NGU
Norges geologiske undersøkelse
Geological Survey of Norway

DAMES & MOORE
GROUP

LATVIJA
VĢD
VALSTS ĢEOLOĢIJAS DIENESTS
STATE GEOLOGICAL SURVEY

NGU Rapport 98.096

Assessment of soil and groundwater contamination at a former Soviet Military Base. Valmieras Iela Armoured Vehicle Workshop, Riga, Latvia

APPENDICES

NGU
Norges geologiske undersøkelse
Geological Survey of Norway

Postboks 3006 -
Lade
7002 TRONDHEIM
Tlf. 73 90 40 11

RAPPORT

Rapport nr.: 98.096	ISSN 0800-3416	Gradering: Åpen

Tittel:
Assessment of soil and groundwater contamination at a former Soviet Military Base.
Valmieras Iela Armoured Vehicle Workshop, Riga, Latvia. APPENDICES

Forfatter:
Banks, D., Grundy, C., Johnsen, A., Johnsen, B., Lacis, A., Misund, A., Quint, M., Tørnes, J.Aa.

Oppdragsgiver:
Det Norske Utenriksdepartementet
Latvian Ministry of the Environment

Fylke:
Latvia

Kommune:
Riga

Kartblad (M=1:250.000)

Kartbladnr. og -navn (M=1:50.000)

Forekomstens navn og koordinater:

Sidetall: 225 Pris: 245
Kartbilag:

Feltarbeid utført:	Rapportdato:	Prosjektnr.:	Ansvarlig:
1996-97	1.7.1998	2699.00	

Sammendrag:

A former Soviet military armoured vehicle workshop has been subject to site investigation to examine soil and groundwater contamination. Site investigations have indicated that groundwater is contaminated by hydrocarbons, free phase LNAPL oil being found in one of the boreholes (borehole 3 beneath the scrapyard). Soils at the site are contaminated by oil and the heavy metals Pb, Cu, Zn and Cd. Risk assessment techniques have been applied to make a so-called "Tier 2" assessment of risk to human health and risk to water resources. The assessment has concluded that contamination from the site will not reach the River Daugava within 39 years, even without taking into account sorption and biodegradation.

The risk assessment concludes that the site can remain in its current usage or be redeveloped for commercial purposes without any risk to human health. The assessment predicts no unacceptable risk to off-site groundwater resources (well in Quaternary aquifer at 200 m distance or bore in Devonian at 500 m distance) or to the River Daugava from the site.

If the site is redeveloped for residential use or for open public access (parkland), an unacceptable human health risk may be present. If such redevelopment is proposed, either (a) a "Tier 3" risk assessment should be carried out to make a more refined, less conservative assessment of risk or (b) cleanup of selected areas should be carried out to cited risk-based clean-up levels.

The investigation has had three main shortcomings:

(i) Lack of reproducibility of analytical data. *Recommendation: that all national laboratories used for contamination assessments should take part in internationally recognised accreditation schemes and international ring tests. Sampling should include adequate provision for spiked samples and blanks.*
(ii) Lack of sensitivity analysis for modelling of groundwater contaminant transport and risk assessment. *Recommendation: no model results or risk assessments should be accepted as the basis for decision-making unless accompanied by a quantitative sensitivity analysis or, at the very least, (i) some quantification of likely margins of error in the results or (ii) a full justification of the conservatism of the approach.*
(iii) Lack of modelling or risk assessment of evolution of LNAPL plume or risk therefrom. *Recommendation: As LNAPL plumes frequently represent the greatest concentrations of contaminants at many former military bases, transport and risk models simulating LNAPL evolution should be assessed and implemented as a matter of urgency.*

APPENDICES

Appendix 1:

Analyses carried out in Latvia in 1996 on soil and groundwater samples from Valmieras iela site.

SOIL / SEDIMENTS

Results of determination of metals using atomic - adsorption spectrophotometry

Valmieras street

Nr.	Sample Nr.	Zn	Cu	Pb	Cd	Hg
		µg/g				
1.	II - 1.	128	61	2190	0,97	0,09
2.	II - 2.	133	58	155	0,68	0,53
3.	II - 3.	263	33	169	0,15	0,13
4.	II - 4.	50	26	43	0,08	0,04
5.	II - 5.	28	6	17	0,05	0,04
6.	II - 6.	413	64	296	1,25	0,08
7.	II - 7.	330	124	99	1,79	0,03
8.	II - 8.	417	108	400	11,11	0,02
9.	II - 9.	203	23	85	1,08	0,01
10.	II - 10.	48	10	30	0,10	0,06
11.	II - 11.	210	128	254	0,60	0,21
12.	II - 12.	338	173	233	0,72	0,24
13.	II - 13.	60	13	24	0,15	0,09
14.	II - 14.	98	25	29	0,14	0,05
15.	II - 15.	95	47	60	0,21	0,06
16.	II - 16.	563	225	240	1,57	0,09
17.	II - 17.	345	143	405	1,47	0,18
18.	II - 18.	383	60	236	0,64	0,28
19.	II - 19.	285	191	3300	1,00	0,62
20.	II - 20.	94	46	83	0,32	0,13
21.	Well 3. 1 m	166	127	318	0,85	0,30
22.	Well 3. 3 m	5	4	3	0,05	0,02
23	Well 4. 1 m	209	170	341	0,93	0,25
24.	Well 4. 3 m	5	4	2	0,02	0,01
25.	Well 5. 1 m	96	49	159	0,64	0,09
26.	Well 5. 3 m	36	11	46	0,05	0,11

Grain size distribution, %
Valmieras street

	Sample Nr.	5 mm	5-2 mm	2-1 mm	1-0,5 mm	0,5-0,25 mm	0,25-0,10 mm	0,10-0,05 mm	0,05 mm
1.	II - 1.	3,84	5.17	4,70	6.56	10,64	59,84	6,88	2,67
2.	II - 2.	9,82	7,36	5,93	8,19	11.46	47,03	7,07	3,14
3.	II - 3.	2,48	2,98	3,31	6.16	20,55	55,87	6,59	2,09
4.	II - 4.	0,69	7,51	14,90	20,84	29,34	21,42	3,63	1,67
5.	II - 5.	1.67	0,59	0,62	1,55	10,78	76,84	6,83	1.12
6.	II - 6.	5,29	5,14	6,94	10.87	20,10	39,64	9,48	2,57
7.	II - 7.	4,57	6,91	7,36	17,59	22,10	29,14	11,31	0,82
8.	II - 8.	5,61	8,22	10,48	17,75	27,69	19,95	6,01	4,29
9.	II - 9.	-	0,37	0,91	3,33	16,79	68,35	9,05	1,00
10.	II - 10.	15,92	5,03	3,58	4.08	11,05	53,38	4,77	2,19
11.	II - 11.	29,03	12,61	8,57	10,01	9,40	21,95	4,58	3,85
12.	II - 12.	13,86	6,00	5,41	8,61	16,25	38,53	8,35	2,99
13.	II - 13.	5,61	2,06	2,35	3,97	13,62	58,69	9,54	4,16
14.	II - 14.	10,69	6,23	5.25	7,73	16,78	44,63	7,33	1,36
15.	II - 15.	8,03	8,02	9,15	13,08	19,24	35,33	4,77	2,38
16.	II - 16.	26,95	12,90	7,87	7,81	9,74	13,32	6,87	14,54
17.	II - 17.	26,63	9,17	5.76	7,38	12,13	21,25	8,20	9,48
18.	II - 18.	19,01	7,00	4.87	6,61	14,27	40,45	5,08	2,71
19.	II - 19.	15,75	9.53	7,92	12.32	17,74	27,77	6,48	2,49
20.	II - 20.	6,77	7,42	6,41	8,09	22,82	37,77	5,38	3,34
21.	Well 3. 5 m	-	-	-	0,32	6,00	77,94	12,09	3,65
22.	Well 3. 1 m	1,93	3,11	4,61	6,82	11,48	44,79	7,56	19,70
23.	Well 4. 5 m	-	0.01	0,02	0,31	15,14	69,12	10,78	4,62
24.	Well 4. 1 m	13,87	4,59	3,91	5,72	9,95	39,46	6,24	16,46
25.	Well 5. 1 m	10,47	3,20	5,57	6,07	11,08	52.36	6,25	5,00
26.	Well 5.	4,86	3,50	1,41	2.31	7,22	71,69	7,27	1.69

GROUNDWATER

Results of chemical analyses
Valmieras iela

Well		1	2	3	4	5
pH		7.52	6.78	6.21	6.60	6.80
Conductivity	µS/cm	995	643	1025	828	1291
Dry residue		490	367	736	596	901
Na		37	12	74	9.2	9.2
K		5.9	3.9	4.7	3.9	4.3
Ca		98	87	138	146	212
Mg		26	23	41	42	72.5
Cl		66	24	62	19.5	19.5
SO4		88	35	34	51	91
HCO3		288	317	696	574	867
N/NH4		0.35	0.12	0.06	0.68	0.2
N/NO2	mg/l	0.012	0.008	0.010	0.024	0.012
N/NO3		1.82	0.60	0.50	1.30	0.98
N min.		2.18	1.03	0.57	2.00	1.19
N tot.		16	9.31	0.69	4.31	2.88
N org.		13.82	8.28	0.12	2.31	1.69
P/PO4		1.56	1.20	2.05	0.76	2.98
Oil		0.08	0.14	0.41	0.16	0.23
Phenol		0.003	0.012	0.018	0.016	0.025
SSAS		0.04	0.02	0.02	0.02	0.03
COD-Cr	mg O2/l	90	37	83	85	178
BOD5		3.2	2.6	5.2	2.2	7.8
Cr		<2	<2	<2	<2	<2
Cd		0.1	0.3	0.9	0.3	1.8
Pb	µg/l	<2	<2	<2	<2	<2
Cu		0.8	0.9	1.2	1	1.8
Hg		<0.05	<0.05	<0.05	<0.05	<0.05
Ni		0.8	1	1.2	0.9	1.4

Appendix 2:

Analyses carried out in Latvia in 1997 on soil and groundwater samples from Valmieras iela site.

Soil Samples
-Taken May 1997
Analysed in Latvia May '97

Oil analysis in soil samples

Number of sample	Oil mg/kg	Number of sample	Oil mg/kg
Viestura prospect			
31	26	34	46
32	83	35	38
32^{A}	320	36	92
33	24		
Valmieras street			
1	72	11	68
2	60	12	52
3	38	13	72
4	64	14	60
5	24	15	60
6	38	16	190
7	250	17	140
8	128	18	103
9	84	19	74
10	60	20	38

FIELD READINGS

below well top

Viestura prospekts

Borhole	date	water level	temp	pH	EC 20	EC 25
1	17-Jūn	6.16	10.4	6.45	*Broken device*	
2	17-Jūn	2.28	8.4	6.20	*Broken device*	
3	17-Jūn	4.17	8.0	7.12	*Broken device*	
4	16-Jūn	3.42	8.4	6.47	*Broken device*	
5	16-Jūn	4.17	8.3	6.64	470	
6	17-Jūn	4.01		6.43	*Broken device*	
7	16-Jūn	3.58	9.6	6.39	646	
8	16-Jūn	3.80	6.8	7.58	339	
9	16-Jūn	3.16	9.7	7.20	403	
10	16-Jūn	3.40	8.9	7.35	*Broken device*	
11	17-Jūn	3.02	8.4	7.30	*Broken device*	
12	16-Jūn	5.22	9.1	6.32	*Broken device*	
13	17-Jūn	5.73		*don't pumping*		
14	17-Jūn	3.31	7.8	6.37	*Broken device*	
15	16-Jūn	4.50	9.1	6.86	507	
222A	18-Jūn	3.79	7.3	8.17		368

Valmieras iela

Borhole	date	water level	temp	pH	EC 20	EC 25
1	19-Jūn	4.12	9.8	7.81		855
2	19-Jūn	4.22	11.0	7.04		718
3	19-Jūn	4.81	8.8	6.56		1250
4	19-Jūn	3.71	8.8	6.92		879
5	19-Jūn	3.98	9.3	6.83		1390

STATE GEOLOGICAL SURVEY OF LATVIA

5, Eksporta Street, Riga LV-1010, Latvia Phone: (371) 7320379 Fax: (371) 7333218

Date: Our ref. Your ref.

August 1, 1997

To: fax +47 73 92 16 20
NGU
Trondheim, Norway

Attn: Mr David Banks

Dear David,

Sorry for the delay in answering your fax.

Thank you for the software diskettes and the analytical results. Please find enclosed the analytical results for the water samples taken at Viestura Pros. and Valmieras St. (2 pages).

The collection of samples within the framework of the Baltic Soil Survey continues. It takes place parallel to the sampling within the framework of the Latvian geochemical mapping, scale 1:500,000. It is planned to complete the sampling till the end of August. The samples will be sent to Norway in mid-September.

I will send the information necessary for modelling next week.

Best regards,

Agris

Results of water chemical analyses **(Valmieras street)**

Well		1	2	3	4	5
Ca^{2+}	mg/l	65.1	91.2	144	127	231
Mg^{2+}	mg/l	16.9	24.9	43.0	37.9	69.1
Na^{+}	mg/l	117	18.4	78.2	14.0	19.3
K^{+}	mg/l	5.9	3.9	4.7	3.1	3.9
HCO_3^{-}	mg/l	335	349	732	525	970
SO_4^{2}	mg/l	86.5	30.7	35.5	48.0	40.8
Cl^{-}	mg/l	85.1	35.8	64.2	26.2	34.7
Dry residue	mg/l	587	411	780	550	998
N/NH_4	mg/l	0.65	0.34	0.61	1.06	0.70
N/NO_2	mg/l	0.013	0.015	0.014	0.038	0.026
N/NO_3	mg/l	3.20	0.78	1.12	1.00	1.20
N total	mg/l	7.90	6.85	2.58	4.11	4.44
P/PO_4	mg/l	1.05	1.70	2.90	0.50	2.08
BOD_7	mg O_2/l	2.55	0.67	4.38	3.32	6.78
COD	mg O_2/l	70.0	41.0	88.0	92.0	110
Phenol	mg/l	0.004	0.009	0.025	0.015	0.030
SSAS	mg/l	0.03	0.02	0.04	0.02	0.04
Oil	mg/l	0.08	0.08	0.18	0.06	0.04
Cd	µg/l	0.3	0.3	0.8	0.5	1.3
Cu	µg/l	0.9	1.0	2.0	1.8	3.0
Ni	µg/l	1.0	0.9	1.7	1.0	1.9
Pb	µg/l	<1.5	<1.5	<1.5	<1.5	<1.5
Cr	µg/l	<1.5	<1.5	<1.5	<1.5	<1.5
Hg	µg/l	<0.05	<0.05	<0.05	<0.05	<0.05

Parameter	Methods	Sample volume, flash weight	Solvent for extraction	Clean up method	Analytical method
Cd, Cu, Ni, Pb	Filtration of sample through membrane filters 0.45 µm. Adding 5 ml 6 N HCl + 0.25 g ammonium peroxydisulphate, boiling 20 min, cooling to room temperature, neutralization with ammonia 6 N solution. Adding chelating agents 0.1% 8-hxiquinoline and 5% sodium diethyldithiocarbamate	0.25 l	Chloroform 3 times extraction	Distillation of chloroform, residue digestion with 1ml HNO_3, in oven at 500° C. After digestion dry residue was dissolved in 1ml 6N HCl and have used for injection to graphite furnace	AASGF
Cr	Filtration of sample through membrane filters 0.45 µm. Adding 5 ml 6 N HCl + 0.25 g ammonium peroxydisulphate, boiling 20 min, cooling to room temperature, neutralization with ammonia 6 N solution.	0.25 l	none	none	AAS Flame
Hg	Filtration of sample through membrane filters 0.45 µm. Adding 0.5 ml 2% $KMnO_4$ + 1 ml H_2SO_4 1:1	0.1 l	none		Cold vapour AAS
	At the day of determination adding 0.5 ml 20 % $SnCl_2$ in 6 N HCl to the sample.	2.5 ml	none	none	
Oil in water.	2 times extraction with 25 ml CCl_4 30 min ; drying with anhydrous Na_2SO_4	1l	CCl_4	extract passes through column with aluminium oxide	IR spectrometry
Oil in soil	We extract the soil sample 2g with 15 ml acetone using electromechanical stirer during 3 minutes, centrifugate extract 10 min with the velosity 1500 revolution per minute, pour the extract in the flask and repeat these procedure once more. After that we add 15 ml of methylene chloride to the soil and extract using electromechanical stirrer during 3 min, centrifuge the extract 10 min with the velosity 1500 revolution per minute, pour the extract in the flask and repeat these procedure two times more. After that we combine all methylene chloride and acetone extract to a volume approximately 2ml of extract by solvent evaporation in water bath. Then we add 8-10ml CCl_4 to approximately 2ml of extract and clean up these extract	2g	methylene chloride and acetone	We prepare a chromatography column with 6g of aluminium oxide and transrfer the extract to the column and close these system. The extract passes the column under atmospheric pressure. After that we dry these extract under room temperature to dry state and disolve these dry material in 20 ml CCl_4 and transfer these extract quantitatively into 25 ml volumetric flask and fill up to the mark with CCl_4. The purified extract will be measured by Ir spectrometry	IR spectrometry

Appendix 3:

Analyses carried out by NGU in 1996 on soil and groundwater samples from Valmieras iela site.

Samples from Latvia

All samples are filtered at 0,45 µm in the field but not conserved with acid.

In the lab all samples were gently shaken and a small portion (ca. 10 ml) of water was removed for analysis by Ion Chromatograph (anions)

The remaining sample in the flask was acidified with Suprapur kons. HNO_3 (10 drops / 100 ml, or more if necessary to dissolve iron precipitate). The samples were then gently shaken and allowed to stand for 24 hours. These acidified samples were then analysed by:

ICP (cations + metals)
AA for As, Hg, Sb, Pb, Cd

Field Measurements	EC µS/cm	T °C	pH	CO_2 mg/l	Date
Lv1F - Bore no. 1, Viestura prospekt, Riga	670	9,6	6,68	100	26/9/96
Lv2F - Bore no. 2, Viestura prospekt, Riga					26/9/96
Lv3F - Bore no. 3, Viestura prospekt, Riga	622	8,8	7,10	60	26/9/96
Lv4F - Bore no. 4, Viestura prospekt, Riga	833	9,5	6,71	100	26/9/96
Lv6F - Bore no. 6, Viestura prospekt, Riga	856	11,2	6,53	>100	26/9/96
Lv7F - Bore no. 7, Viestura prospekt, Riga	843	10,2	6,27		26/9/96
Lv8F - Bore no. 8 (3,92m), Viestura prospekt, Riga					26/9/96
Lv9F - Bore no. 9, Viestura prospekt, Riga	463	9,3	7,20		26/9/96
Lv10F - Bore no. 10, Viestura prospekt, Riga	472	8,3	7,58		26/9/96
Lv11F - Bore no. 11, Viestura prospekt, Riga				40	26/9/96
Lv7aF - Bore no. 7a, Viestura prospekt, Riga	873	11,8	6,11		3/10/96
Lv14F - Bore no. 14, Viestura prospekt, Riga	558	9,5	6,14	> 100	3/10/96
Lv15F - Bore no. 15, Viestura prospekt, Riga	527	10(?)	6,56		3/10/96
Lv20F - Bore no. 222a, Viestura prospekt, Riga	323	7,2	7,81		3/10/96
Lv21F -Cemetry well (SE of Viestura prospekt)		8,7*	7,96*		3/10/96
Lv22F -Cemetry well (SW of Viestura prospekt)		8,8*	7,54*		3/10/96
Lv23F - stream draining Skrunda radar base 28/9/96					
Lv24F - water (lake?) downstream of chem. weapons store Daugavpils 1/10/96					
Lv25F - well in cemetry SW of chem. store, Daugavpils					1/10/96
Lv26F - well downstream of area 1, Daugavpils					1/10/96

NB: samples Lv5F, Lv12F, Lv13F & Lv16F-19F do not exist

* measured with NGUs pH-meter, which gives results consistently c. 0,2 pH units higher than the Latvian equipment and 0,3°C higher for temperature.

SOILSAMPLING in Valmieras iela

Locality	colour	grainsize	smell	remarks
1	grey-black	fine	no	bricks and roots
2	brown-black	fine	no	marbleised, pebbles
3	golden brown	medium	no	concrete, stone, roots
4	brown - black	sand - gravel	no	marbleised, stone, roots
5	light - brown	fine	no	pebbles
6	black - brown	sand - gravel	no	roots, pebbles, concrete
7	dark - brown	sand - gravel	heavy oil	stone, roots, painting, glass
7A	black	silt	strong - heavy oil	point pollution in washinghall
8	grey - brown	sand - gravel	diesel	pebbles
9	black - grey	sand - gravel	heavy oil	pebbles
10	light - brown	medium sand	no	pebbles
11	black	gravely sand	solvents	organic, pebbles, from fuelstorage area
12	black - brown	medium sand	no	roots and pebbles
13	grey - black	medium sand	no	pebbles
14	grey - black	medium sand	no	roots, pebbles, asphalt
15	grey - black	medium sand	no	pebbles, roots
16	grey - black	sand - gravel	no	pebbles and sorted sand
17	black	sand - gravel	lubrication oil	stone, glass, oily after drain out of the oil
18	grey - black	sand - gravel	old oil	iron, concrete, glass, pebbles
19	grey - black	sand - gravel	old oil	asphalt, pebbles, nail
20	grey - brown	sand - gravel	no	roots, pebbles, asphalt

Nail obs.

Banks David

From: Banks Sheila
To: Banks David
Subject: Latvia samples and Russian sample
Date: 07. November 1996 15:46

In the report,

LvS2-R = LvS2 Renset med toluene
LvS3-R = LvS3 Renset med toluene

I didn't prepare a "blank" of "clean" material. We could do this, but the blank would need to be as similar as possible in composition to the samples as we don't know exactly what effect the toluene may have on the natural carbon content.. Sample LvS3 seemed much cleaner than LvS2 (- judging from the smell! -)-and the results seem to agree with this.

