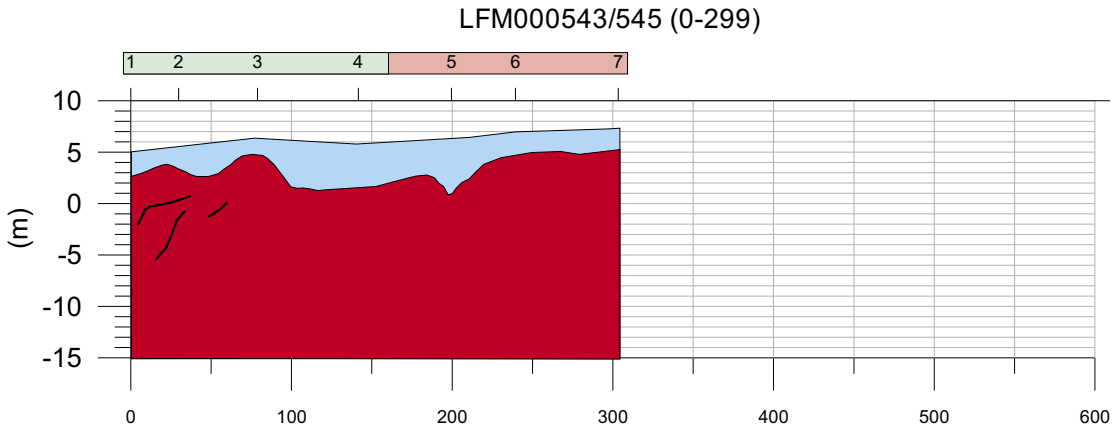
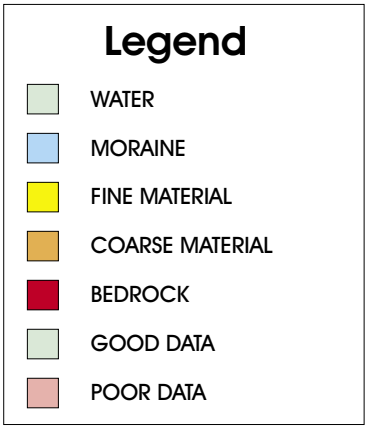
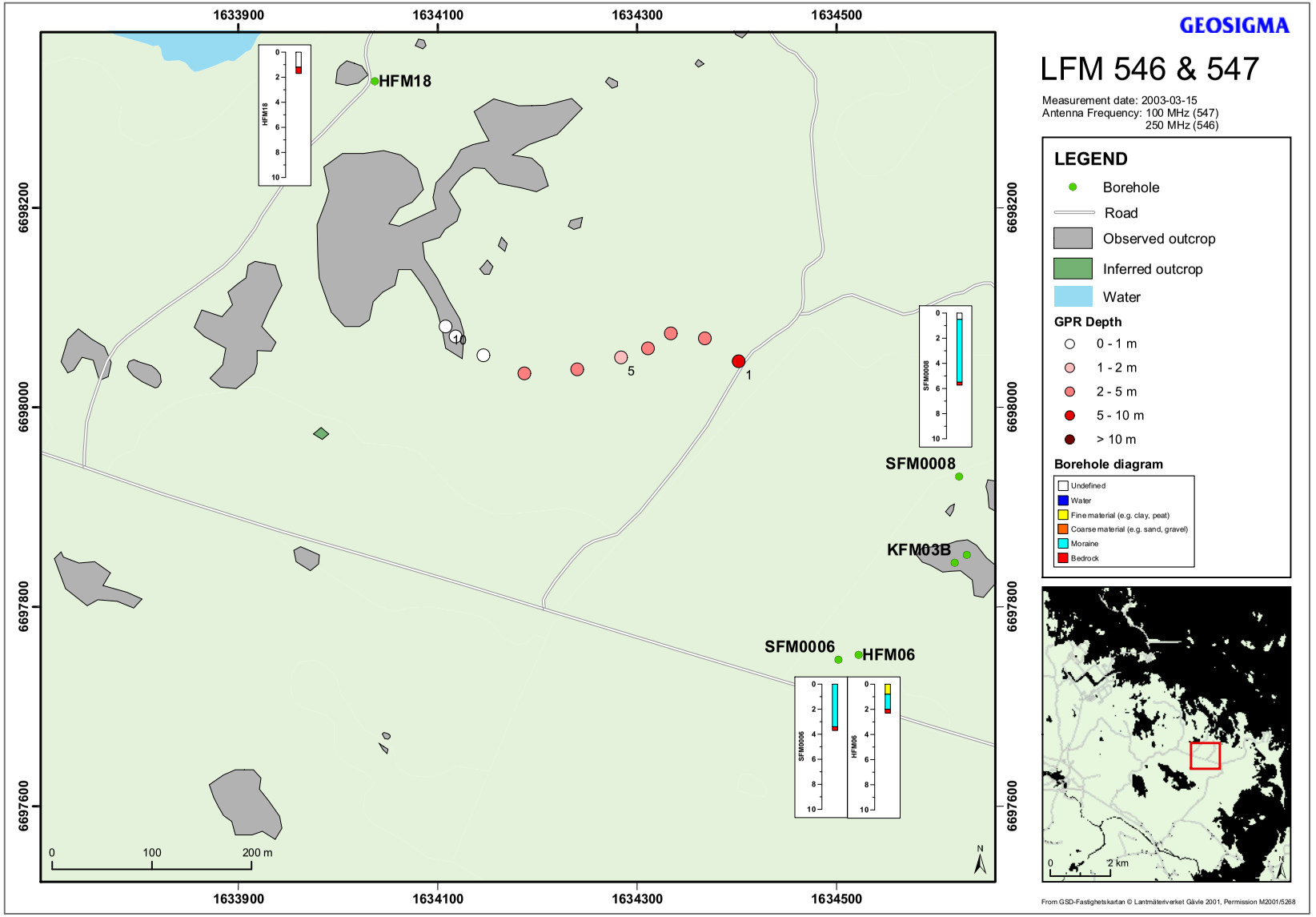

LFM000543/545 (0-299)
1
2
3
4
5
6
7
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 546 & 547
Measurement date: 2003-03-15
Antenna Frequency: 100 MHz (547)
250 MHz (546)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
HFM18
SFM0008
KFM03B
SFM0006
HFM06