NB: the "rensing" was carried out at room temperature, with 3g sample in 15 ml toluene and shaking regularly over c. 1.5 hours. The samples were filtered, then washed with ca. 25 ml methanol to remove the toluene, then with ca. 25 ml water to remove the methanol, and finally air-dried in a dessicator at room temp. There may still be non- volatile "diesel" compounds present, but we have no way of definitively checking this unless we have a clean sample of the same material. An organics lab could give you a better idea of the total diesel organics present, though they would also ideally need a clean sample as a blank.

Re. Re-run Russian sample: we gat some very strange results here!!

When we spike the sample with fluoride we get lower total results for fluoride than expected and the relative lowering of the result INCREASES as the amount of fluoride added increases (same volume of sample used, same dilution of sample). Is there anything in the sample which could be mopping up added fluoride - eg calcium??? If this is the case then the "fluoride" peak in the unspiked sample is presumably NOT fluoride .

Sheila

WATER

LEGENDE

VAL1 - VAL5 = Wells1 - 5: VALMIERAS

P1 - P2 : Cemetry wells Viestura

NGU, Miljøundersøkelse Latvia
v/Arve Misund
Prosjektnr. 2699.00

Analyserapport 1997.0026

NGU
Norges geologiske undersøkelse
Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ANALYSERAPPORT

NORSK AKKREDITERING Nr. P020

ANALYSEKONTRAKT NR.: 1997.0026
NGU PROSJEKT NR.: 2699.00

OPPDRAGSGIVER: NGU, Miljøundersøkelse Latvia

ADRESSE:

TLF.: 300

KONTAKTPERSON: Arve Misund

PRØVETYPE: Vann
ANTALL PRØVER: 7
IDENTIFIKASJON AV PRØVER: Iflg. liste fra oppdragsgiver
PRØVER MOTTATT: 19.02.97
ANMERKNINGER: Ingen

SPESIFIKASJON AV OPPDRAGET I HENHOLD TIL ANALYSEKONTRAKT:

METODE	DOKUMENTASJON *)	OMFATTES AV AKKREDITERING
ICP-AES vann	NGU-SD 3.1	Ja
GFAAS - Cd, Pb, As	NGU-SD 3.2	Ja
CVAAS - Hg	NGU-SD 3.3	Ja
GFAAS - Sb		Nei
IC	NGU-SD 3.4	Ja

Denne rapporten inneholder i alt 12 sider. Rapporten må ikke gjengis i utdrag uten skriftlig godkjenning fra NGU-Lab.

Alle forhold ved prøvetaking, behandling og transport av prøvene før innlevering til NGU-Lab er underlagt oppdragsgivers ansvar. Analyseresultater framlagt i denne rapporten refererer derfor kun til det prøvematerialet som er mottatt av NGU-Lab.

Trondheim, 20. februar 1997

Magne Ødegård (e.f.)

*) Fortegnelse over dokumentasjon finnes i NGU-Labs Kvalitetshåndbok, NGU-SD 0.1, som kan rekvireres fra NGU-Labs sekretariat.

NGU
Norges geologiske undersøkelse
NGU-Lab

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ICP-AES ANALYSER
VANN
Analysekontraktsnr:1997.0026

NORSK AKKREDITERING Nr. P020

INSTRUMENT TYPE : **Thermo Jarrell Ash ICP 61**

NEDRE BESTEMMELSESGRENSER VANNANALYSER
(For vannprøver som tynnes, blir deteksjonsgrensene automatisk omregnet).

Si ppb	Al ppb	Fe ppb	Ti ppb	Mg ppb	Ca ppb	Na ppb	K ppb	Mn ppb	P ppb
20.-	20.-	10.-	5.-	50.-	20.-	50.-	500.-	1.-	100.-
Cu ppb	**Zn ppb**	**Pb ppb**	**Ni ppb**	**Co ppb**	**V ppb**	**Mo ppb**	**Cd ppb**	**Cr ppb**	**Ba ppb**
5.-	2.-	50.-	20.-	10.-	5.-	10.-	5.-	10.-	2.-
Sr ppb	**Zr ppb**	**Ag ppb**	**B ppb**	**Be ppb**	**Li ppb**	**Sc ppb**	**Ce ppb**	**La ppb**	**Y ppb**
1.-	5.-	10.-	10.-	1.-	5.0	1.-	50.-	10.-	1.-

ANALYSEUSIKKERHET: ± 20 rel. % for K, Pb, Cd, Li, Ce.
± 10 rel. % for Si, Al, Na, Mo, Cr, Zr, Ag, B og La.
± 5 rel. % for Fe, Ti, Mg, Ca, Mn, P, Cu, Zn, Ni, Co, V, Ba, Sr, Be, Sc, Y.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 7

ANMERKNINGER: 3 av prøvene hadde utfelling

Ferdig analysert	19. februar 1997	Idun Melby
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse
NGU-Lab

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ICP-AES ANALYSER
VANN
Analysekontraktsnr:1997.0026

NORSK AKKREDITERING
Nr. P020

	VAL-1	VAL-2	VAL-3	VAL-4	VAL-5	P-1	P-2
Si	3.4ppm	4.8ppm	8.1ppm	6.9ppm	7.0ppm	3.6ppm	3.4ppm
Al	<20.0ppb	<20.0ppb	<20.0ppb	<20.0ppb	<20.0ppb	<20.0ppb	<20.0ppb
Fe	78.8ppb	23.1ppb	8.3ppm	15.9ppm	966ppb	363ppb	373ppb
Ti	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb
Mg	38.8ppm	20.5ppm	35.9ppm	21.4ppm	82.3ppm	11.1ppm	18.8ppm
Ca	65.5ppm	86.0ppm	182ppm	136ppm	125ppm	48.0ppm	91.0ppm
Na	57.8ppm	25.9ppm	21.6ppm	16.1ppm	65.8ppm	9.5ppm	13.7ppm
K	83.5ppm	18.5ppm	16.0ppm	12.9ppm	41.0ppm	9.5ppm	7.3ppm
Mn	549ppb	81.1ppb	4.3ppm	981ppb	490ppb	6.7ppb	16.9ppb
P	557ppb	406ppb	< 100ppb	627ppb	729ppb	< 100ppb	123ppb
Cu	5.6ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb
Zn	31.0ppb	25.3ppb	93.5ppb	60.6ppb	25.4ppb	4.4ppb	682ppb
Ni	21.9ppb	<20.0ppb	<20.0ppb	<20.0ppb	<20.0ppb	<20.0ppb	<20.0ppb
Co	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb
V	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb
Mo	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb
Cr	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb
Ba	63.1ppb	121ppb	419ppb	234ppb	244ppb	46.3ppb	40.7ppb
Sr	287ppb	192ppb	764ppb	431ppb	515ppb	90.9ppb	161ppb
Zr	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb
Ag	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb
B	174ppb	65.4ppb	59.4ppb	111ppb	178ppb	39.6ppb	73.3ppb
Be	<1.00ppb	<1.00ppb	1.5ppb	3.5ppb	<1.00ppb	<1.00ppb	<1.00ppb
Li	13.7ppb	8.7ppb	23.0ppb	28.6ppb	9.3ppb	< 5.0ppb	< 5.0ppb
Sc	<1.00ppb	<1.00ppb	<1.00ppb	<1.00ppb	<1.00ppb	<1.00ppb	<1.00ppb
Ce	<50.0ppb	<50.0ppb	<50.0ppb	<50.0ppb	<50.0ppb	<50.0ppb	<50.0ppb
La	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb
Y	<1.00ppb	<1.00ppb	<1.00ppb	<1.00ppb	<1.00ppb	16.7ppb	<1.00ppb

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Cd, Pb og As - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0026

NORSK AKKREDITERING Nr. P020

NGU - Lab

INSTRUMENT TYPE : **Perkin Elmer type SIMAA 6000**

NEDRE BESTEMMELSES GRENSER : Cd : 0.02 µg/l (0.02 ppb) **Pb : 0.2 µg/l (0.2ppb)** **As : 3.0 µg/l (3.0ppb)**

ANALYSEUSIKKERHET Analyseusikkerheten er gitt i tabellen under

Element	Usikkerhet
Cd	± 10 % rel.
Pb	± 10 % rel.
As	± 10 % rel.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 7

ANMERKNINGER: Ingen.

Ferdig analysert	20. februar 1997	Egil Kvam
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Cd, Pb og As - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0026

NGU - Lab

Prøve Id.	Cd µg/l	Pb µg/l	As µg/l
1	0.02	0.71	< 3.0
2	< 0.02	< 0.2	< 3.0
3	< 0.02	< 0.2	< 3.0
4	0.22	2.44	< 3.0
5	< 0.02	< 0.2	< 3.0
P-1	< 0.02	< 0.2	< 3.0
P-2	0.03	0.62	< 3.0

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Hg-Kalddampteknikk AA/HMS-1)
VANN
Analysekontraktsnr:1997.0026

NORSK AKKREDITERING Nr. P020

NGU - Lab

Metoden er utviklet for bestemmelse av kvikksølv i vann med Perkin Elmer Mercury Hydride System - 20 og en gullfelleenhet koblet til Perkin Elmer AA.

INSTRUMENT TYPE : **Perkin Elmer type 460 (AA) / 20 (MHS)**

NEDRE BESTEMMELSES GRENSER : 0.010 µg/l (10 ppt)

ANALYSEUSIKKERHET **± 10 % rel.**

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 7

ANMERKNINGER: Ingen.

Ferdig analysert	20. februar 1997	W. Koziel
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Hg-Kalddampteknikk AA/HMS-1)

VANN

Analysekontraktsnr:1997.0026

NGU - Lab

Prøve Id.	Hg µg/l
1	< 0.010
2	< 0.010
3	< 0.010
4	< 0.010
5	< 0.010
P-1	< 0.010
P-2	< 0.010

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Sb - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0026

NGU - Lab

INSTRUMENT TYPE : **Perkin Elmer type SIMAA 6000**

NEDRE BESTEMMELSES GRENSER : Sb : 3.0 µg/l (3.0 ppb)

ANALYSEUSIKKERHET Analyseusikkerheten er gitt i tabellen under

Element	Usikkerhet
Sb	± 10 % rel.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 7

ANMERKNINGER: Ingen.

Ferdig analysert	20. februar 1997	Egil Kvam
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Sb - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0026

NGU - Lab

Prøve Id.	Sb µg/l
1	< 3.0
2	< 3.0
3	< 3.0
4	< 3.0
5	< 3.0
P-1	< 3.0
P-2	< 3.0

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

IC- ANALYSER
VANN
Analysekontraktsnr:1997.0026

NORSK AKKREDITERING Nr. P020

7 ANIONER : F^-, Cl^-, NO_2^-, Br^-, NO_3^-, PO_4^{3-}, SO_4^{2-}

INSTRUMENT TYPE : **DIONEX IONEKROMATOGRAF 2120i**

NEDRE BESTEMMELSESGRENSER

ION	F^-	Cl^-	NO_2^-*	Br^-	NO_3^-	PO_4^{3-}	SO_4^{2-}
Nedre bestemmelsesgrense - mg/l	0.05	0.1	0.05	0.1	0.05	0.2	0.1

ANALYSEUSIKKERHET : **10 % rel. for alle ionene**

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 5

ANMERKNINGER: Ingen.

*** NGU-LAB er ikke akkreditert for NO_2^- ***

Ferdig analysert	13. februar 1997	Egil Kvam
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

IC- ANALYSER
VANN
Analysekontraktsnr:1997.0026

Prøve Id.	F^- [mg/l]	Cl^- [mg/l]	NO_2^- [mg/l]	Br^- [mg/l]	NO_3^- [mg/l]	PO_4^{3-} [mg/l]	SO_4^{2-} [mg/l]
26/97 - P 1	0.229	8.55	< 0.05	< 0.1	12.3	< 0.2	55.0
26/97 - P 2	0.326	25.2	< 0.05	< 0.1	28.0	< 0.2	47.3
26/97 - # 3	0.319	19.9	< 0.05	< 0.1	< 0.05	< 0.2	1.32
26/97 - # 4	0.253	16.8	< 0.05	< 0.1	< 0.05	< 0.2	39.1
26/97 - # 5	0.241	17.2	< 0.05	< 0.1	0.140	0.384	86.2

Latvia Sediment Samples

LvS1 = Viestura prospekt, Soil sample 31
LvS2 = Valmieras, borehole 3 @ 5.5 m
LvS3 = Valmieras, borehole 4 @ 3.1 m

All analytical results refer to < 2 mm fraction

The suffix R (e.g. LvS1R) refers to a portion of the sample where soluble hydrocarbons (e.g. diesel) have been removed by rinsing with toluene. The results for TC and TOC for toluene-rinsed samples should give «refractory» (non-toluene-soluble) contents.

SOIL

NGU, Miljøundersøkelser i Latvia
v/David Banks
Prosjektnr. 2699.00

Analyserapport 1996.0240

NGU
Norges geologiske undersøkelse
Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ANALYSERAPPORT

NORSK AKKREDITERING Nr. P020

ANALYSEKONTRAKT NR.: 1996.0240
NGU PROSJEKT NR.: 2699.00

OPPDRAGSGIVER: NGU, Miljøundersøkelser i Latvia

ADRESSE:

TLF.: 310

KONTAKTPERSON: David Banks

PRØVETYPE: Sediment
ANTALL PRØVER: 3
IDENTIFIKASJON AV PRØVER: Iflg. liste fra oppdragsgiver
PRØVER MOTTATT: 09.10.96
ANMERKNINGER: Ingen

SPESIFIKASJON AV OPPDRAGET I HENHOLD TIL ANALYSEKONTRAKT:

METODE	DOKUMENTASJON *)	OMFATTES AV AKKREDITERING
ICP-AES geologisk materiale	NGU-SD 2.11	Ja
GFAAS - Cd og Pb	NGU-SD 2.12	Ja
CVAAS - Hg	NGU-SD 2.13	Ja
Bestemmelse av total karbon (TC)	NGU-SD 2.14	Ja
Best. av total organisk karbon (TOC)	NGU-SD 2.15	Ja

Denne rapporten inneholder i alt 10 sider + vedlegg. Rapporten må ikke gjengis i utdrag uten skriftlig godkjenning fra NGU-Lab.

Alle forhold ved prøvetaking, behandling og transport av prøvene før innlevering til NGU-Lab er underlagt oppdragsgivers ansvar. Analyseresultater framlagt i denne rapporten refererer derfor kun til det prøvematerialet som er mottatt av NGU-Lab.

Trondheim, 5. november 1996

Magne Ødegård (e.f.)

*) Fortegnelse over dokumentasjon finnes i NGU-Labs Kvalitetshåndbok. NGU-SD 0.1, som kan rekvireres fra NGU-Labs sekretariat.

NGU
Norges geologiske undersøkelse
NGU-Lab

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ICP-AES ANALYSER
GEOLOGISK MATERIALE
Analysekontraktsnr:1996.0240

Metoden er basert på fremstilling av analyseløsninger ved ekstraksjon med 7 N HNO_3 i autoklav i samsvar med Norsk Standard - NS 4770

INSTRUMENT TYPE : **Thermo Jarrell Ash ICP 61**

NEDRE BESTEMMELSESGRENSER FOR PLASMA ANALYSER BASERT PÅ AUTOKLAVEKSTRASJON (1 g prøve i 100 ml analysevolum)
(For analyser med tynningsfaktor som avviker fra 100, blir deteksjonsgrensene automatisk omregnet.)

Si	Al	Fe	Ti	Mg	Ca	Na	K	Mn	P
ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
100.-	20.-	5.-	1.-	100.-	200.-	200.-	100.-	0.2	10.-

Cu	Zn	Pb	Ni	Co	V	Mo	Cd	Cr	Ba
ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
1.-	2.-	5.-	2.-	1.-	1.-	1.-	1.-	1.-	1.-

Sr	Zr	Ag	B	Be	Li	Sc	Ce	La	Y
ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
2.-	1.-	1.-	5.-	0.2	1.-	0.2	10.-	1.-	0.2

ANALYSEUSIKKERHET: For samtlige elementer regnes med en total usikkerhet i ekstraksjon og analyse på ± 10 %.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om onskelig.

ANTALL PRØVER: 3

ANMERKNINGER: Ingen

Ferdig analysert	28. oktober 1996	Brit Inger Vongraven
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse
NGU-Lab

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ICP-AES ANALYSER
GEOLOGISK MATERIALE
Analysekontraktsnr:1996.0240

	LvS1	LvS2	LvS3
Si	150ppm	143ppm	151ppm
Al	0.22%wt	0.19%wt	0.14%wt
Fe	0.20%wt	0.22%wt	0.20%wt
Ti	61.3ppm	71.2ppm	60.0ppm
Mg	305ppm	0.63%wt	0.66%wt
Ca	424ppm	1.9%wt	2.2%wt
Na	< 200ppm	< 200ppm	< 200ppm
K	265ppm	561ppm	435ppm
Mn	23.5ppm	100ppm	99.2ppm
P	186ppm	236ppm	266ppm
Cu	2.4ppm	5.6ppm	8.7ppm
Zn	9.2ppm	10.2ppm	10.1ppm
Ni	< 2.0ppm	< 2.0ppm	< 2.0ppm
Co	< 1.0ppm	< 1.0ppm	< 1.0ppm
V	3.7ppm	4.7ppm	4.4ppm
Mo	< 1.0ppm	< 1.0ppm	< 1.0ppm
Cr	2.2ppm	2.2ppm	2.2ppm
Ba	6.4ppm	10.9ppm	8.8ppm
Sr	3.0ppm	15.1ppm	20.3ppm
Zr	1.9ppm	3.4ppm	2.6ppm
Ag	< 1.0ppm	< 1.0ppm	< 1.0ppm
B	< 5.0ppm	< 5.0ppm	5.0ppm
Be	585ppb	650ppb	617ppb
Li	1.4ppm	2.0ppm	2.0ppm
Sc	495ppb	693ppb	594ppb
Ce	16.0ppm	29.4ppm	35.5ppm
La	7.8ppm	7.4ppm	8.5ppm
Y	2.7ppm	4.6ppm	4.5ppm

NGU
Norges geologiske undersøkelse
Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Cd og Pb - Grafittovn teknikk)
GEOLIGISK MATERIALE
Analysekontraktsnr:1996.0240

NORSK AKKREDITERING Nr. P020

Metoden er basert på fremstilling av analyseløsninger ved ekstraksjon med 7 N HNO_3 i autoklav i samsvar med NORSK STANDARD - NS 4770

INSTRUMENT TYPE : **Perkin Elmer type SIMAA 6000**

NEDRE BESTEMMELSES GRENSER : Cd : 0.02 ppm Pb : 0.4 ppm
(For analyser med tynningsfaktor som avviker fra 100, blir deteksjonsgrensene automatisk omregnet.)

ANALYSEUSIKKERHET Analyseusikkerheten er gitt i tabellen under

Element	Usikkerhet
Cd	± 20 % rel.
Pb	± 10 % rel.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 3

ANMERKNINGER: Ingen

Ferdig analysert	4. november 1996	Frank Berge
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse
Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Cd og Pb - Grafittovn teknikk)
GEOLIGISK MATERIALE
Analysekontraktsnr:1996.0240

Resultater.

Prøve nr.	Cd mg/kg	Pb mg/kg
1	0.107	2.86
2	0.013	1.5
3	0.026	0.969

NGU
Norges geologiske undersøkelse
Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Hg-Kalddampteknikk AA/HMS-1)
GEOLOGISK MATERIALE
Analysekontraktsnr:1996.0240

Metoden er basert på fremstilling av analyseløsninger ved ekstraksjon med 7 N HNO_3 i autoklav i samsvar med Norsk Standard - NS 4770

INSTRUMENT TYPE : **Perkin Elmer type 403 (AA) / 1 (MHS)**

NEDRE BESTEMMELSES GRENSER : 0.010 ppm
(For analyser med tynningsfaktor som avviker fra 100, blir deteksjonsgrensene automatisk omregnet.)

ANALYSEUSIKKERHET **± 10 % rel.**

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 3

ANMERKNINGER: Ingen

Ferdig analysert	28. oktober 1996	Frank Berge
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Hg-Kalddampteknikk AA/HMS-1)
GEOLOGISK MATERIALE
Analysekontraktsnr: 1996.0240

Resultater.

Prøve nr.	Hg mg/kg
1.	0.010
2.	< 0.01
3.	< 0.01

NORGES GEOLOGISKE UNDERSØKELSE
NGU-Lab

Postboks 3006 - Lade
N-7002 Trondheim
Telefon: 73 90 40 11
Telefax: 73 92 16 20

TOTAL KARBON/TOTAL SVOVEL/TOTAL ORGANISK KARBON
GEOLGISK MATERIALE
Analysekontraktsnr: 1996.0240

BESTEMMELSE AV TOTAL KARBON(TC) / TOTAL SVOVEL(TS) / TOTAL ORGANISK KARBON (TOC) (LECO OVN)

INSTRUMENT TYPE : Leco SC-444

I) TOTAL KARBON

Nedre bestemmelsesgrense : 0.07 %

Analysenøyaktighet

Måleområde/ %	Usikkerhet
0.07-3.0	± 0.07 %
> 3.0	± 2.5 % rel.

II TOTAL SVOVEL

Nedre bestemmelsesgrense : 0.01 %

Analysenøyaktighet

Måleområde/ %	Usikkerhet
0.01-1.0	± 10 % rel.
1.0-3.0	± 5 % rel
> 3.0	± 2.5 % rel.

III) TOTAL ORGANISK KARBON

Nedre bestemmelsesgrense : 0.10 %

Analysenøyaktighet

Måleområde/ %	Usikkerhet
0.1-3.0	± 15 % rel.
> 3.0	± 10 % rel.

PRESISJON :
Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANMERKNINGER :Ingen.

Ferdig analysert	1/11-96	Anne Nordtømme
	Dato	OPERATØR

NORGES GEOLOGISKE UNDERSØKELSE
NGU-Lab

N-7002 Trondheim
Telefon: 73 90 40 11
Telefax: 73 92 16 20

TOTAL KARBON/TOTAL SVOVEL/TOTAL ORGANISK KARBON
GEOLGISK MATERIALE
Analysekontraktsnr: 1996.0240

ID Code	TC %	TOC %
LVS-2R	0.43	< 0.10
LVS-3R	0.70	< 0.10
LVS-2	0.97	0.10
LVS-3	0.90	< 0.10

SOIL - XRF

Sample of greasy glass from scrapyard site, Valmieras

NGU, Miljøundersøkelser Lativia
v/David Banks
Prosjektnr.2699.00

Analyserapport 1997.0059

NGU
Norges geologiske undersøkelse
Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ANALYSERAPPORT

NORSK AKKREDITERING Nr. P020

ANALYSEKONTRAKT NR.: 1997.0059
NGU PROSJEKT NR.: 2699.00

OPPDRAGSGIVER: NGU, Miljøundersøkelser Lativia

ADRESSE:

TLF.: 310

KONTAKTPERSON: David Banks

PRØVETYPE: Glass
ANTALL PRØVER: 1
IDENTIFIKASJON AV PRØVER: Iflg. liste fra oppdragsgiver
PRØVER MOTTATT: 25.02.97
ANMERKNINGER: Ingen

SPESIFIKASJON AV OPPDRAGET I HENHOLD TIL ANALYSEKONTRAKT:

METODE	DOKUMENTASJON *)	OMFATTES AV AKKREDITERING
XRF-sporelementer	NGU-SD 2.4	Ja

Denne rapporten inneholder i alt 6 sider. Rapporten må ikke gjengis i utdrag uten skriftlig godkjenning fra NGU-Lab.

Alle forhold ved prøvetaking, behandling og transport av prøvene før innlevering til NGU-Lab er underlagt oppdragsgivers ansvar. Analyseresultater framlagt i denne rapporten refererer derfor kun til det prøvematerialet som er mottatt av NGU-Lab.

Trondheim, 27. februar 1997

Magne Ødegård (e.f.)

*) Fortegnelse over dokumentasjon finnes i NGU-Labs Kvalitetshåndbok, NGU-SD 0.1, som kan rekvireres fra NGU-Labs sekretariat.

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

XRF-ANALYSE SPORELEMENT (Spor C)
GEOLOGISK MATERIALE
Analysekontraktsnr:1997.0059

PRESSEDE PRØVER : 5.4 g prøve + 1.2 g Hoechst C voks som bindemiddel; Analyseprogram : SPORC INSTRUMENT TYPE : Philips PW1480 x-ray spectrometer

DETEKSJONSGRENSER FOR SPORELEMENTER

Element	Pb	U	Th	Rb	Y	Nb	Sr	Zr	Mo	As	V	Cr	Sc	S	Cl	F
Det.grense / ppm	10	10	10	5	5	5	5	5	5	10	5	10	10	830	980	1430

ANALYSEUSIKKERHET : Analyseusikkerheten er beregnet fra regresjonsanalyse av internasjonale standarder, hvor det er benyttet en veid regresjonsmodell.

i) Sporelement : Usikkerheten er gitt ved: $\text{USIKKERHET} = \pm K_{Element} \cdot \sqrt{C_i + 1000}$ [ppm hvor C_i er den rapporterte konsentrasjon i ppm, $K_{Element}$ er gitt for de enkelte element i tabellen nedenfor

Element	*Pb*	*U*	*Th*	*Rb*	Y	Nb	Sr	Zr	Mo	As	V	Cr	Sc	S	Cl	F
$K_{ELEMENT}$ / $ppm^{½}$	0.214	0.305	0.228	0.202	0.099	0.084	0.171	0.325	0.077	0.140	0.300	0.399	0.130	12.3	15.2	22.2

De oppgitte usikkerhetene er for 1σ nivå (68% konfidensnivå), ved å multiplisere usikkerheten med 2 oppnås et 95% konfidensnivå.

EKSEMPEL
Det er rapportert et analyseresultat på 0.0100% (dvs. C_i=100 ppm) for Pb. Denne konsentrasjonen samt K-verdien fra tabellen over innsatt i likn.[1] gir:

$\text{USIKKERHET} = +\_\ 0.214 \bullet \sqrt{100+1000} = 7\text{ppm}$ *Et konfidensintervall på 68%-nivå vil da bli: 100 ± 7 ppm, og konfidensintervallet på 95%-nivå: 100 ± 14 ppm*

ii) Hovedelement (rapporteres som oksyder) : Usikkerheten er gitt ved: $\text{USIKKERHET} = +\_\ K_{Element} \bullet \sqrt{0.1 + C_i}$ [%]
i dette tilfellet er C_i den rapporterte konsentrasjon i %, $K_{Element}$ er gitt for de enkelte element i tabellen nedenfor.

Element	**SiO_2**	**SiO_2**	**SiO_2**	**Al_2O_3**	**Fe_2O_3**	**TiO_2**	**MgO**	**CaO**	**K_2O**	**Na_2O**	**MnO**	**P_2O_5**
Kons.område / %	**1-36**	**36-75**	**>75**	**>0.5**	**>0.2**	**>0.03**	**>0.4**	**>0.2**	**>0.1**	**>0.2**	**>0.02**	**>0.04**
$K_{ELEMENT}$ / $\%^{½}$	**0.369**	**0.323**	**0.153**	**0.267**	**0.111**	**0.043**	**0.302**	**0.208**	**0.102**	**0.183**	**0.023**	**0.053**

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 1

ANMERKNINGER: Ingen

Ferdig analysert	27. februar 1997	Bjørn Nilsen
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

XRF-ANALYSE SPORELEMENT.(Spor C)
GEOLOGISK MATERIALE
Analysekontraktsnr:1997.0059

NORSK AKKREDITERING
Nr. P020

****
* RESULTATER FRA NGU'S XRF-LAB. INSTRUMENT: PHILIPS PW1480 *
* 5.4 g pr▒ve + 1.2 g Hoechst C voks som bindemiddel *
****

Milj▒unders▒kelser Latvia v/D.Banks
kontraktnr: 1997.0059 prosjektnr: 2699.00

Pr.navn	Mo %	Nb %	Zr %	Y %	Sr %	Rb %	U %	Th %	Pb %	Cr %	V %	As %
96-552 GRØNN	<0.0005	<0.0005	0.0075	<0.0005	0.0006	<0.0005	<0.0010	<0.0010	<0.0010	<0.0005	0.0005	<0.0010

Pr.navn	Sc %	S %	Cl %	F %	SiO2 %	Al2O3 %	Fe2O3 %	TiO2 %	MgO %	CaO %	Na2O %	K2O %
96-552 GRØNN	<0.0010	<0.10	<0.10	<0.10	67.75	0.09	0.05	0.02	0.27	0.37	28.68	0.04

Pr.navn	MnO %	P2O5 %	Sum Si-P %
96-552 GRØNN	<0.01	<0.01	97.24

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

XRF-ANALYSE SPORELEMENT (Spor D)
GEOLOGISK MATERIALE
Analysekontraktsnr:1997.0059

PRESSEDE PRØVER : 5.4 g prøve + 1.2 g Hoechst C voks som bindemiddel; Analyseprogram : SPORD INSTRUMENT TYPE : Philips PW 1480 x-ray spectrometer

DETEKSJONSGRENSER FOR SPORELEMENTER

Element	Ba	Sb	Sn	Cd	Ag	Ga	Zn	Cu	Ni	Yb	Co	Ce	Nd	La	W
Det.grense / ppm	10	10	10	10	10	5	5	10	5	16	10	15	10	10	10

ANALYSEUSIKKERHET : Analyseusikkerheten er beregnet fra regresjonsanalyse av internasjonale standarder, hvor det er benyttet en veid regresjonsmodell.
i) Sporelement : Usikkerheten er gitt ved:

hvor C_i er den rapporterte konsentrasjon i ppm, $K_{Element}$ er gitt for de enkelte element i tabellen nedenfor.

Element	Ba	Sb	Sn	Cd	Ag	Ga	Zn	Cu	Ni	Yb	Co	Ce	Nd	La	W
$K_{ELEMENT}$ / ppm^{½}	0.783	0.069	0.136	0.164	0.046	0.067	0.244	0.136	0.247	0.215	0.164	0.249	0.176	0.195	0.239

De oppgitte usikkerhetene er for 1s nivå (68% konfidensnivå), ved å multiplisere usikkerheten med 2 oppnås et 95% konfidensnivå.

EKSEMPEL
Det er rapportert et analyseresultat på 0.0100% (dvs. C_i=100 ppm) for Ag. Denne konsentrasjonen samt K-verdien fra tabellen over innsatt i likn.[1] gir:

$$\text{USIKKERHET} = +\_\ 0.046 \bullet \sqrt{100 + 1000} = 2\text{ppm}$$

Et konfidensintervall på 68%-nivå vil da bli: 100 ± 2 ppm, og konfidensintervallet på 95%-nivå: 100 ± 4 ppm

ii) Hovedelement (rapporteres som oksyder) : Usikkerheten er gitt ved:

$$\text{USIKKERHET} = +\_\ K_{Element} \bullet \sqrt{0.1 + C_i}\ [\%] \quad [2]$$

i dette tilfellet er C_i den rapporterte konsentrasjon i %, $K_{Element}$ er gitt for de enkelte element i tabellen nedenfor.

Element	SiO_2	SiO_2	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	MgO	CaO	K_2O	Na_2O	MnO	P_2O_5
Kons.område / %	1-36	36-75	>75	>0.5	>0.2	>0.03	>0.4	>0.2	>0.1	>0.2	>0.02	>0.04
$K_{ELEMENT}$ / %^{½}	0.369	0.323	0.153	0.267	0.111	0.043	0.302	0.208	0.102	0.183	0.023	0.053

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 1

ANMERKNINGER: Ingen

Rapporten må ikke gjengis i utdrag uten skriftlig godkjenning fra NGU-Lab.

Ferdig analysert	27. februar 1997	Bjørn Nilsen
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

XRF-ANALYSE SPORELEMENT (Spor D)
GEOLOGISK MATERIALE
Analysekontraktsnr:1997.0059

****
* RESULTATER FRA NGU'S XRF-LAB. INSTRUMENT: PHILIPS PW1480 *
* 5.4 g prøve + 1.2 g Hoechst C voks som bindemiddel *
****

Miljøundersøkelser Latvia v/D.Banks
kontraktnr: 1997.0059 prosjektnr: 2699.00

Pr.navn	Ba %	Sb %	Sn %	Cd %	Ag %	Ga %	Zn %	Cu %	Ni %	Yb %	Co %	Ce %
96-552 GRØNN	0.0032	0.0019	<0.0010	<0.0010	<0.0010	<0.0010	<0.0005	<0.0005	<0.0005	<0.0010	<0.0010	<0.0010

Pr.navn	La %	Nd %	W %	SiO2 %	Al2O3 %	Fe2O3 %	TiO2 %	MgO %	CaO %	Na2O %	K2O %	MnO %
96-552 GRØNN	<0.0010	<0.0010	0.0034	68.03	0.11	0.10	0.02	0.22	0.39	31.97	0.03	<0.01

Pr.navn	P2O5 %	Sum Si-P %
96-552 GRØNN	<0.01	100.84

SOIL - XRF

NGU, Miljøundersøkelser Latvia
v/David Banks
Prosjektnr. 2699.00

Analyserapport 1997.0007

NGU
Norges geologiske undersøkelse
Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ANALYSERAPPORT

NORSK AKKREDITERING Nr. P020

ANALYSEKONTRAKT NR.: 1997.0007
NGU PROSJEKT NR.: 2699.00

OPPDRAGSGIVER: NGU, Miljøundersøkelser Latvia

ADRESSE:

TLF.: 310

KONTAKTPERSON: David Banks

PRØVETYPE: Glass
ANTALL PRØVER: 2
IDENTIFIKASJON AV PRØVER: Iflg. liste fra oppdragsgiver
PRØVER MOTTATT: 09.01.97
ANMERKNINGER: Ingen

SPESIFIKASJON AV OPPDRAGET I HENHOLD TIL ANALYSEKONTRAKT:

METODE	DOKUMENTASJON *)	OMFATTES AV AKKREDITERING
XRF-hovedelementer	NGU-SD 2.3	Ja

Denne rapporten inneholder i alt 4 sider. Rapporten må ikke gjengis i utdrag uten skriftlig godkjenning fra NGU-Lab.

Alle forhold ved prøvetaking, behandling og transport av prøvene før innlevering til NGU-Lab er underlagt oppdragsgivers ansvar. Analyseresultater framlagt i denne rapporten refererer derfor kun til det prøvematerialet som er mottatt av NGU-Lab.

Trondheim, 22. januar 1997

Magne Ødegård (e.f.)

*) Fortegnelse over dokumentasjon finnes i NGU-Labs Kvalitetshåndbok, NGU-SD 0.1, som kan rekvireres fra NGU-Labs sekretariat.

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

XRF-ANALYSE HOVEDELEMENT (Hoved)
GEOLOGISK MATERIALE
Analysekontraktsnr:1997.0007

NORSK AKKREDITERING
Nr. P020

5.6 g $Li_2B_4O_7$ + 0.8 g prøve smeltet til glassplate

Analyseprogram : **HOVED**

INSTRUMENT TYPE : Philips PW 1480 x-ray spectrometer

ANALYSEUSIKKERHET
Analyseusikkerheten er beregnet fra regresjonsanalyse av internasjonale standarder, hvor det er benyttet en veid regresjonsmodell. Usikkerheten er gitt ved:

$$\text{USIKKERHET} = +\_ \; K_{Element} \bullet \sqrt{0.1 + C_i} \; [\%]$$

hvor C_i er den rapporterte konsentrasjon i %, $K_{Element}$ er gitt for de enkelte komponenter i tabellen nedenfor.

Element	SiO_2	Al_2O_3	Fe_2O_3	TiO_2	MgO	CaO	K_2O	Na_2O	MnO	P_2O_5
$K_{ELEMENT}$ / $\%^{½}$	0.055	0.040	0.035	0.018	0.063	0.037	0.029	0.062	0.008	0.025

De oppgitte usikkerhetene er for 1s nivå (68% konfidensnivå), ved å multiplisere usikkerheten med 2 oppnås et 95% konfidensnivå.

EKSEMPEL
Det er rapportert et analyseresultat på 20.0% (dvs. C_i=20.0 %) for Al2O3. Denne konsentrasjonen samt K-verdien fra tabellen over innsatt i likn.[1] gir:

$$\text{USIKKERHET} = +\_ \; 0.040 \bullet \sqrt{0.1 + 20} = 0.2\%$$

Et konfidensintervall på 68%-nivå vil da bli: 20.0 ± 0.2 %, og konfidensintervallet på 95%-nivå: 20.0 ± 0.4 %

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig..

ANTALL PRØVER: 2

ANMERKNINGER: Analysene er utført på uglødete prøver

Ferdig analysert	22. januar 1997	Bjørn Nilsen
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

XRF-ANALYSE HOVEDELEMENT (Hoved)
GEOLOGISK MATERIALE
Analysekontraktsnr:1997.0007

Resultater fra NGU's XRF LAB. Instrument: Philips PW1480.
Analysene er utf▒rt p▒ ugl▒dete pr▒ver
Pr▒vene er isoformert med Li2B4O7 i forholdet 1:7

Milj▒unders▒kelse Latvia v/David Banks
kontraktnr: 1997.0007 prosjektnr: 2699.00

PR.NAVN	SiO2 %	Al2O3 %	Fe2O3 %	TiO2 %	MgO %	CaO %	Na2O %	K2O %	MnO %	P2O5 %	Gl.tap %	Sum %
HVIT	74.13	0.39	0.29	0.04	<0.01	0.44	12.81	0.25	<0.01	<0.01	12.64	100.99
GRONN	72.64	0.28	0.12	0.03	<0.01	0.27	25.86	0.03	<0.01	<0.01	1.93	101.16

Appendix 4:

Analyses carried out by NGU in 1997 on groundwater samples from Valmieras iela site.

Ark1

NGU results

Viestura no.	Free phase	T (NGU)	Eh	Alkalinity 1	Alkalinity 2	Average alkalinity
	cm	deg C	mV	meq/L	meq/L	meq/L
1	0	9.6	-240	9	9.2	9.1
2	0	8.7	-148	12.1	12.5	12.3
3	0	8.5	-134	6.2	6.3	6.25
4	0			11.6	11.5	11.55
5	0	8.9	-134	10.5	10.7	10.6
6	0	9.9	-166	12.1	12.2	12.15
7	0	9.7	-157	10.2	10.4	10.3
8	0	7.7	-154	4.4	4.6	4.5
9	0	9.9	-167	4.6	4.8	4.7
10	0			4	4.2	4.1
11	0	8.7	-203	5.2	5.3	5.25
12	20			14.2	14.1	14.15
13	45					
14	0	8.1	-168	7.7	7.7	7.7
15	0	9.2	-180	7.3		7.3
222a	0	7.7	-180	2.4	2.2	2.3
Valmieras no.						
Vm1	0	10.1	-67	3.5	3.4	3.45
Vm2	0	11.3	-23	5.3	5.3	5.3
Vm3	60	9.1	-138	13.4	13.6	13.5
Vm4	0	9.1	-149	8.9	9.2	9.05
Vm5	0	9.6	-186	16.2	16.6	16.4

Checked DB 24/6/97

Groundwater Samples from Latvia - June 1997

All samples are filtered at 0,45 um, but unacidified.

- 0 = no visible colour
- b = brown tinge
- B = brown colour
- BB = very brown colour (presumably precipitated iron)

Viestura Prospekt Oil Store

Location	Marking	Colour
Borehole 1	Lv1BF	B
Borehole 2	Lv2BF	BB
Borehole 3	Lv3BF	B
Borehole 4	Lv4BF	BB
Borehole 5	Lv5BF	BB
Borehole 6	Lv6BF	B
Borehole 7	Lv7BF	BB
Borehole 8	Lv8BF	b
Borehole 9	Lv9BF	B
Borehole 10	Lv10BF	b
Borehole 11	Lv11BF	BB
Borehole 12	Lv12BF	BB
Borehole 14	Lv14BF	BB
Borehole 15	Lv15BF	b
Borehole222a	Lv222aBF	O

Valmieras iela tank repair works

Borehole 1	Vm1BF	b
Borehole 2	Vm2BF	b
Borehole 3	Vm3BF	B
Borehole 4	Vm4BF	B
Borehole 5	Vm5BF	b

Analytical Procedure

Prøvene kan inneholde mindre mengder oppløst olje. Dette gjelder spesielt Lv12BF og Vm3BF. Prøvene inneholder antakelig også mye oppløst jern.

1. Ryst flaskene sakte for å distribuere bunnfelt jern.
2. Ta ut ca. 10 ml vann til IC analyse
3. Surgjør gjenværende 90 ml i flasken for å løse opp utfelt jern.
4. Analyser den surgjorte prøven med
   (a) ICP
   (b) AA (Sn, Sb, Cd, Hg, Pb, As)

1997.0153

2644.00

Groundwater Samples from Latvia - June 1997

All samples are filtered at 0,45 um, but unacidified.

- 0 = no visible colour
- b = brown tinge
- B = brown colour
- BB = very brown colour (presumably precipitated iron)

Viestura Prospekt Oil Store

Location	Marking		Colour	Tilsatt HNO_3
Borehole 1	Lv1BF	B		1.1 ml
Borehole 2	Lv2BF	BB		1.1 "
Borehole 3	Lv3BF	B		1.1 "
Borehole 4	Lv4BF	BB		1.1 "
Borehole 5	Lv5BF	BB		1.1 "
Borehole 6	Lv6BF	B		1.1 "
Borehole 7	Lv7BF	BB		1.1 "
Borehole 8	Lv8BF	b		0.2 "
Borehole 9	Lv9BF	B		0.3 "
Borehole 10	Lv10BF	b		1.1 "
Borehole 11	Lv11BF	BB		1.1 "
Borehole 12	Lv12BF	BB		1.1 "
Borehole 14	Lv14BF	BB		0.2 "
Borehole 15	Lv15BF	b		0.1 "
Borehole222a	Lv222aBF	O		

Valmieras iela tank repair works

Borehole 1	Vm1BF	b	0.4 "
Borehole 2	Vm2BF	b	0.4 "
Borehole 3	Vm3BF	B	1.1 "
Borehole 4	Vm4BF	B	1.1 "
Borehole 5	Vm5BF	b	1.1 "

20/8-97 B.S

Analytical Procedure

Prøvene kan inneholde mindre mengder oppløst olje. Dette gjelder spesielt Lv12BF og Vm3BF. Prøvene inneholder antakelig også mye oppløst jern.

1. Ryst flaskene sakte for å distribuere bunnfelt jern.
2. Ta ut ca. 10 ml vann til IC analyse
3. Surgjør gjenværende 90 ml i flasken for å løse opp utfelt jern.
4. Analyser den surgjorte prøven med
   (a) ICP
   (b) AA (Sn, Sb, Cd, Hg, Pb, As)

NGU, Miljøundersøkelser Latvia
v/David Banks
Prosjektnr. 2699.00

Analyserapport 1997.0153

NGU
Norges geologiske undersøkelse
Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ANALYSERAPPORT

NORSK AKKREDITERING Nr. P020

ANALYSEKONTRAKT NR.: 1997.0153
NGU PROSJEKT NR.: 2699.00

OPPDRAGSGIVER: NGU, Miljøundersøkelser Latvia

ADRESSE:

TLF.: 310

KONTAKTPERSON: David Banks

PRØVETYPE: Vann
ANTALL PRØVER: 20
IDENTIFIKASJON AV PRØVER: Iflg. liste fra oppdragsgiver
PRØVER MOTTATT: 24.06.97
ANMERKNINGER: Ingen

SPESIFIKASJON AV OPPDRAGET I HENHOLD TIL ANALYSEKONTRAKT:

METODE	DOKUMENTASJON *)	OMFATTES AV AKKREDITERING
ICP-AES vann	NGU-SD 3.1	Ja
GFAAS - Cd, Pb, As, Sn	NGU-SD 3.2	Ja
GFAAS - Sb		Nei
CVAAS - Hg	NGU-SD 3.3	Ja
IC	NGU-SD 3.4	Ja

Denne rapporten inneholder i alt 13 sider. Rapporten må ikke gjengis i utdrag uten skriftlig godkjenning fra NGU-Lab.