1633900
1634100
1634300
1634500
6698200
6698000
6697800
6697600
0
100
200 m
2 km
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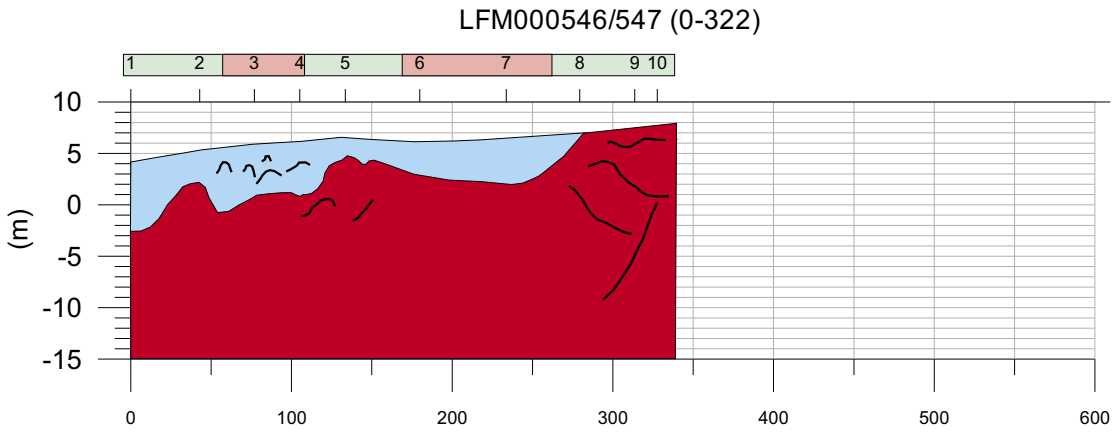
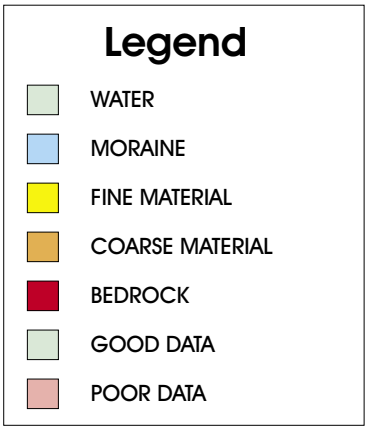
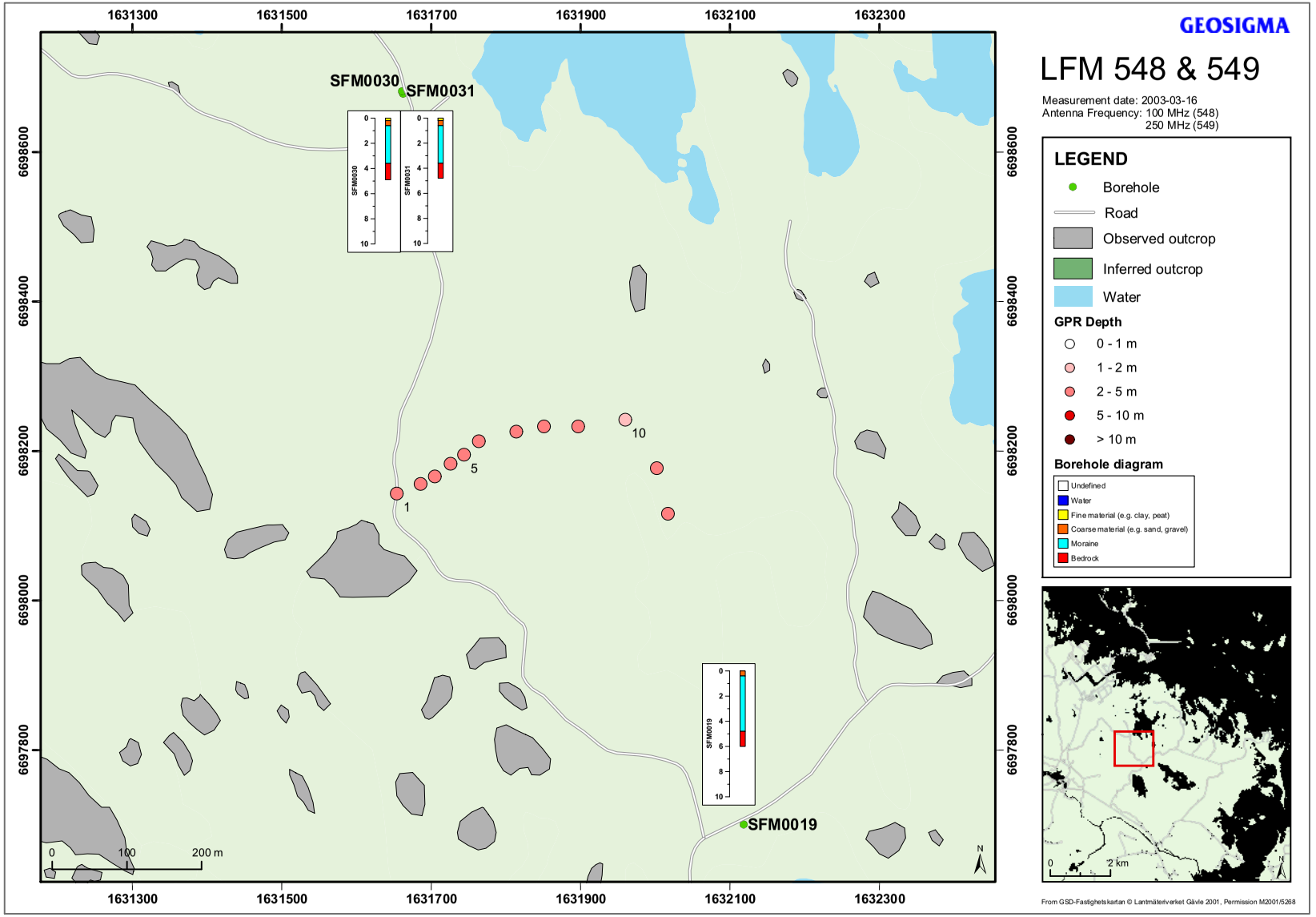
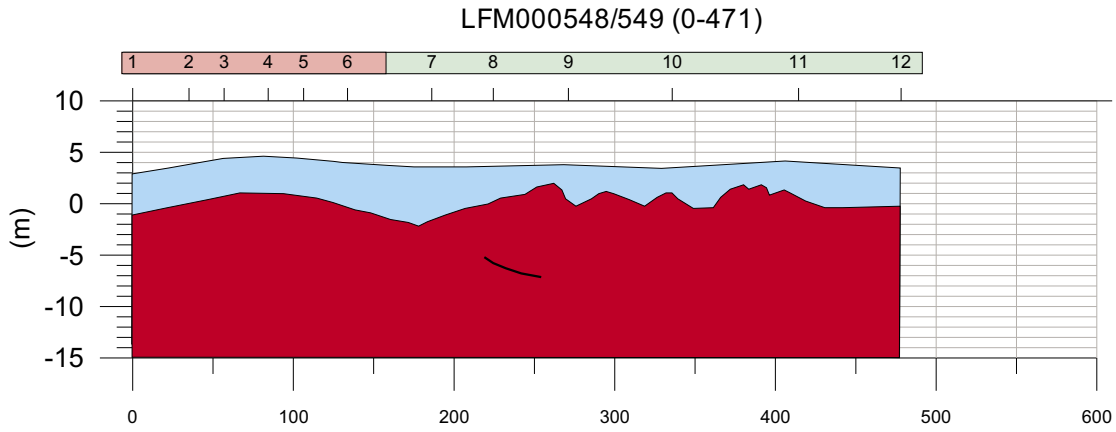
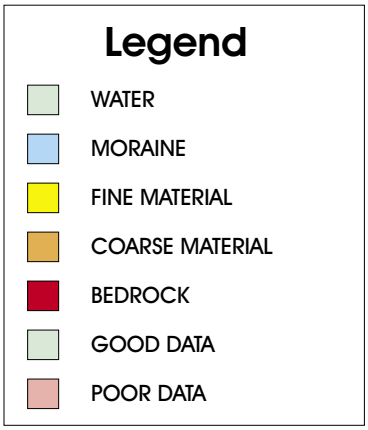

LFM000546/547 (0-322)
1
2
3
4
5
6
7
8
9
10
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA


GEOSIGMA
LFM 548 & 549
Measurement date: 2003-03-16
Antenna Frequency: 100 MHz (548)
250 MHz (549)
LEGEND
Borehole
Road
Observed outcrop
Inferred outcrop
Water
GPR Depth
0 - 1 m
1 - 2 m
2 - 5 m
5 - 10 m
> 10 m
Borehole diagram
Undefined
Water
Fine material (e.g. clay, peat)
Coarse material (e.g. sand, gravel)
Moraine
Bedrock
SFM0030
SFM0031
SFM0019
1
5
10
1631300
1631500
1631700
1631900
1632100
1632300
6698600
6698400
6698200
6698000
6697800
0
100
200 m
0
2 km
N
From GSD-Fastighetskartan © Lantmäteriverket Gävle 2001, Permission M2001/5268


LFM000548/549 (0-471)
1
2
3
4
5
6
7
8
9
10
11
12
10
5
0
-5
-10
-15
(m)
0
100
200
300
400
500
600


Legend
WATER
MORAINE
FINE MATERIAL
COARSE MATERIAL
BEDROCK
GOOD DATA
POOR DATA