Alle forhold ved prøvetaking, behandling og transport av prøvene før innlevering til NGU-Lab er underlagt oppdragsgivers ansvar. Analyseresultater framlagt i denne rapporten refererer derfor kun til det prøvematerialet som er mottatt av NGU-Lab.

Trondheim, 10. juli 1997

Magne Ødegård (e.f.)

*) Fortegnelse over dokumentasjon finnes i NGU-Labs Kvalitetshåndbok, NGU-SD 0.1, som kan rekvireres fra NGU-Labs sekretariat.

NGU
Norges geologiske undersøkelse
NGU-Lab

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ICP-AES ANALYSER
VANN
Analysekontraktsnr:1997.0153

INSTRUMENT TYPE : Thermo Jarrell Ash ICP 61

NEDRE BESTEMMELSESGRENSER VANNANALYSER
(For vannprøver som tynnes, blir deteksjonsgrensene automatisk omregnet).

Si ppb	Al ppb	Fe ppb	Ti ppb	Mg ppb	Ca ppb	Na ppb	K ppb	Mn ppb	P ppb
20.-	20.-	10.-	5.-	50.-	20.-	50.-	500.-	1.-	100.-
Cu ppb	**Zn ppb**	**Pb ppb**	**Ni ppb**	**Co ppb**	**V ppb**	**Mo ppb**	**Cd ppb**	**Cr ppb**	**Ba ppb**
5.-	2.-	50.-	20.-	10.-	5.-	10.-	5.-	10.-	2.-
Sr ppb	**Zr ppb**	**Ag ppb**	**B ppb**	**Be ppb**	**Li ppb**	**Sc ppb**	**Ce ppb**	**La ppb**	**Y ppb**
1.-	5.-	10.-	10.-	1.-	5.0	1.-	50.-	10.-	1.-

ANALYSEUSIKKERHET: ± 20 rel. % for K, Pb, Cd, Li, Ce.
± 10 rel. % for Si, Al, Na, Mo, Cr, Zr, Ag, B og La.
± 5 rel. % for Fe, Ti, Mg, Ca, Mn, P, Cu, Zn, Ni, Co, V, Ba, Sr, Be, Sc, Y.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 20

ANMERKNINGER: B slettes p.g.a. forurensinger av B i systemet

Ferdig analysert	2. juli 1997	Brit Inger Vongraven og Baard Søberg
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse
NGU-Lab

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ICP-AES ANALYSER
VANN
Analysekontraktsnr:1997.0153

	Lv1BF	Lv2BF	Lv3BF	Lv4BF	Lv5BF	Lv6BF	Lv7BF	Lv8BF	Lv9BF	Lv10BF
Si	3.2ppm	7.0ppm	7.2ppm	6.1ppm	5.3ppm	4.1ppm	4.0ppm	2.6ppm	9.0ppm	3.6ppm
Al	<20.3ppb	<20.3ppb	<20.3ppb	<20.3ppb	<20.3ppb	<20.3ppb	<20.3ppb	<20.3ppb	<20.1ppb	<20.1ppb
Fe	24.6ppm	47.9ppm	25.6ppm	38.4ppm	38.5ppm	18.6ppm	29.6ppm	2.6ppm	16.0ppm	4.0ppm
Ti	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.0ppb	< 5.0ppb
Mg	19.6ppm	12.9ppm	11.0ppm	20.2ppm	18.1ppm	17.4ppm	14.7ppm	13.7ppm	10.6ppm	15.2ppm
Ca	118ppm	174ppm	75.5ppm	135ppm	129ppm	175ppm	140ppm	70.0ppm	71.7ppm	63.6ppm
Na	3.9ppm	1.9ppm	1.1ppm	5.0ppm	3.8ppm	1.7ppm	2.4ppm	2.8ppm	6.3ppm	16.1ppm
K	1.9ppm	1.6ppm	4.5ppm	23.4ppm	5.9ppm	3.8ppm	3.0ppm	1.6ppm	7.9ppm	1.9ppm
Mn	2.3ppm	2.5ppm	141ppb	1.4ppm	3.8ppm	1.3ppm	4.1ppm	30.8ppb	117ppb	881ppb
P	559ppb	205ppb	< 101ppb	547ppb	454ppb	500ppb	478ppb	< 101ppb	< 100ppb	< 100ppb
Cu	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.0ppb	< 5.0ppb
Zn	< 2.0ppb	3.7ppb	3.2ppb	< 2.0ppb	< 2.0ppb	3.6ppb	< 2.0ppb	78.1ppb	17.8ppb	30.4ppb
Ni	<20.3ppb	<20.3ppb	<20.3ppb	<20.3ppb	<20.3ppb	<20.3ppb	<20.3ppb	<20.3ppb	<20.1ppb	<20.1ppb
Co	<10.1ppb	<10.1ppb	20.6ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.0ppb	<10.0ppb
V	< 5.1ppb	10.2ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.0ppb	< 5.0ppb
Mo	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.0ppb	<10.0ppb
Cr	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.0ppb	<10.0ppb
Ba	82.2ppb	154ppb	171ppb	190ppb	156ppb	132ppb	109ppb	73.1ppb	114ppb	63.0ppb
Sr	130ppb	242ppb	159ppb	400ppb	196ppb	223ppb	143ppb	69.1ppb	178ppb	84.0ppb
Zr	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.0ppb	< 5.0ppb
Ag	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.0ppb	<10.0ppb
Be	4.9ppb	9.7ppb	5.1ppb	7.7ppb	7.5ppb	3.6ppb	5.7ppb	< 1.0ppb	3.1ppb	< 1.0ppb
Li	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.0ppb	< 5.0ppb
Sc	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb
Ce	<50.7ppb	<50.7ppb	<50.7ppb	<50.7ppb	<50.7ppb	<50.7ppb	<50.7ppb	<50.7ppb	<50.1ppb	<50.2ppb
La	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.1ppb	<10.0ppb	<10.0ppb
Y	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb

NGU
Norges geologiske undersøkelse
NGU-Lab

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ICP-AES ANALYSER
VANN
Analysekontraktsnr:1997.0153

	Lv11BF	Lv12BF	Lv14BF	Lv15BF	Lv222aBF	Vm1BF	Vm2BF	Vm3BF	Vm4BF	Vm5BF
Si	7.4ppm	6.3ppm	5.0ppm	8.6ppm	3.7ppm	3.0ppm	4.4ppm	8.0ppm	6.0ppm	7.7ppm
Al	<20.3ppb	<20.3ppb	<20.3ppb	<20.1ppb	<20.0ppb	<20.1ppb	<20.1ppb	<20.3ppb	<20.3ppb	<20.3ppb
Fe	21.8ppm	51.5ppm	31.4ppm	9.1ppm	182ppb	54.7ppb	16.8ppb	28.9ppm	22.0ppm	5.0ppm
Ti	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb
Mg	9.0ppm	19.9ppm	7.3ppm	7.6ppm	12.2ppm	15.2ppm	16.6ppm	43.6ppm	22.7ppm	72.9ppm
Ca	64.1ppm	176ppm	98.1ppm	96.3ppm	48.1ppm	42.2ppm	81.7ppm	142ppm	113ppm	124ppm
Na	4.6ppm	2.7ppm	3.7ppm	7.9ppm	3.7ppm	63.3ppm	25.0ppm	25.1ppm	13.4ppm	49.5ppm
K	2.9ppm	8.0ppm	2.0ppm	19.2ppm	1.4ppm	53.4ppm	17.1ppm	11.2ppm	11.0ppm	37.4ppm
Mn	209ppb	1.9ppm	5.3ppm	1.3ppm	32.4ppb	81.7ppb	1.8ppb	1.4ppm	829ppb	1.5ppm
P	< 101ppb	554ppb	461ppb	295ppb	< 100ppb	1.3ppm	438ppb	965ppb	1.4ppm	691ppb
Cu	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb
Zn	< 2.0ppb	25.8ppb	13.9ppb	< 2.0ppb	< 2.0ppb	3.8ppb	10.9ppb	5.1ppb	< 2.0ppb	< 2.0ppb
Ni	<20.3ppb	<20.3ppb	<20.3ppb	<20.1ppb	<20.0ppb	<20.1ppb	<20.1ppb	<20.3ppb	<20.3ppb	<20.3ppb
Co	<10.1ppb	<10.1ppb	<10.1ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.1ppb	<10.1ppb	<10.1ppb
V	< 5.1ppb	9.1ppb	6.9ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb
Mo	<10.1ppb	<10.1ppb	<10.1ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.1ppb	<10.1ppb	<10.1ppb
Cr	<10.1ppb	<10.1ppb	<10.1ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.1ppb	<10.1ppb	<10.1ppb
Ba	135ppb	141ppb	127ppb	109ppb	37.8ppb	39.2ppb	91.2ppb	322ppb	137ppb	301ppb
Sr	91.2ppb	336ppb	118ppb	206ppb	72.0ppb	159ppb	171ppb	590ppb	369ppb	461ppb
Zr	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.0ppb	< 5.1ppb	< 5.1ppb	< 5.1ppb
Ag	<10.1ppb	<10.1ppb	<10.1ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.1ppb	<10.1ppb	<10.1ppb
Be	4.3ppb	10.1ppb	6.1ppb	1.6ppb	<1.00ppb	< 1.0ppb	< 1.0ppb	5.5ppb	4.1ppb	< 1.0ppb
Li	< 5.1ppb	< 5.1ppb	< 5.1ppb	< 5.0ppb	< 5.0ppb	10.2ppb	9.6ppb	19.3ppb	24.8ppb	15.9ppb
Sc	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	<1.00ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb
Ce	<50.7ppb	<50.7ppb	<50.7ppb	<50.1ppb	<50.0ppb	<50.2ppb	<50.2ppb	<50.7ppb	<50.7ppb	<50.7ppb
La	<10.1ppb	<10.1ppb	<10.1ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.0ppb	<10.1ppb	<10.1ppb	<10.1ppb
Y	< 1.0ppb	< 1.0ppb	1.3ppb	< 1.0ppb	<1.00ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb	< 1.0ppb

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Cd, Pb, As og Sn - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0153

NGU - Lab

INSTRUMENT TYPE : **Perkin Elmer type SIMAA 6000**

NEDRE BESTEMMELSES GRENSER : Cd : 0.02 µg/l (0.02 ppb) Pb : 0.2 µg/l (0.2ppb) As : 3.0 µg/l (3.0 ppb) Sn : 2.0 µg/l (2.0 ppb)

ANALYSEUSIKKERHET Analyseusikkerheten er gitt i tabellen under

Element	Usikkerhet
Cd	± 10 % rel.
Pb	± 10 % rel.
As	± 20 % rel.
Sn	± 20 % rel.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 20

ANMERKNINGER: Ingen

Ferdig analysert	8. juli 1997	Frank Berge
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Cd, Pb, ... og Sn - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0153

NGU - Lab

Prøvenr.	As µg/l mg/kg	Cd µg/l mg/kg	Pb µg/l mg/kg	Sn µg/l mg/kg
Lv1BF	< 3.0	< 0.02	0.44	< 2.0
Lv2BF	6.0	0.03	4.46	< 2.0
Lv3BF	3.8	< 0.02	0.66	< 2.0
Lv4BF	9.0	< 0.02	0.99	< 2.0
Lv5BF	3.6	0.15	16.78	< 2.0
Lv6BF	< 3.0	0.04	1.99	< 2.0
Lv7BF	3.4	0.02	2.13	< 2.0
Lv8BF	< 3.0	0.02	0.81	< 2.0
Lv9BF	< 3.0	< 0.02	0.75	< 2.0
Lv10BF	< 3.0	0.03	0.76	< 2.0
Lv11BF	< 3.0	0.10	2.15	< 2.0
Lv12BF	< 3.0	< 0.02	< 0.20	< 2.0
Lv14BF	< 3.0	< 0.02	0.57	< 2.0
Lv15BF	6.0	< 0.02	0.60	< 2.0
Lv222aBF	< 3.0	< 0.02	0.32	< 2.0
Vm1BF	3.4	< 0.02	0.46	< 2.0
Vm2BF	< 3.0	< 0.02	0.44	< 2.0
Vm3BF	5.3	< 0.02	0.93	< 2.0
Vm4BF	< 3.0	< 0.02	0.28	2.0
Vm5BF	< 3.0	< 0.02	0.20	< 2.0

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Sb - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0153

NGU - Lab

INSTRUMENT TYPE : **Perkin Elmer type SIMAA 6000**

NEDRE BESTEMMELSES GRENSER : Sb 0.5 µg/l

ANALYSEUSIKKERHET Analyseusikkerheten er gitt i tabellen under

Element	Usikkerhet
Sb	± 10 % rel.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 20

ANMERKNINGER: Ingen

Ferdig analysert	8. juli 1997	Frank Berge
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Sb - Gr. .tovn teknikk)
Vann
Analysekontraktsnr:1997.0153

NGU - Lab

Prøvenr.	Sb
Lv1BF	< 0.50
Lv2BF	1.00
Lv3BF	< 0.50
Lv4BF	< 0.50
Lv5BF	< 0.50
Lv6BF	< 0.50
Lv7BF	0.50
Lv8BF	< 0.50
Lv9BF	< 0.50
Lv10BF	0.80
Lv11BF	0.88
Lv12BF	0.59
Lv14BF	< 0.50
Lv15BF	0.52
Lv222aBF	< 0.50
Vm1BF	1.32
Vm2BF	1.80
Vm3BF	< 0.50
Vm4BF	< 0.50
Vm5BF	0.56

µg/l

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Hg-Kalddampteknikk AA/HMS-1)
VANN
Analysekontraktsnr:1997.0153

NORSK AKKREDITERING
Nr. P020

NGU - Lab

Metoden er utviklet for bestemmelse av kvikksølv i vann med Perkin Elmer Mercury Hydride System - 20 og en gullfelleenhet koblet til Perkin Elmer AA.

INSTRUMENT TYPE : **Perkin Elmer type 460 (AA) / 20 (MHS)**

NEDRE BESTEMMELSES GRENSER : 10 pg/ml (10 ppt)

ANALYSEUSIKKERHET **± 10 % rel.**

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 20

ANMERKNINGER: Ingen

Ferdig analysert	7. juli 1997	Idun Melby
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Hg-Kalddampteknikk AA/HMS-1)
VANN
Analysekontraktsnr:1997.0153

NORSK AKKREDITERING
Nr. P020

NGU - Lab

Prøvenr.	Hg µg/l
Lv1BF	< 0.010
Lv2BF	< 0.010
Lv3BF	< 0.010
Lv4BF	< 0.010
Lv5BF	< 0.010
Lv6BF	< 0.010
Lv7BF	< 0.010
Lv8BF	< 0.010
Lv9BF	< 0.010
Lv10BF	< 0.010
Lv11BF	< 0.010
Lv12BF	< 0.010
Lv14BF	< 0.010
Lv15BF	< 0.010
Lv222aBF	< 0.010
Vm1BF	< 0.010
Vm2BF	< 0.010
Vm3BF	< 0.010
Vm4BF	< 0.010
Vm5BF	< 0.010

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

IC- ANALYSER
VANN
Analysekontraktsnr:1997.0153

NORSK AKKREDITERING Nr. P020

7 ANIONER : F^-, Cl^-, NO_2^-, Br^-, NO_3^-, PO_4^{3-}, SO_4^{2-}

INSTRUMENT TYPE : **DIONEX IONEKROMATOGRAF 2120i**

NEDRE BESTEMMELSESGRENSER

ION	F^-	Cl^-	NO_2^-*	Br^-	NO_3^-	PO_4^{3-}	SO_4^{2-}
Nedre bestemmelsesgrense - mg/l	0.05	0.1	0.05	0.1	0.05	0.2	0.1

ANALYSEUSIKKERHET : **10 % rel. for alle ionene**

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 20.

ANMERKNINGER: Alle prøvene er kjørt gjennom Sep Pak C_{18} patron før analyse.

* NGU-LAB er ikke akkreditert for NO_2^- *

Rapporten må ikke gjengis i utdrag uten skriftlig godkjenning fra NGU-Lab.

Ferdig analysert	2. juli 1997	Egil Kvam
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

IC- ANALYSER
VANN
Analysekontraktsnr:1997.0153

Prøve Id.	Analyse dato	F^- [mg/l]	Cl^- [mg/l]	NO_2^- [mg/l]	Br^- [mg/l]	NO_3^- [mg/l]	PO_4^{3-} [mg/l]	SO_4^{2-} [mg/l]
153/97 - Lv BF 1	30.06.97	0.076	6.69	< 0.05	< 0.1	< 0.05	< 0.2	0.386
153/97 - Lv BF 2	30.06.97	0.172	4.06	< 0.05	0.228	< 0.05	< 0.2	0.560
153/97 - Lv BF 3	30.06.97	0.373	2.44	< 0.05	< 0.1	< 0.05	< 0.2	0.382
153/97 - Lv BF 4	30.06.97	0.051	4.98	< 0.05	< 0.1	< 0.05	< 0.2	0.742
153/97 - Lv BF 5	30.06.97	0.058	5.19	< 0.05	< 0.1	< 0.05	< 0.2	< 0.1
153/97 - Lv BF 6	30.06.97	0.098	3.07	< 0.05	< 0.1	< 0.05	< 0.2	0.209
153/97 - Lv BF 7	30.06.97	0.068	3.71	< 0.05	< 0.1	< 0.05	< 0.2	0.281
153/97 - Lv BF 8	30.06.97	0.058	2.90	< 0.05	< 0.1	< 0.05	< 0.2	25.8
153/97 - Lv BF 9	30.06.97	< 0.05	4.80	< 0.05	< 0.1	< 0.05	< 0.2	47.6
153/97 - Lv BF 10	30.06.97	< 0.05	5.44	< 0.05	< 0.1	< 0.05	< 0.2	70.1
153/97 - Lv BF 11	30.06.97	0.119	5.76	< 0.05	< 0.1	< 0.05	< 0.2	1.63
153/97 - Lv BF 12	30.06.97	0.062	3.57	< 0.05	< 0.1	< 0.05	< 0.2	3.34
153/97 - Lv BF 14	30.06.97	0.224	5.54	< 0.05	< 0.1	< 0.05	< 0.2	0.918
153/97 - Lv BF 15	30.06.97	0.187	3.98	< 0.05	< 0.1	< 0.05	< 0.2	6.16
153/97 - Lv BF 222a	30.06.97	0.100	5.67	< 0.05	< 0.1	1.75	< 0.2	63.8
153/97 - Vm BF 1	30.06.97	0.166	52.2	2.56	< 0.1	51.9	3.29	91.5
153/97 - Vm BF 2	30.06.97	0.139	26.2	< 0.05	< 0.1	19.4	1.07	60.6
153/97 - Vm BF 3	30.06.97	0.239	45.5	< 0.05	< 0.1	< 0.05	< 0.2	0.192
153/97 - Vm BF 4	30.06.97	0.153	14.1	< 0.05	< 0.1	< 0.05	< 0.2	45.2
153/97 - Vm BF 5	30.06.97	0.141	13.2	< 0.05	< 0.1	< 0.05	< 0.2	27.3

Samples re-analysed
to obtain correct
B - results

NGU, Miljøundersøkelser Latvia
v/ David Banks
Prosjektnr.2699.00
Endring av analyserapport 1997.0153
Analyserapport 1997.0153

NGU
Norges geologiske undersøkelse
Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ANALYSERAPPORT

NORSK AKKREDITERING Nr. P020

ANALYSEKONTRAKT NR.: 1997.0153
NGU PROSJEKT NR.: 2699.00

OPPDRAGSGIVER: NGU, Miljøundersøkelser Latvia

ADRESSE:

TLF.: 310

KONTAKTPERSON: David Banks

PRØVETYPE: Vann
ANTALL PRØVER: 20
IDENTIFIKASJON AV PRØVER: Iflg. liste fra oppdragsgiver
PRØVER MOTTATT: 24.06.97
ANMERKNINGER: Ingen

SPESIFIKASJON AV OPPDRAGET I HENHOLD TIL ANALYSEKONTRAKT:

METODE	DOKUMENTASJON *)	OMFATTES AV AKKREDITERING
ICP-AES vann	NGU-SD 3.1	Ja
GFAAS - Cd, Pb, As, Sn	NGU-SD 3.2	Ja
GFAAS - Sb		Nei
CVAAS - Hg	NGU-SD 3.3	Ja
IC	NGU-SD 3.4	Ja

Endring av analyserapport 1997.0153. Tidligere utsendte rapporter er ugyldig, og skal makuleres.
Denne rapporten inneholder i alt 13 sider. Rapporten må ikke gjengis i utdrag uten skriftlig godkjenning fra NGU-Lab.

Alle forhold ved prøvetaking, behandling og transport av prøvene før innlevering til NGU-Lab er underlagt oppdragsgivers ansvar. Analyseresultater framlagt i denne rapporten refererer derfor kun til det prøvematerialet som er mottatt av NGU-Lab.

Trondheim, 20. august 1997

Magne Ødegård (e.f.)

*) Fortegnelse over dokumentasjon finnes i NGU-Labs Kvalitetshåndbok, NGU-SD 0.1, som kan rekvireres fra NGU-Labs sekretariat.

NGU
Norges geologiske undersøkelse
NGU-Lab

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ICP-AES ANALYSER
VANN
Analysekontraktsnr:1997.0153

NORSK AKKREDITERING
Nr. P020

INSTRUMENT TYPE : **Thermo Jarrell Ash ICP 61**

NEDRE BESTEMMELSESGRENSER VANNANALYSER
(For vannprøver som tynnes, blir deteksjonsgrensene automatisk omregnet).

Si ppb	Al ppb	Fe ppb	Ti ppb	Mg ppb	Ca ppb	Na ppb	K ppb	Mn ppb	P ppb
20.-	20.-	10.-	5.-	50.-	20.-	50.-	500.-	1.-	100.-
Cu ppb	Zn ppb	Pb ppb	Ni ppb	Co ppb	V ppb	Mo ppb	Cd ppb	Cr ppb	Ba ppb
5.-	2.-	50.-	20.-	10.-	5.-	10.-	5.-	10.-	2.-
Sr ppb	Zr ppb	Ag ppb	B ppb	Be ppb	Li ppb	Sc ppb	Ce ppb	La ppb	Y ppb
1.-	5.-	10.-	20.-	1.-	5.0	1.-	50.-	10.-	1.-

ANALYSEUSIKKERHET: ± 20 rel. % for K, Pb, Cd, Li, Ce.
± 10 rel. % for Si, Al, Na, Mo, Cr, Zr, Ag, B og La.
± 5 rel. % for Fe, Ti, Mg, Ca, Mn, P, Cu, Zn, Ni, Co, V, Ba, Sr, Be, Sc, Y.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 20

ANMERKNINGER: Ny rapport erstatter 02.07.97. Endring gjelder inkludering av B og korigering av inteferens av Fe på Be.

Ferdig analysert	14.08.97	Brit I. Vongraven
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse
NGU-Lab

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ICP-AES ANALYSER
VANN
Analysekontraktsnr:1997.0153

Prøve navn	Si	Al	Fe	Ti	Mg	Ca	Na	K	Mn	P	Cu	Zn	Ni	Co	V
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Lv1BF	3.35	<0.02	25.6	<0.005	20.2	122	4.06	1.76	2.44	0.562	<0.005	<0.002	<0.02	<0.01	<0.005
Lv2BF	7.35	0.0434	49.8	<0.005	13.4	180	2.02	1.78	2.62	0.294	<0.005	0.00511	<0.02	<0.01	0.0159
Lv3BF	7.59	<0.02	26.6	<0.005	11.3	78.0	1.12	4.34	0.149	0.101	<0.005	0.00499	<0.02	0.0193	<0.005
Lv4BF	6.42	<0.02	39.9	<0.005	20.7	139	5.15	24.4	1.52	0.579	<0.005	0.00255	<0.02	<0.01	0.00906
Lv5BF	5.53	<0.02	39.8	<0.005	18.6	133	3.98	5.61	4.03	0.465	<0.005	<0.002	<0.02	<0.01	0.00877
Lv6BF	4.29	0.0283	19.3	<0.005	17.8	178	1.76	4.30	1.33	0.500	<0.005	0.00484	<0.02	<0.01	0.00713
Lv7BF	4.27	0.0226	30.9	<0.005	15.3	144	2.51	3.00	4.35	0.441	<0.005	<0.002	<0.02	<0.01	0.00773
Lv8BF	2.68	<0.02	2.80	<0.005	14.0	71.6	2.93	1.35	0.0317	0.145	<0.005	0.0807	<0.02	<0.01	<0.005
Lv9BF	9.42	<0.02	16.7	<0.005	10.8	73.5	6.40	8.17	0.124	<0.1	<0.005	0.0191	<0.02	<0.01	<0.005
Lv10BF	3.75	<0.02	4.16	<0.005	15.4	64.5	16.2	2.17	0.920	0.142	<0.005	0.0312	<0.02	<0.01	<0.005
Lv11BF	7.70	<0.02	22.5	<0.005	9.10	65.4	4.65	2.44	0.221	0.135	<0.005	0.00233	<0.02	<0.01	<0.005
Lv12BF	6.67	<0.02	53.8	<0.005	20.6	181	2.67	8.30	2.04	0.653	<0.005	0.0275	<0.02	<0.01	0.0141
Lv14BF	5.31	0.0548	33.0	<0.005	7.52	102	3.71	1.94	5.66	0.530	<0.005	0.0214	<0.02	<0.01	0.0131
Lv15BF	9.10	<0.02	9.56	<0.005	7.87	100	8.19	20.5	1.38	0.515	<0.005	0.00265	<0.02	<0.01	<0.005
Lv222aBF	3.93	<0.02	0.204	<0.005	12.8	50.6	3.74	0.698	0.0355	<0.1	<0.005	0.00267	<0.02	<0.01	<0.005
Vm1BF	3.08	<0.02	0.0584	<0.005	15.5	43.8	64.4	55.9	0.0888	1.39	<0.005	0.00549	<0.02	<0.01	<0.005
Vm2BF	4.71	<0.02	0.0195	<0.005	17.6	87.4	26.4	18.3	0.00323	0.491	<0.005	0.0139	<0.02	<0.01	<0.005
Vm3BF	8.57	<0.02	30.5	<0.005	45.7	149	26.1	11.4	1.55	1.02	<0.005	0.00623	<0.02	<0.01	0.00817
Vm4BF	6.41	<0.02	23.1	<0.005	23.7	118	13.8	11.6	0.889	1.48	<0.005	<0.002	<0.02	<0.01	<0.005
Vm5BF	8.23	<0.02	5.30	<0.005	75.7	130	51.0	39.4	1.57	0.789	<0.005	<0.002	<0.02	<0.01	<0.005

NGU
Norges geologiske undersøkelse
NGU-Lab

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ICP-AES ANALYSER
VANN
Analysekontraktsnr:1997.0153

Prøve navn	Mo	Cr	Ba	Sr	Zr	Ag	B	Be	Li	Sc	Ce	La	Y
	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Lv1BF	<0.01	<0.01	0.0838	0.132	<0.005	<0.01	0.0374	<0.001	<0.005	<0.001	<0.05	<0.01	<0.001
Lv2BF	<0.01	<0.01	0.181	0.247	<0.005	<0.01	0.0270	<0.001	<0.005	<0.001	0.0607	<0.01	<0.001
Lv3BF	<0.01	<0.01	0.176	0.162	<0.005	<0.01	0.0312	<0.001	<0.005	<0.001	<0.05	<0.01	<0.001
Lv4BF	<0.01	<0.01	0.195	0.406	<0.005	<0.01	0.0333	<0.001	<0.005	<0.001	0.0698	<0.01	<0.001
Lv5BF	<0.01	<0.01	0.158	0.200	<0.005	<0.01	0.0374	<0.001	<0.005	<0.001	<0.05	<0.01	<0.001
Lv6BF	<0.01	<0.01	0.150	0.226	<0.005	<0.01	<0.02	<0.001	<0.005	<0.001	0.0563	<0.01	<0.001
Lv7BF	<0.01	<0.01	0.113	0.147	<0.005	<0.01	0.0333	<0.001	<0.005	<0.001	<0.05	<0.01	<0.001
Lv8BF	<0.01	<0.01	0.0746	0.0708	<0.005	<0.01	<0.02	<0.001	<0.005	<0.001	<0.05	<0.01	<0.001
Lv9BF	<0.01	<0.01	0.117	0.182	<0.005	<0.01	<0.02	<0.001	<0.005	<0.001	<0.05	<0.01	<0.001
Lv10BF	<0.01	<0.01	0.0637	0.0852	<0.005	<0.01	0.0309	<0.001	<0.005	<0.001	<0.05	<0.01	<0.001
Lv11BF	<0.01	<0.01	0.136	0.0925	<0.005	<0.01	0.0416	<0.001	<0.005	<0.001	<0.05	<0.01	<0.001
Lv12BF	<0.01	<0.01	0.146	0.344	<0.005	<0.01	0.0270	<0.001	<0.005	<0.001	0.0782	<0.01	<0.001
Lv14BF	<0.01	<0.01	0.133	0.122	<0.005	<0.01	0.0437	<0.001	<0.005	<0.001	<0.05	<0.01	<0.001
Lv15BF	<0.01	<0.01	0.113	0.213	<0.005	<0.01	0.0206	<0.001	<0.005	<0.001	0.0591	<0.01	<0.001
Lv222a	<0.01	<0.01	0.0392	0.0752	<0.005	<0.01	<0.02	<0.001	<0.005	<0.001	<0.05	<0.01	<0.001
Vm1BF	<0.01	<0.01	0.0397	0.163	<0.005	<0.01	0.0660	<0.001	0.00716	<0.001	<0.05	<0.01	<0.001
Vm2BF	<0.01	<0.01	0.0973	0.184	<0.005	<0.01	0.0783	<0.001	0.00716	<0.001	<0.05	<0.01	<0.001
Vm3BF	<0.01	<0.01	0.336	0.616	<0.005	<0.01	0.112	<0.001	0.0177	<0.001	0.0580	<0.01	<0.001
Vm4BF	<0.01	<0.01	0.143	0.383	<0.005	<0.01	0.106	<0.001	0.0249	<0.001	<0.05	<0.01	<0.001
Vm5BF	<0.01	<0.01	0.309	0.475	<0.005	<0.01	0.156	<0.001	0.0161	<0.001	<0.05	<0.01	<0.001

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Cd, Pb, As og Sn - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0153

NGU - Lab

INSTRUMENT TYPE : **Perkin Elmer type SIMAA 6000**

NEDRE BESTEMMELSES GRENSER : Cd : 0.02 µg/l (0.02 ppb) Pb : 0.2 µg/l (0.2ppb) As : 3.0 µg/l (3.0 ppb) Sn : 2.0 µg/l (2.0 ppb)

ANALYSEUSIKKERHET Analyseusikkerheten er gitt i tabellen under

Element	Usikkerhet
Cd	± 10 % rel.
Pb	± 10 % rel.
As	± 20 % rel.
Sn	± 20 % rel.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 20

ANMERKNINGER: Ingen

Ferdig analysert	8. juli 1997	Frank Berge
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Cd, Pb, As og Sn - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0153

NGU - Lab

Prøvenr.	As µg/l	Cd µg/l	Pb µg/l	Sn µg/l
Lv1BF	< 3.0	< 0.02	0.44	< 2.0
Lv2BF	6.0	0.03	4.46	< 2.0
Lv3BF	3.8	< 0.02	0.66	< 2.0
Lv4BF	9.0	< 0.02	0.99	< 2.0
Lv5BF	3.6	0.15	16.78	< 2.0
Lv6BF	< 3.0	0.04	1.99	< 2.0
Lv7BF	3.4	0.02	2.13	< 2.0
Lv8BF	< 3.0	0.02	0.81	< 2.0
Lv9BF	< 3.0	< 0.02	0.75	< 2.0
Lv10BF	< 3.0	0.03	0.76	< 2.0
Lv11BF	< 3.0	0.10	2.15	< 2.0
Lv12BF	< 3.0	< 0.02	< 0.20	< 2.0
Lv14BF	< 3.0	< 0.02	0.57	< 2.0
Lv15BF	6.0	< 0.02	0.60	< 2.0
Lv222aBF	< 3.0	< 0.02	0.32	< 2.0
Vm1BF	3.4	< 0.02	0.46	< 2.0
Vm2BF	< 3.0	< 0.02	0.44	< 2.0
Vm3BF	5.3	< 0.02	0.93	< 2.0
Vm4BF	< 3.0	< 0.02	0.28	2.0
Vm5BF	< 3.0	< 0.02	0.20	< 2.0

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Sb - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0153

NGU - Lab

INSTRUMENT TYPE : **Perkin Elmer type SIMAA 6000**

NEDRE BESTEMMELSES GRENSER : Sb 0.5 µg/l

ANALYSEUSIKKERHET Analyseusikkerheten er gitt i tabellen under

Element	Usikkerhet
Sb	± 10 % rel.

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 20

ANMERKNINGER: Ingen

Rapporten må ikke gjengis i utdrag uten skriftlig godkjenning fra NGU-Lab.

Ferdig analysert	8. juli 1997	Frank Berge
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Sb - Grafittovn teknikk)
Vann
Analysekontraktsnr:1997.0153

NGU - Lab

Prøvenr.	Sb µg/l
Lv1BF	< 0.50
Lv2BF	1.00
Lv3BF	< 0.50
Lv4BF	< 0.50
Lv5BF	< 0.50
Lv6BF	< 0.50
Lv7BF	0.50
Lv8BF	< 0.50
Lv9BF	< 0.50
Lv10BF	0.80
Lv11BF	0.88
Lv12BF	0.59
Lv14BF	< 0.50
Lv15BF	0.52
Lv222aBF	< 0.50
Vm1BF	1.32
Vm2BF	1.80
Vm3BF	< 0.50
Vm4BF	< 0.50
Vm5BF	0.56

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Hg-Kalddampteknikk AA/HMS-1)
VANN
Analysekontraktsnr:1997.0153

NORSK AKKREDITERING
Nr. P020

NGU - Lab

Metoden er utviklet for bestemmelse av kvikksølv i vann med Perkin Elmer Mercury Hydride System - 20 og en gullfelleenhet koblet til Perkin Elmer AA.

INSTRUMENT TYPE : **Perkin Elmer type 460 (AA) / 20 (MHS)**

NEDRE BESTEMMELSES GRENSER : 10 pg/ml (10 ppt)

ANALYSEUSIKKERHET **± 10 % rel.**

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 20

ANMERKNINGER: Ingen

Ferdig analysert	7. juli 1997	Idun Melby
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

ATOMABSORPSJONS-ANALYSE (Hg-Kalddampteknikk AA/HMS-1)

VANN

Analysekontraktsnr:1997.0153

NORSK AKKREDITERING
Nr. P020

NGU - Lab

Prøvenr.	Hg µg/l
Lv1BF	< 0.010
Lv2BF	< 0.010
Lv3BF	< 0.010
Lv4BF	< 0.010
Lv5BF	< 0.010
Lv6BF	< 0.010
Lv7BF	< 0.010
Lv8BF	< 0.010
Lv9BF	< 0.010
Lv10BF	< 0.010
Lv11BF	< 0.010
Lv12BF	< 0.010
Lv14BF	< 0.010
Lv15BF	< 0.010
Lv222aBF	< 0.010
Vm1BF	< 0.010
Vm2BF	< 0.010
Vm3BF	< 0.010
Vm4BF	< 0.010
Vm5BF	< 0.010

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

IC- ANALYSER
VANN
Analysekontraktsnr:1997.0153

NORSK AKKREDITERING
Nr. P020

7 ANIONER : F^-, Cl^-, NO_2^-, Br^-, NO_3^-, PO_4^{3-}, SO_4^{2-}

INSTRUMENT TYPE : **DIONEX IONEKROMATOGRAF 2120i**

NEDRE BESTEMMELSESGRENSER

ION	F^-	Cl^-	NO_2^-*	Br^-	NO_3^-	PO_4^{3-}	SO_4^{2-}
Nedre bestemmelsesgrense - mg/l	0.05	0.1	0.05	0.1	0.05	0.2	0.1

ANALYSEUSIKKERHET : **10 % rel. for alle ionene**

PRESISJON : Det kjøres rutinemessig kontrollprøver, som føres i kontrolldiagram (X-diagram). Disse kan forevises om ønskelig.

ANTALL PRØVER: 20.

ANMERKNINGER: Alle prøvene er kjørt gjennom Sep Pak C_{18} patron før analyse.

*** NGU-LAB er ikke akkreditert for NO_2^- ***

Ferdig analysert	2. juli 1997	Egil Kvam
	Dato	OPERATØR

NGU
Norges geologiske undersøkelse

Postboks 3006 - Lade
7002 TRONDHEIM
Tlf.: 73 90 40 11
Telefaks: 73 92 16 20

IC- ANALYSER
VANN
Analysekontraktsnr:1997.0153

Prøve Id.	Analyse dato	F^- [mg/l]	Cl^- [mg/l]	NO_2^- [mg/l]	Br^- [mg/l]	NO_3^- [mg/l]	PO_4^{3-} [mg/l]	SO_4^{2-} [mg/l]
153/97 - Lv BF 1	30.06.97	0.076	6.69	< 0.05	< 0.1	< 0.05	< 0.2	0.386
153/97 - Lv BF 2	30.06.97	0.172	4.06	< 0.05	0.228	< 0.05	< 0.2	0.560
153/97 - Lv BF 3	30.06.97	0.373	2.44	< 0.05	< 0.1	< 0.05	< 0.2	0.382
153/97 - Lv BF 4	30.06.97	0.051	4.98	< 0.05	< 0.1	< 0.05	< 0.2	0.742
153/97 - Lv BF 5	30.06.97	0.058	5.19	< 0.05	< 0.1	< 0.05	< 0.2	< 0.1
153/97 - Lv BF 6	30.06.97	0.098	3.07	< 0.05	< 0.1	< 0.05	< 0.2	0.209
153/97 - Lv BF 7	30.06.97	0.068	3.71	< 0.05	< 0.1	< 0.05	< 0.2	0.281
153/97 - Lv BF 8	30.06.97	0.058	2.90	< 0.05	< 0.1	< 0.05	< 0.2	25.8
153/97 - Lv BF 9	30.06.97	< 0.05	4.80	< 0.05	< 0.1	< 0.05	< 0.2	47.6
153/97 - Lv BF 10	30.06.97	< 0.05	5.44	< 0.05	< 0.1	< 0.05	< 0.2	70.1
153/97 - Lv BF 11	30.06.97	0.119	5.76	< 0.05	< 0.1	< 0.05	< 0.2	1.63
153/97 - Lv BF 12	30.06.97	0.062	3.57	< 0.05	< 0.1	< 0.05	< 0.2	3.34
153/97 - Lv BF 14	30.06.97	0.224	5.54	< 0.05	< 0.1	< 0.05	< 0.2	0.918
153/97 - Lv BF 15	30.06.97	0.187	3.98	< 0.05	< 0.1	< 0.05	< 0.2	6.16
153/97 - Lv BF 222a	30.06.97	0.100	5.67	< 0.05	< 0.1	1.75	< 0.2	63.8
153/97 - Vm BF 1	30.06.97	0.166	52.2	2.56	< 0.1	51.9	3.29	91.5
153/97 - Vm BF 2	30.06.97	0.139	26.2	< 0.05	< 0.1	19.4	1.07	60.6
153/97 - Vm BF 3	30.06.97	0.239	45.5	< 0.05	< 0.1	< 0.05	< 0.2	0.192
153/97 - Vm BF 4	30.06.97	0.153	14.1	< 0.05	< 0.1	< 0.05	< 0.2	45.2
153/97 - Vm BF 5	30.06.97	0.141	13.2	< 0.05	< 0.1	< 0.05	< 0.2	27.3

Appendix 5:

Analyses carried out by FFI in 1996 / 97 on soil and groundwater samples from Valmieras iela site.

FORSVARETS FORSKNINGSINSTITUTT
Avdeling for miljøtoksikologi

1996

TELEFAX

TIL	Adressat	: Norges Geologiske Undersøkelser
	Saksbehandler	: Arve Misund
	Telefax	: 73 92 16 20

FRA	Saksbehandler	: Bjørn Arne Johnsen	Telefon	: 63 80 78 31
	Dato	: 1 april 1997	Telefax	: 63 80 78 11
	Adresse	: Postboks 25, 2007 Kjeller	Mil retn nr	: 505

SAK	ANALYSERESULTATER FRA LATVIA

Oversender som avtalt resultatene fra analysene av vann og jordprøver i Latvia.

Bjørn

Antall sider inkl denne: 3

Ved manglende sider ring: + 47 63 80 78 31

FFI TOX
20/3-97

ANALYSE AV THC I JORD FRA LATVIA

Instrument : Gasskromatograf, Autosystem, Perkin Elmer til analyse av THC
Deteksjonsgrense: 30 mg/kg TS
Operatør : Marita Ljønes

Intern nr	Ekstern nr.	mg/kg TS
96-525	Viestura prospect, 5-6m, #12	3212
96-528	Viestura prospect, 4,6m, #13	47184
96-534	Viestura prospect, 25 cm, no 32A, oil layer	424
96-541	Valmieras, Bore 1, 2m	< 30
96-542	Valmieras, Bore 2, 4,3m, grunnvann	< 30
96-543	Valmieras, Bore 3, 5m	11000
96-544	Valmieras, Bore 4, 5m	< 30
96-545	Valmieras, Bore 4, 6m	< 30
96-546	Valmieras, II 7A, 25cm	14508
96-548	Valmieras, II 9, 25cm	8489
96-550	Valmieras, II 16, 25cm	121

FFI TOX
20/3-97

ANALYSE AV THC I VANN FRA LATVIA

Instrument : Gasskromatograf, Autosystem, Perkin Elmer til analyse av THC
Deteksjonsgrense: 0,06
Operatør : Marita Ljønes

Intern nr	Ekstern nr.	mg/l
96-513	Viestura prospect, #1	< 0,06
96-514	Viestura prospect, #2	0,445
96-515	Viestura prospect, #6	2,622
96-516	Viestura prospect, #7	0,224
96-518	Viestura prospect, #14	1,054
96-521	Viestura prospect, P2	0,320
96-522	Viestura prospect, #222 A	< 0,06
97-10	Valimierasiela #2	0,334
97-11	Valimierasiela #3	0,114
97-12	Valimierasiela #4	0,319

FORSVARETS FORSKNINGSINSTITUTT
Avdeling for miljøtoksikologi

1997

TELEFAX

TIL	Adressat	: NGU
	Saksbehandler	: Arve Misund
	Telefax	: 73 92 16 20

FRA	Saksbehandler	: Arnt Johnsen	Telefon	: 63 80 78 33
	Dato	: 24 juli 1997	Telefax	: 63 80 78 11
	Adresse	: Postboks 25, 2007 Kjeller	Mil retn nr	: 505

SAK **Analyse av flyktige forbindelser i vannprøve fra Latvia**

To prøver ble sendt til SINTEF for analyse av flyktige forbindelser. Vedlagt analyserapport fra SINTEF. En vannprøve fra brønn nr 2 og en oljeprøve fra brønn 3 ved Valmieras iela. Det ble ikke funnet klorerte løsemidler og lave konsentrasjoner av aromater i vannet. Det bemerkes at vannprøvene ikke var tatt med formål for denne type analyse.

Med hilsen

Arnt Johnsen

Antall sider inkl denne: 3

Ved manglende sider ring: 63 80 78 33

SINTEF

SINTEF Kjemi

Adresse/Address:
Postboks 124 Blindern
N-0314 Oslo 3, NORWAY

Besøksadresse/Location:
Forskningsveien 1

Telefon/Telephone:
+47 22 06 73 00

Telefax:
+47 22 06 73 50

Telex:
71 536 SI N

Foretaksregisteret:
NO 948 007 029 MVA

Forsvarets Forskningsinstitutt
Avd. for miljøtoksikologi
Postboks 25,
2007 Kjeller

Att. Arnt Johnsen

Rapport

Deres ref.:	Vår ref.:	Direkte innvalg:	Oslo,
96/01321-8/FFITOX/AJo/204.4 Lat Best.nr. 61970478	ori\ffi7925r	22 06 74 87	1997-07-02

Oppdrag nr.:
664079.25

Oppdragets tittel:
Innhold av VOC i vann og diesel

Prøveserie:
1997-430

Sammendrag

Det ble ikke påvist klorerte løsemidler i prøvene. Vannprøven inneholdt spor av alkylerte benzener

Innledning

Følgende prøver ble mottatt 27.06.97 for analyse med henblikk på innhold av flyktige organiske forbindelser (VOC), med spesiell vekt på klorerte løsemidler og flyktige aromater.

Prøvemerking	SINTEF Serienr. 1997-	Prøvetype
Valmerias/Ela, brønn 2	430-1	vann
Valmerias/Ela, brønn 3 (olje)	430-2	olje (diesel)

Eksperimentelt

Prøvene ble analysert med en headspace GC/MS teknikk.

Vann: En prøve ble overført til et headspaceglass, og tilsatt indre standarder. Glasset med innhold ble forseglet og satt 45 min. ved 90°C. En delprøve av atmosfæren i glasset ble tatt ut med en forvarmet, gasstett sprøyte og analysert med GC/MS. Påviste forbindelser ble

identifsert utfra opptatte massespektre. Forbindelsene ble kvantifisert ved sammenligning av detektorrespons til forbindelser og indre standarder.
Olje: Oljefasen ble analysert med i prinsipp samme teknikk som for vannfasen.

Resultat

Analysene ga følgende resultat

Forbindelse	Brønn 2 (vann)	Det.grense (vann)	Brønn 3 (olje)	Det.grense (olje)
	µg/l		µg/l	
Triklormetan	-	0,02	-	2
Diklorbrommetan	-	0,05	-	2
Klordibrommetan	-	0,05	-	4
Tribrommetan	-	0,30	-	5
Tetraklormetan	-	0,05	-	1
Dikloreten	-	0,04	-	2
Trikloreten	-	0,04	-	1
Tetrakloreten	-	0,02	-	1
1,1,1-trikloretan	-	0,05	-	2
1,1,2-trikloretan	-	0,15	-	4
Heksakloretan	-	0,30	-	5
Benzen	-	0,05	ia	ia
Toluen	0,05	0,05	ia	ia
Etylbenzen og xylener	1,0	0,05	ia	ia
Sum C3-C4-benzener	1,5	0,1	ia	ia

- = ikke påvist
ia = ikke analysert/bestemt

Kommentarer

Det ble ikke påvist innhold av klorerte løsemidler i noen av prøvene. Vannprøven inneholdt spor av alkylerte benzener. Innhold av benzen og alkylerte benzener er ikke bestemt i oljeprøven, da disse inngår som bestanddeler i oljedestillater av typen diesel.

Med hilsen
SINTEF Kjemi

for
Nina Gjøs
Laboratorieleder
Miljøteknologi og analyse

Oddvar Ringstad
Prosjektleder

Spesielle betingelser

FORSVARETS FORSKNINGSINSTITUTT
Norwegian Defence Research Establishment
Division for Environmental Toxicology

Date
24 September 1997
Our reference
97/00339-19/FFITOX/AJo/138.22
Previous reference

1997

FFITOX
Att:Bjørn A Johnsen
P.O. Box 25
N-2007 KJELLER

ANALYSIS OF WATER AND SOIL SAMPLES FOR CONTENT OF HYDROCARBONS

Due to contamination of Si-columns used to clean-up the extract of water samples, the samples are reportet with too high concentration of THC. Investigations at our laboratory show that the results are approximately 0.18 mg/l too high. The results are therefore corrected for this in the new report. The earlier report should be marked with "Replaced with amended Analysis report no 97/015".

Sincerely,

Arnt Johnsen
Senior Scientist

Enclosures: 1

Exec officer : Arnt Johnsen
Address : P. O. Box 25, N-2007 Kjeller, Norway
Direct : 63 80 78 33
Telephone : + 47 63 80 70 00
Telefax : + 47 63 80 78 11
V.A.T reg. No. : NO 970 963 340 V.A.T

Amendment to Analysis report no 97/013
Analysis of samples from Latvia

Customer:	Forsvarets forskningsinstitutt	Number of samples:	21
Address:	Postboks 25, N-2007 KJELLER	Date received:	21.06.97
		Sample type:	Soil and water
Comments:	The samples has been stored in room temperature from 16 june 1997 until received		

The analysis report applies to the following analyses:

Parameter of analysis	Identity of method	Accredited analysis	Range of measure	Uncertainty, %	Date of analysis
THC	B1	Yes	0.060 - 2.4 mg/l	10	30 june 97
THC	B2	Yes	30 - 1200 mg/kg	10	9 july 97

The analysis report has a total of 3 pages, including potential appendices. The analysis report applies only to the samples as they were received by the Norwegian Defence Research Establishment (FFI). The report can not be reproduced except in full without the written approval of FFI. The methods of analysis can be requested from the laboratory. The samples will be kept for 2 months. The period for entering a complaint is 1 month.

Kjeller, 24 September 1997

Bjørn Arne Johnsen
Acting Director of Research

Arnt Johnsen
Senior Scientist

ANALYSIS OF THC IN WATER

Instrument: Gas Chromatograph, Autosystem, Perkin Elmer for analysis of THC.
Operator: Marita Ljønes

Internal id.	External id.	mg/l
97-158	Valmieras Iela, Borehole 3, oil layer on water surface	820000
97-169	Valmieras Iela, Borehole 2	0.29
97-170	Valmieras Iela, Borehole 5	1.2
97-171	Valmieras Iela, Borehole 3	1.4
97-172	Viestura prospect II, Borehole 11	2.1
97-173	Viestura prospect II, Borehole 1	15
97-174	Viestura prospect II, Borehole 3	5.0
97-175	Viestura prospect II, Borehole 14	12
97-176	Viestura prospect II, Borehole 10	1.2
97-177	Viestura prospect II, Borehole 12	14
97-178	Viestura prospect II, Borehole 8	0.45
97-179	Viestura prospect II, Borehole 9	0.90
97-180	Viestura prospect II, Borehole 7	16
97-181	Viestura prospect II, Borehole 222A, (Meza Parks)	0.21
97-182	Valmieras Iela, Borehole 4	1.9

ANALYSIS OF THC IN SOIL

Intrument: Gas Chromatograph, Autosystem, Perkin Elmer for analysis of THC.
Operator: Marita Ljønes

Internal id.	External id.	mg/kg dry soil
97-132	Valmieras no. 9	8400
97-133	Valmieras no. 16	710
97-136	Viesturas prospect II no. 32A	6000
97-137	Viesturas prospect II no. 32 A, black soil	4800
97-156	Valmieras Iela no. 8	6000
97-157	Valmieras Iela no. 7	1200

FORSVARETS FORSKNINGSINSTITUTT
Norwegian Defence Research Establishment
Division for Environmental Toxicology

KOPI

Date
18 July 1997
Our reference
97/00339-14/FFITOX/AJo/138.22
Previous reference

Original (uncorrected) version 1997

FFITOX
Att:Bjørn A Johnsen
P.O. Box 25
N-2007 KJELLER

ANALYSIS OF WATER AND SOIL SAMPLES FOR CONTENT OF HYDROCARBONS

Enclosed you will find our analysis report with the result from the analysis of water and soil samples for content of hydrocarbons. The report has our internal report number FFITOX/ANALYSERAPPORT-97/013. The oil in samples from Valmieras iela is similar to diesel. The oil in samples from Viestura prospect II is more similar to jet fuel or paraffin. There is little or no signs of degradation of the oil in water samples and the soil sample from Viestura prospect II. There is distinct signs of degradation of the oil in soil samples from Valmieras iela.

Arnt Johnsen
Senior Scientist

Enclosures: 1

Exec officer : Arnt Johnsen
Address : P. O. Box 25, N-2007 Kjeller, Norway
Direct : 63 80 78 33
Telephone : + 47 63 80 70 00
Telefax : + 47 63 80 78 11
V.A.T reg. No. : NO 970 963 340 V.A.T

ANALYSIS REPORT

FROM
MILJØLABORATORIET
FFITOX

ANALYSIS OF SAMPLES FOR CONTENT OF
HYDROCARBONS

FFITOX/ANALYSERAPPORT-97/013

FORSVARETS FORSKNINGSINSTITUTT
Norwegian Defence Research Establishment
Postboks 25, 2007 Kjeller, Norge

ANALYSIS OF SAMPLES FOR CONTENT OF HYDROCARBONS

Client: Forsvarets forskningsinstitutt, Bjørn A Johnsen
Address: P.O. Box 25, N-2007 KJELLER
Sample types: Water and soil
Number of samples: 21
Samples received: 23. June 1997
Comments: The samples has been stored in room temperature from 16 june 1997 until received

The analysis report deals with the following analyses:

Analysis-parameter	Method-identity	Accredited	Measure range	Uncertainty, %	Date of analysis
THC	B1	Yes	0,060 - 2,4 mg/l	10	30 june 1997
THC	B2	Yes	30 - 1200 mg/kg dry soil	10	9 july 1997

The analysis report has a total of 4 pages.

The analysis report relates only to the samples as they were received at the laboratory. The report should not be reproduced except in full without the written approval by the Norwegian Defence Research Establishment. The samples will be kept for two months. Any complaints should be forwarded to the laboratory within one month from the receipt of this report.

Kjeller, 22. July 1997

Bjørn A Johnsen
Director of Research

Arnt Johnsen
Senior Scientist

ANALYSIS OF SAMPLES FOR CONTENT OF HYDROCARBONS

Intrument: Gas chromatograph, autosystem, Perkin Elmer (FID) for analysis of THC in water
Operator: Marita Ljønes

Internal id.	External id.	mg/l
97-158	Valmieras Iela, Borehole 3, oil layer on water surface	820000
97-169	Valmieras Iela, Borehole 2	0,47
97-170	Valmieras Iela, Borehole 5	1,4
97-171	Valmieras Iela, Borehole 3	1,6
97-172	Viestura prospect II, Borehole 11	2,3
97-173	Viestura prospect II, Borehole 1	15
97-174	Viestura prospect II, Borehole 3	5,2
97-175	Viestura prospect II, Borehole 14	12
97-176	Viestura prospect II, Borehole 10	1,4
97-177	Viestura prospect II, Borehole 12	14
97-178	Viestura prospect II, Borehole 8	0,63
97-179	Viestura prospect II, Borehole 9	1,1
97-180	Viestura prospect II, Borehole 7	16
97-181	Viestura prospect II, Borehole 222A, (Meza Parks)	0,39
97-182	Valmieras Iela, Borehole 4	2,1

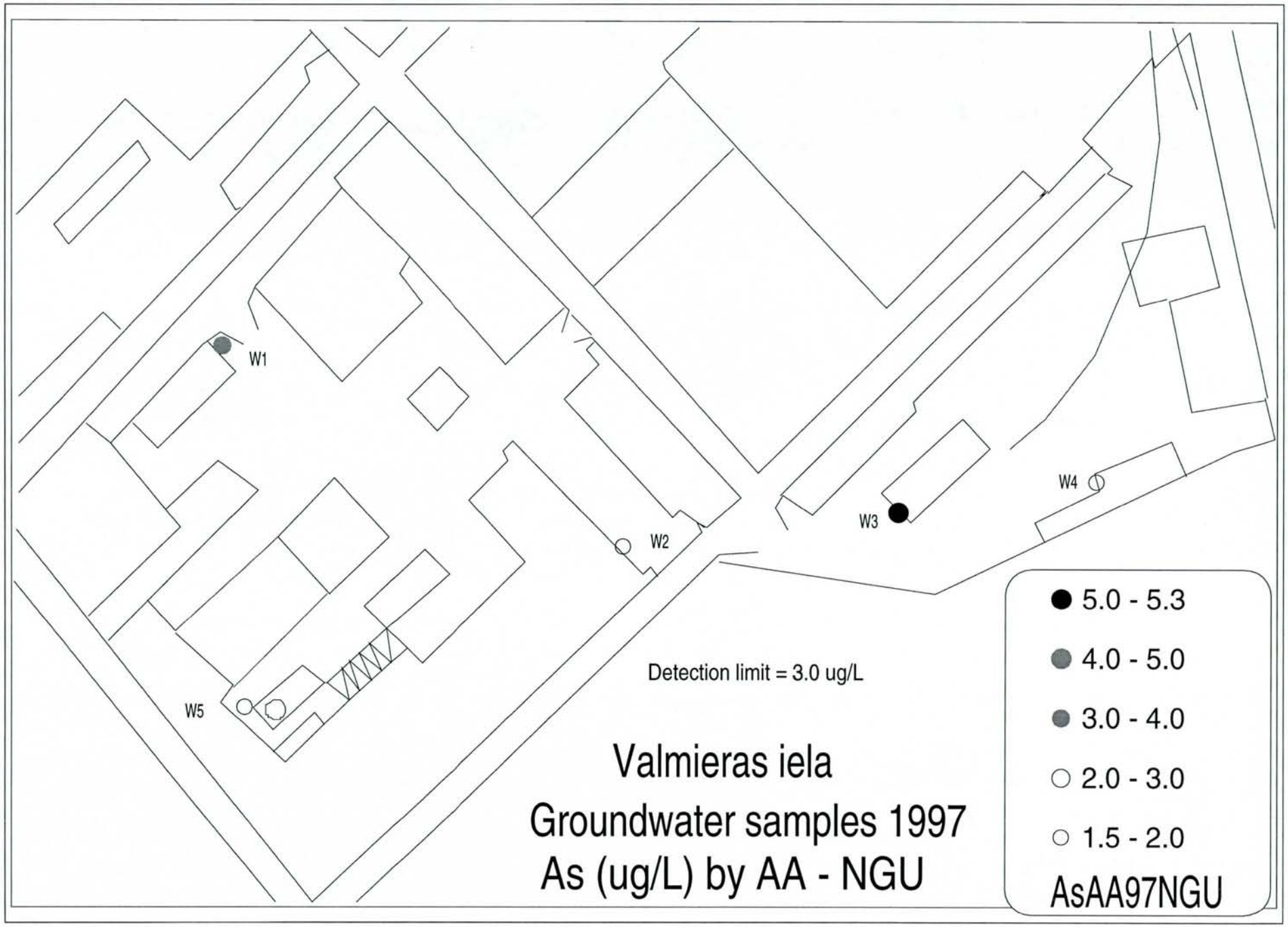
ANALYSIS OF SAMPLES FOR CONTENT OF HYDROCARBONS

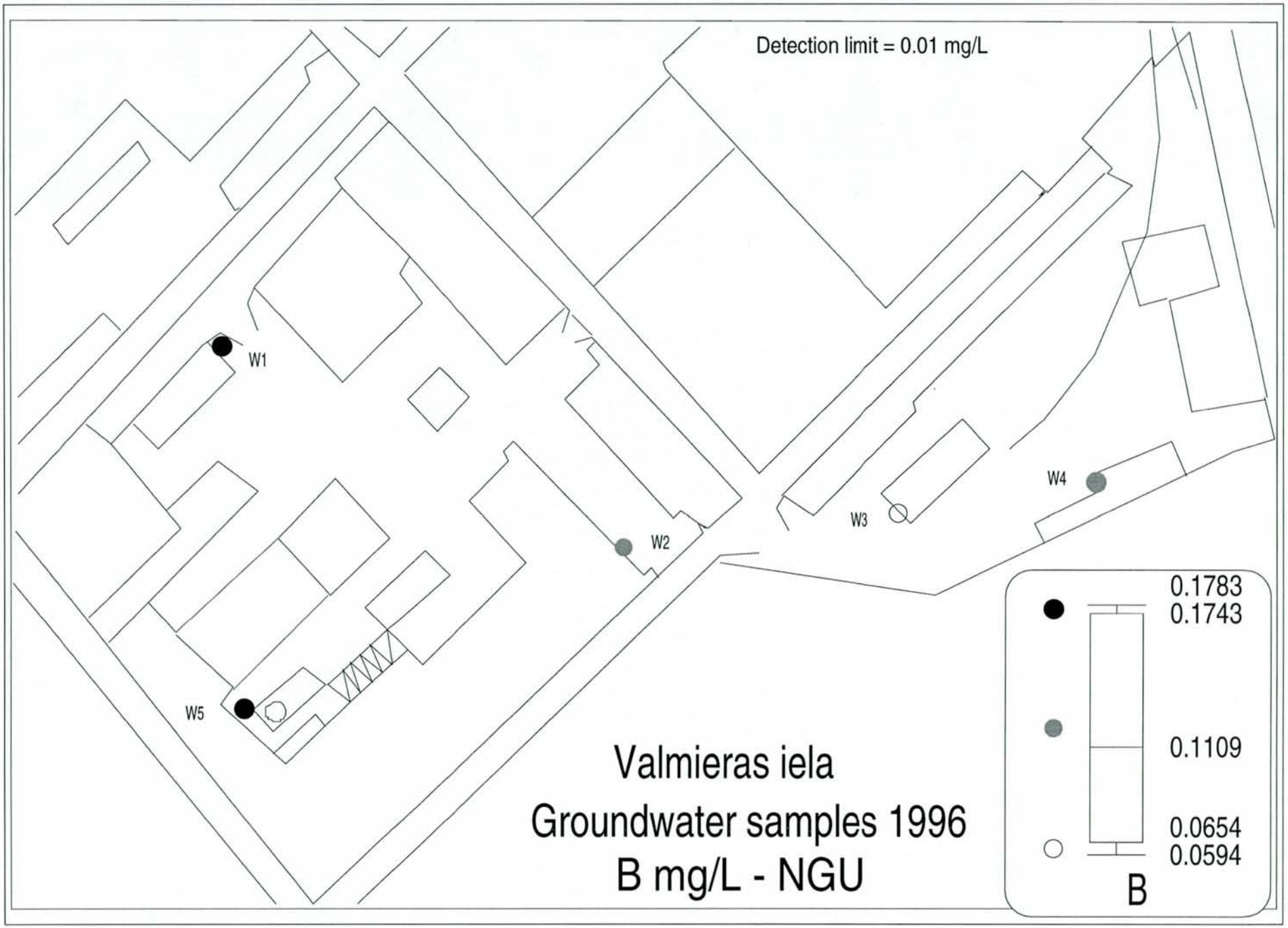
Intrument: Gas chromatograph, autosystem, Perkin Elmer (FID) for analysis of THC in soil
Operators: Marita Ljønes

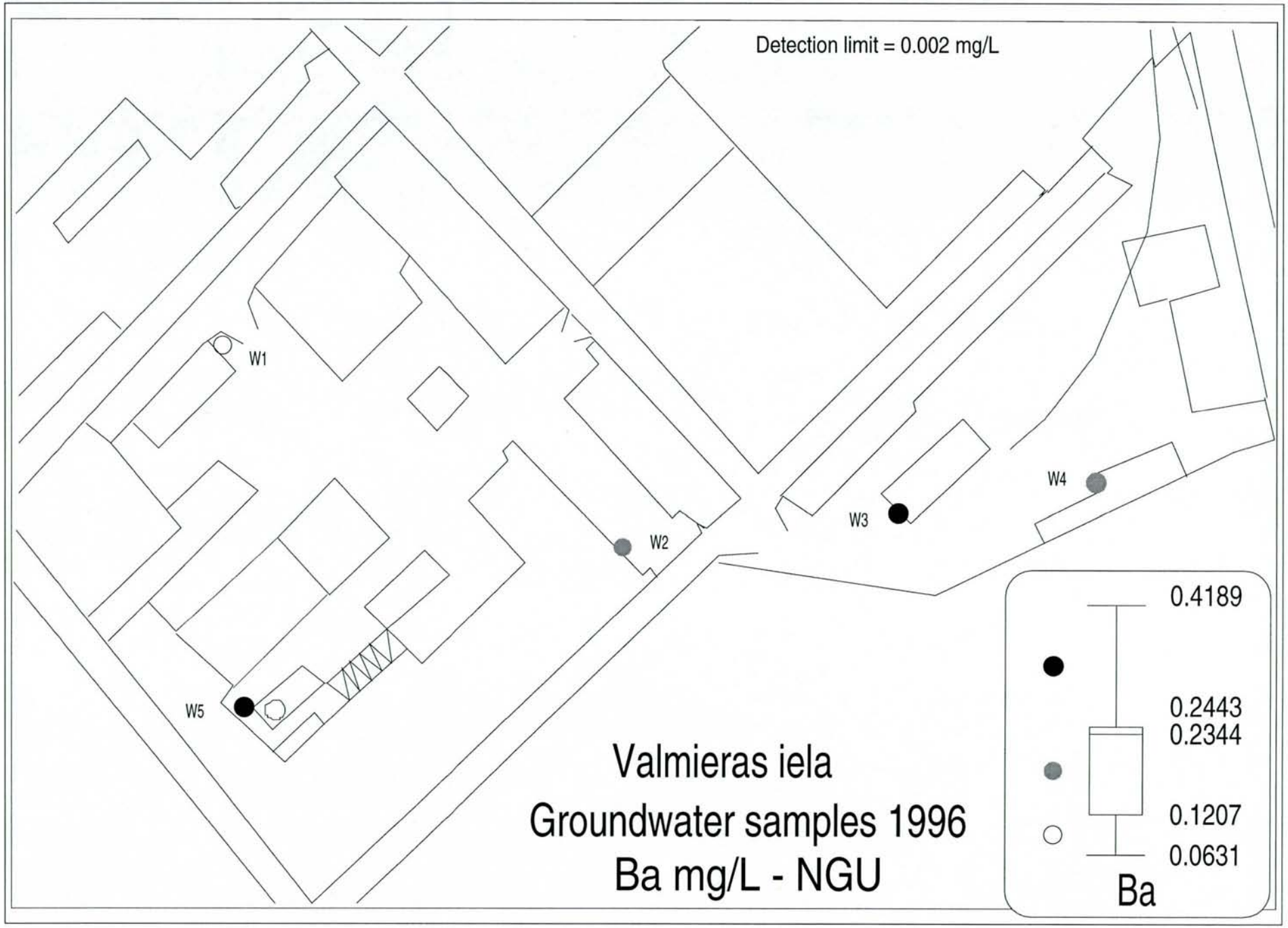
Internal id.	External id.	mg/kg dry soil
97-132	Valmieras no. 9	8400
97-133	Valmieras no. 16	710
97-136	Viesturas prospect II no. 32A	6000
97-137	Viesturas prospect II no. 32 A, black soil	4800
97-156	Valmieras Iela no. 8	6000
97-157	Valmieras Iela no. 7	1200

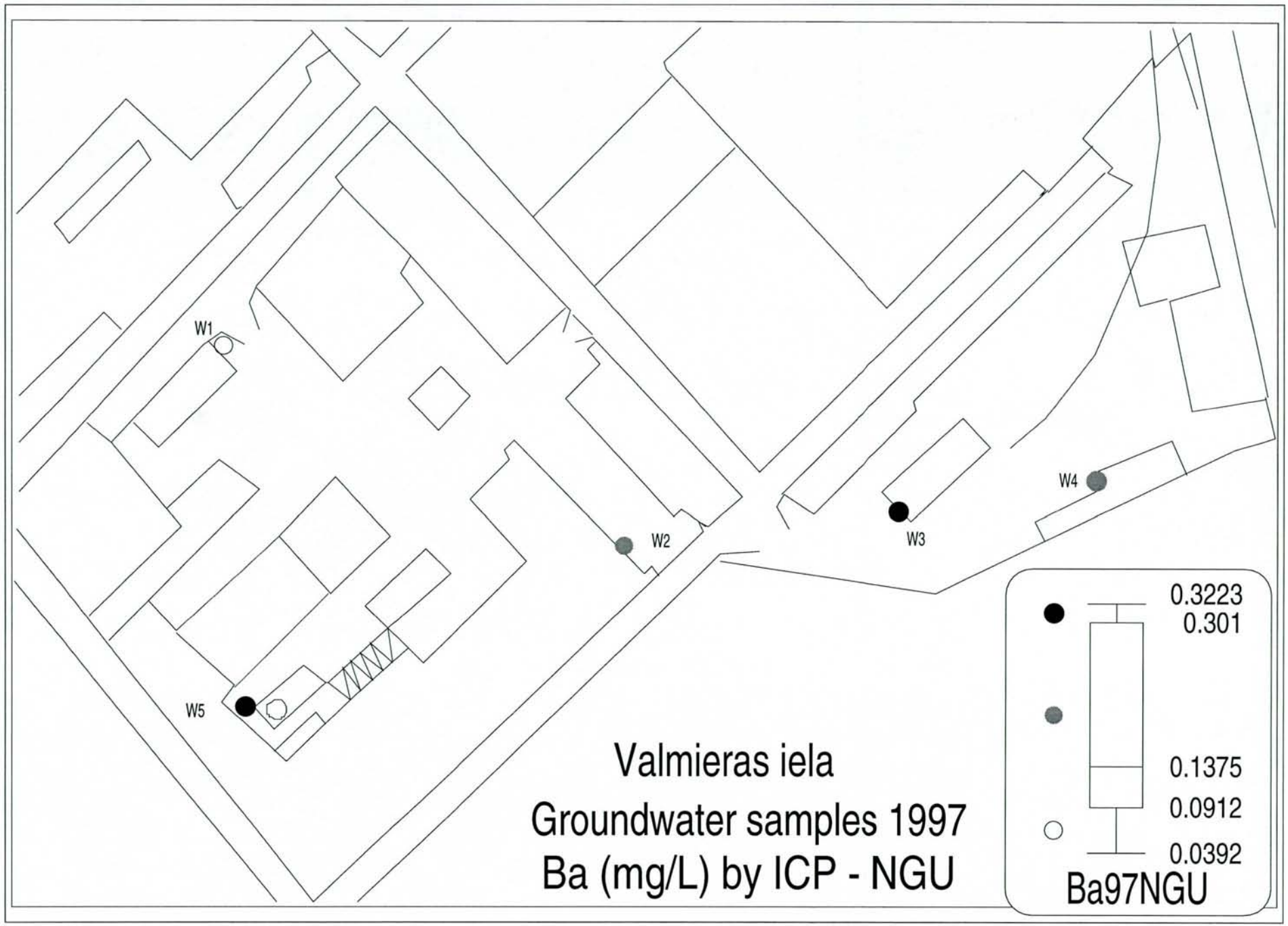
Appendix 6:

Maps of the Valmieras iela site showing concentrations of analysed parameters in groundwater.

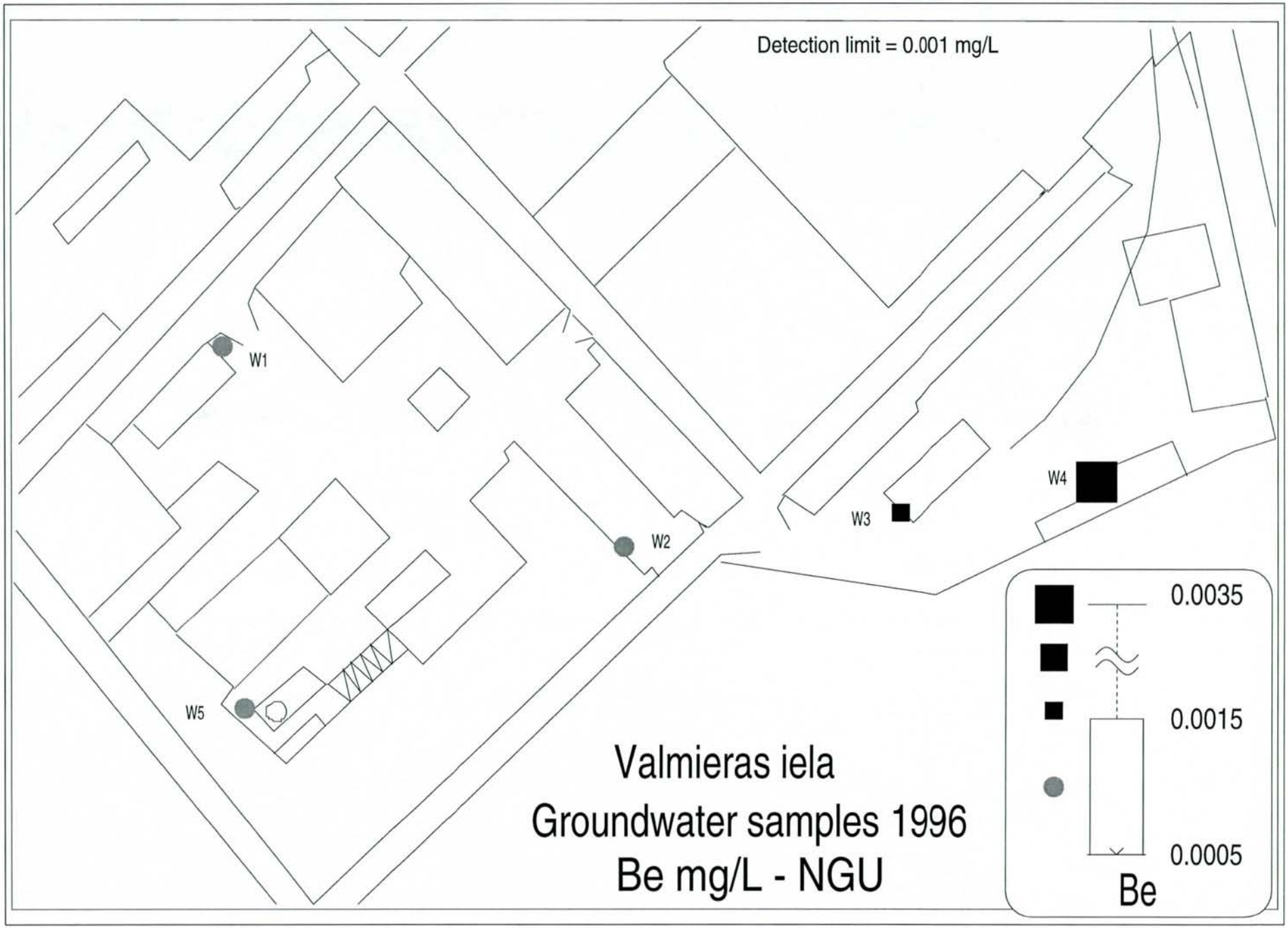

W1
W2
W3
W4
W5
Detection limit = 3.0 ug/L
Valmieras iela
Groundwater samples 1997
As (ug/L) by AA - NGU
5.0 - 5.3
4.0 - 5.0
3.0 - 4.0
2.0 - 3.0
1.5 - 2.0
AsAA97NGU


Detection limit = 0.01 mg/L
W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
B mg/L - NGU
0.1783
0.1743
0.1109
0.0654
0.0594
B

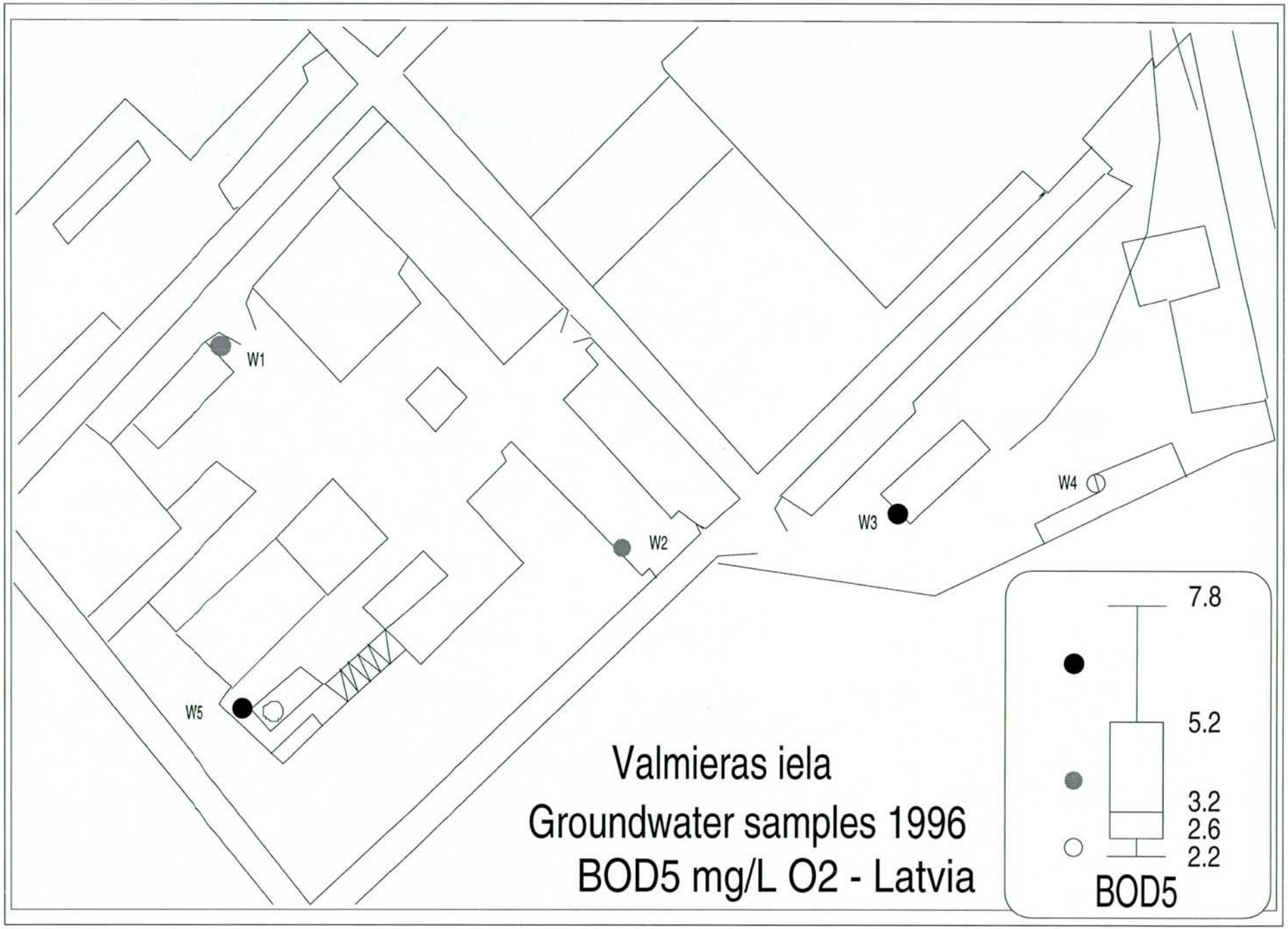

Detection limit = 0.002 mg/L
W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Ba mg/L - NGU
0.4189
0.2443
0.2344
0.1207
0.0631
Ba

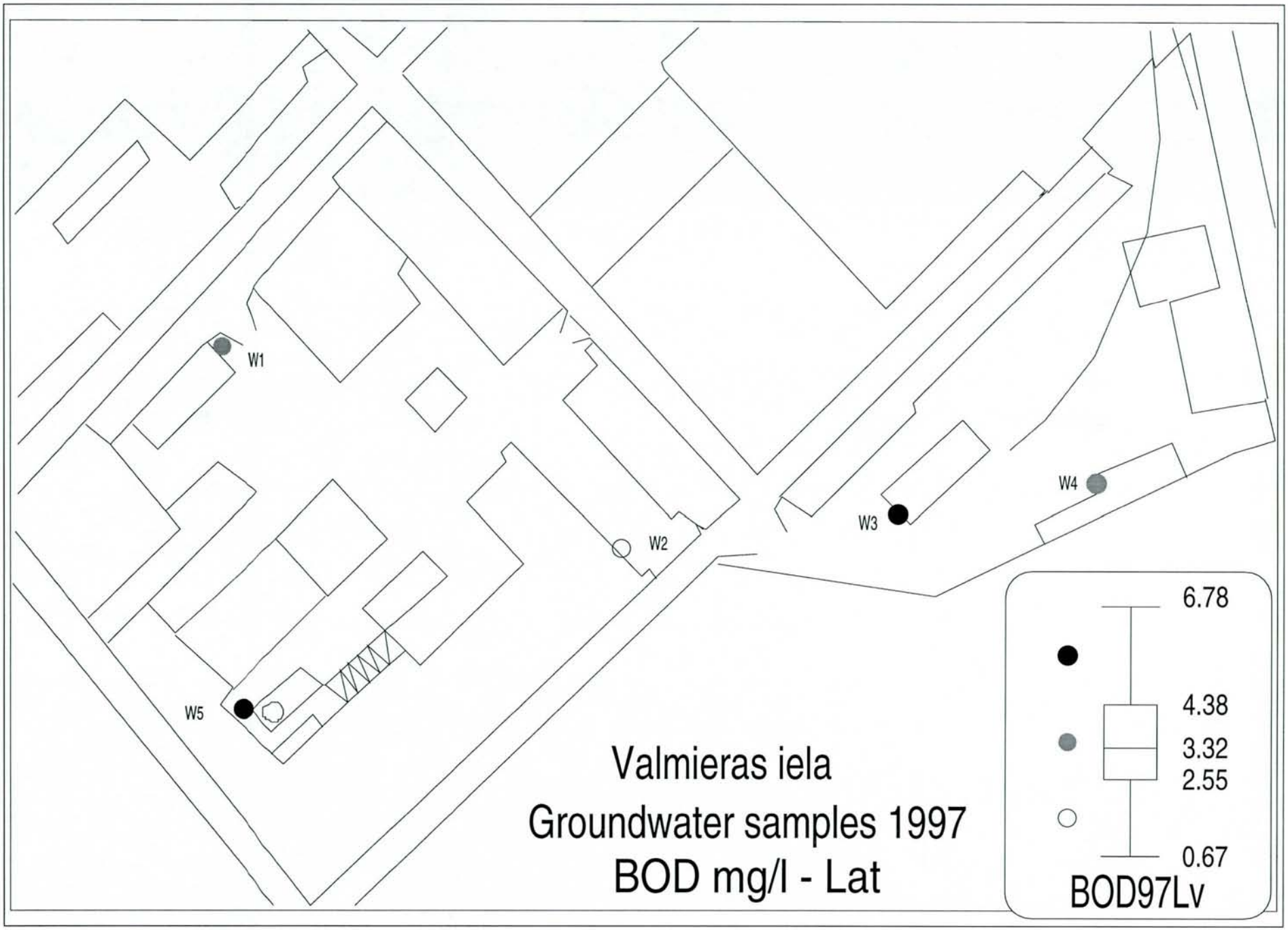

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Ba (mg/L) by ICP - NGU
0.3223
0.301
0.1375
0.0912
0.0392
Ba97NGU

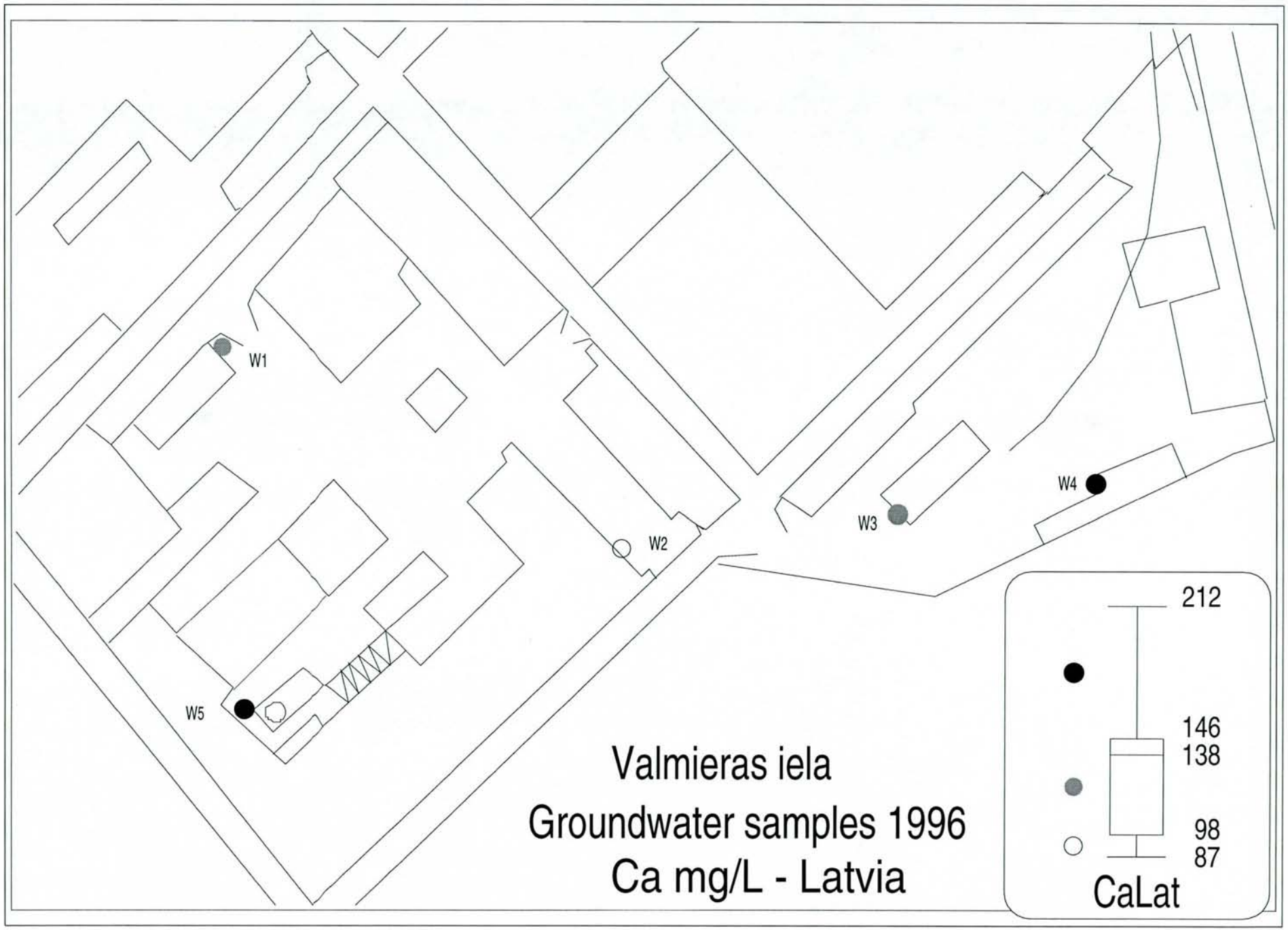
Pauvrhet av interferense med Fe

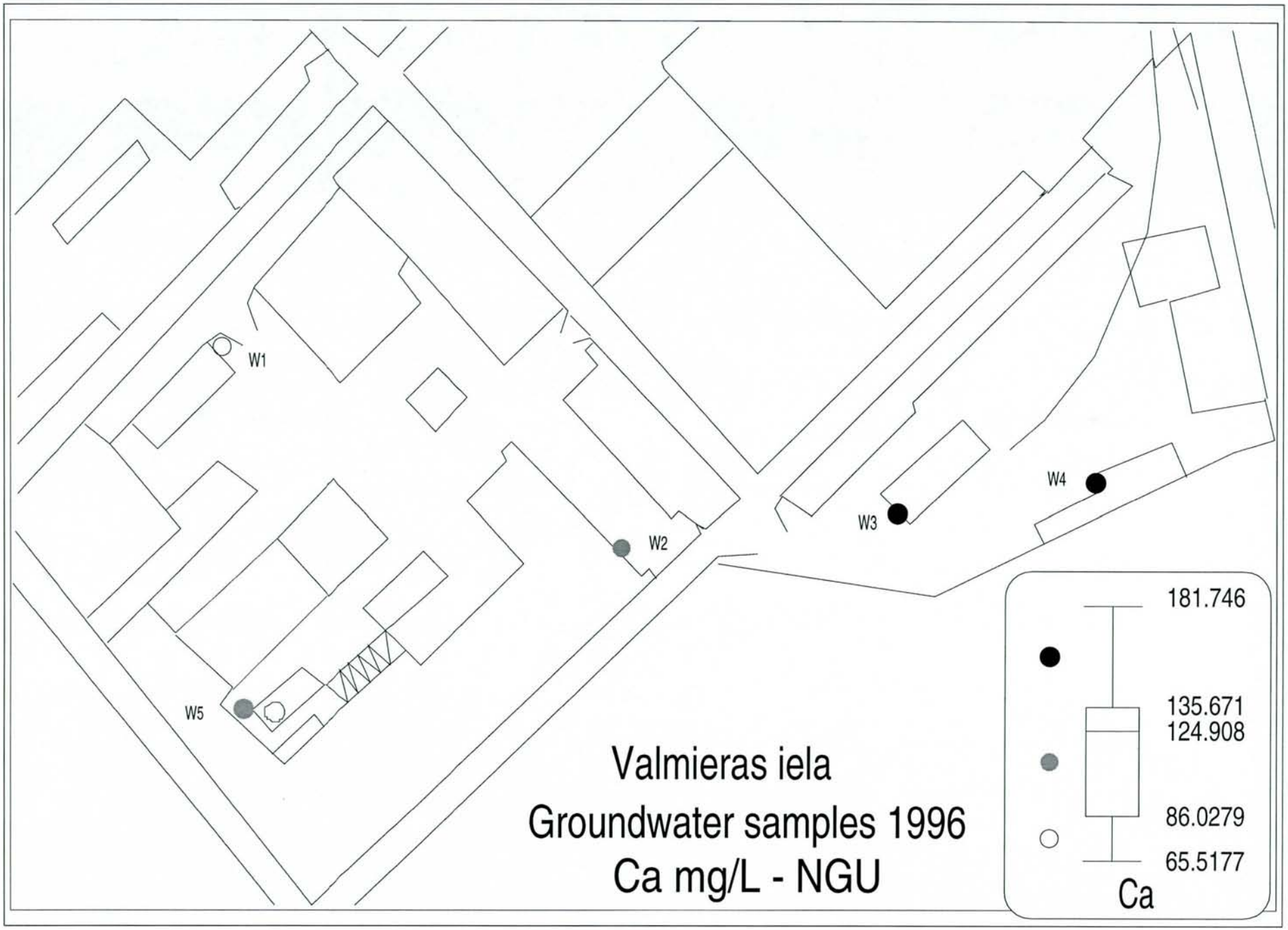


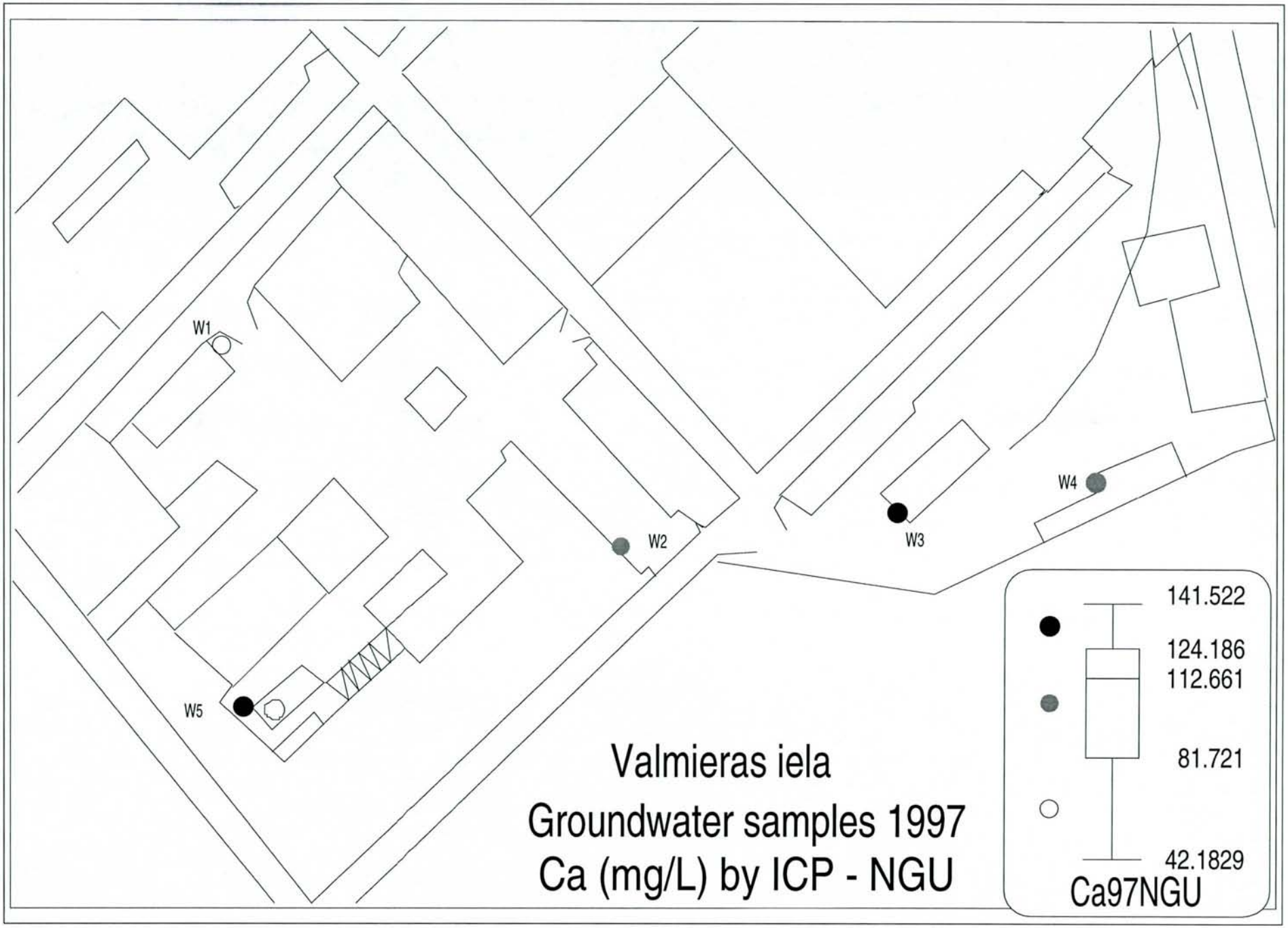
Analysene påvirket av interferense med Fe

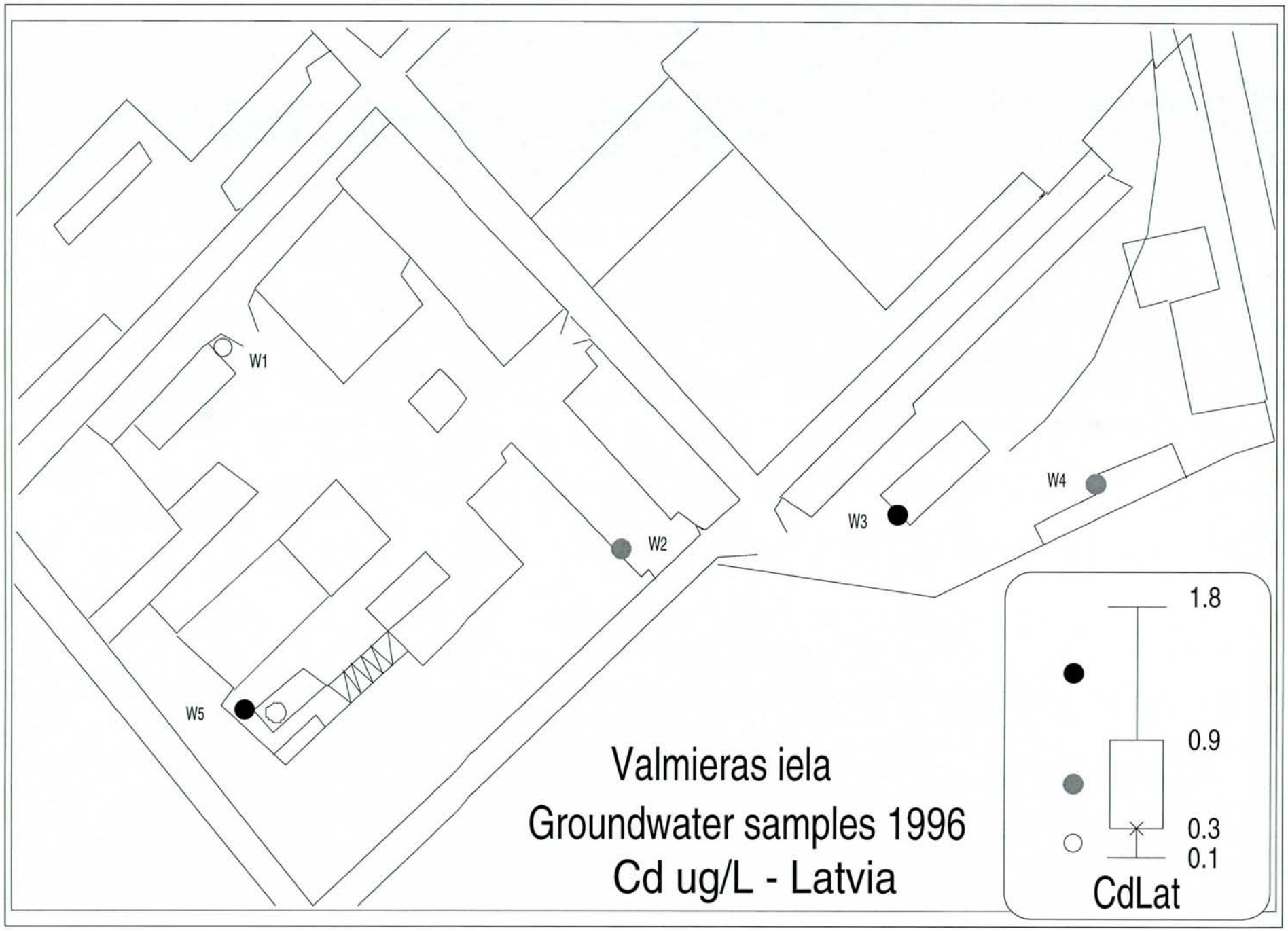

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
BOD5 mg/L O2 - Latvia
7.8
5.2
3.2
2.6
2.2
BOD5

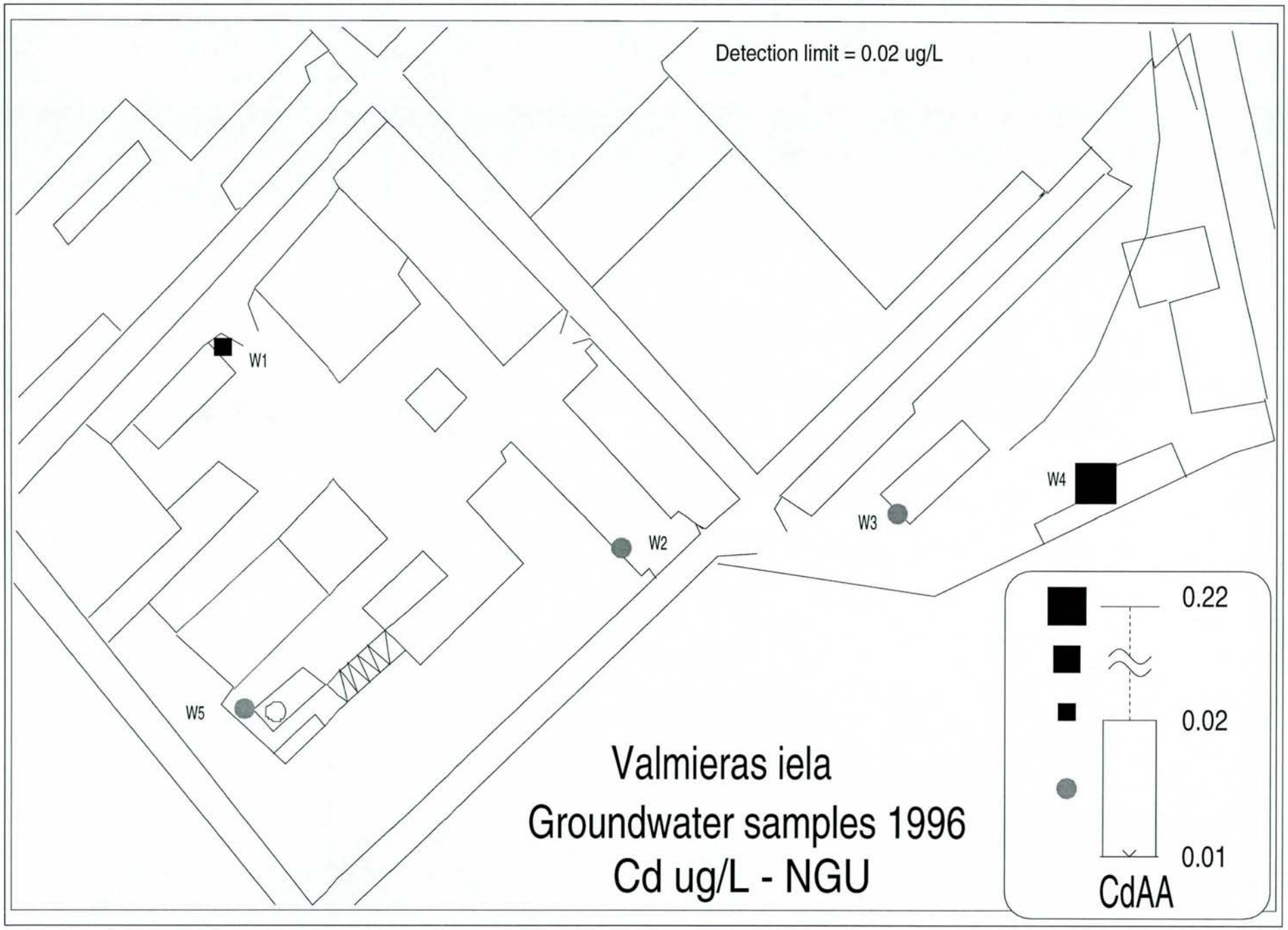

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
BOD mg/l - Lat
6.78
4.38
3.32
2.55
0.67
BOD97Lv

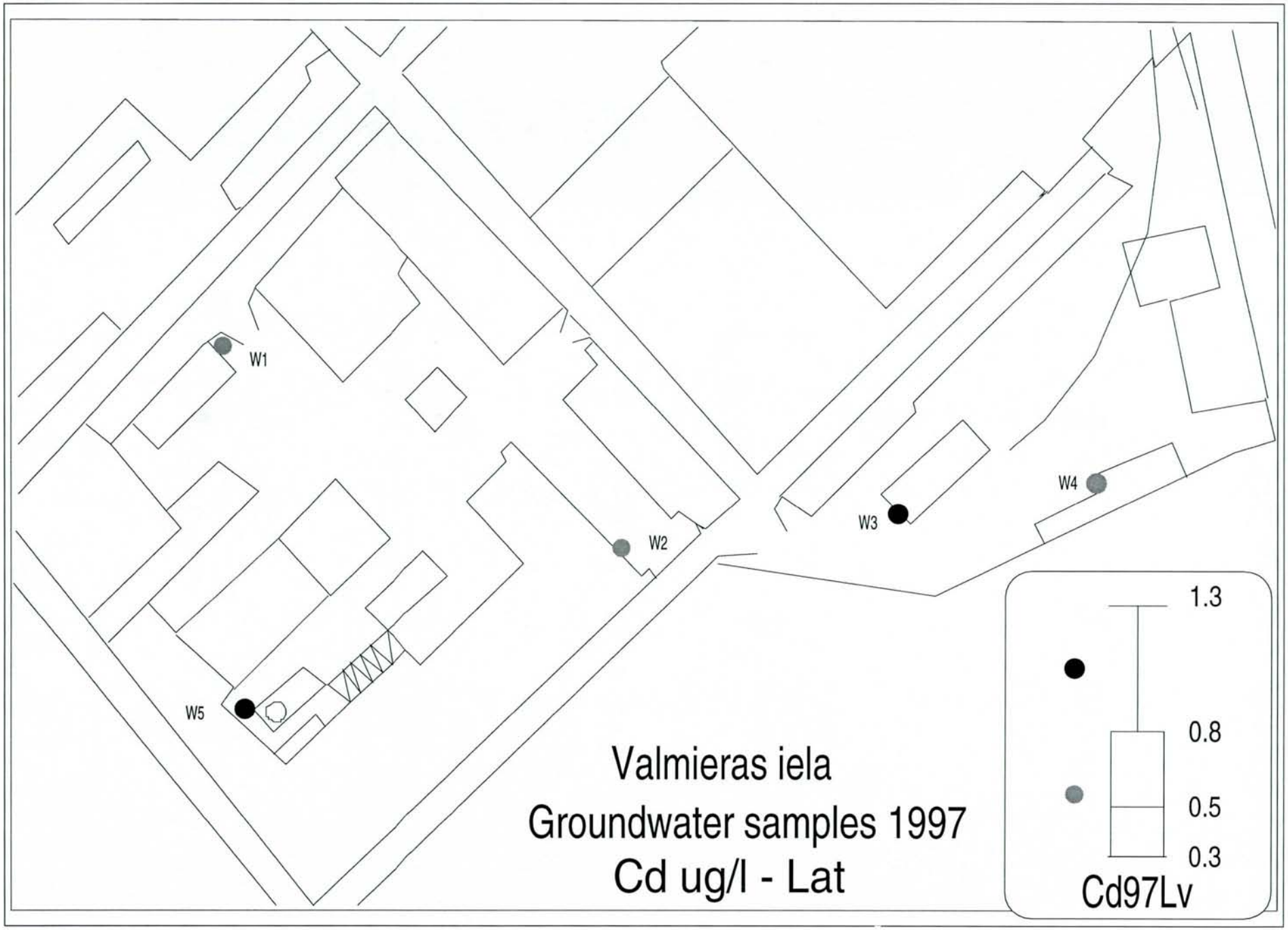

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Ca mg/L - Latvia
212
146
138
98
87
CaLat

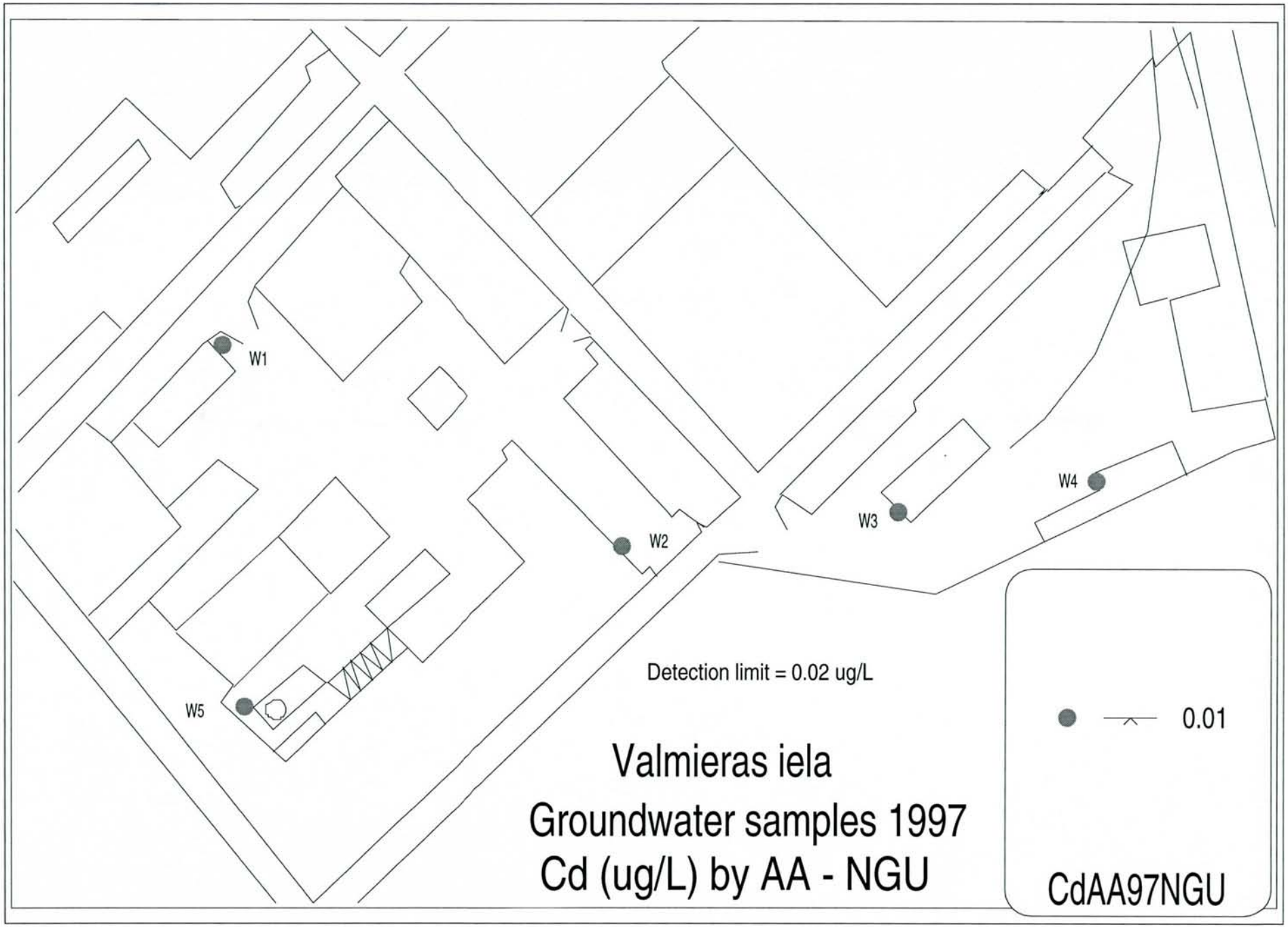

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Ca mg/L - NGU
181.746
135.671
124.908
86.0279
65.5177
Ca

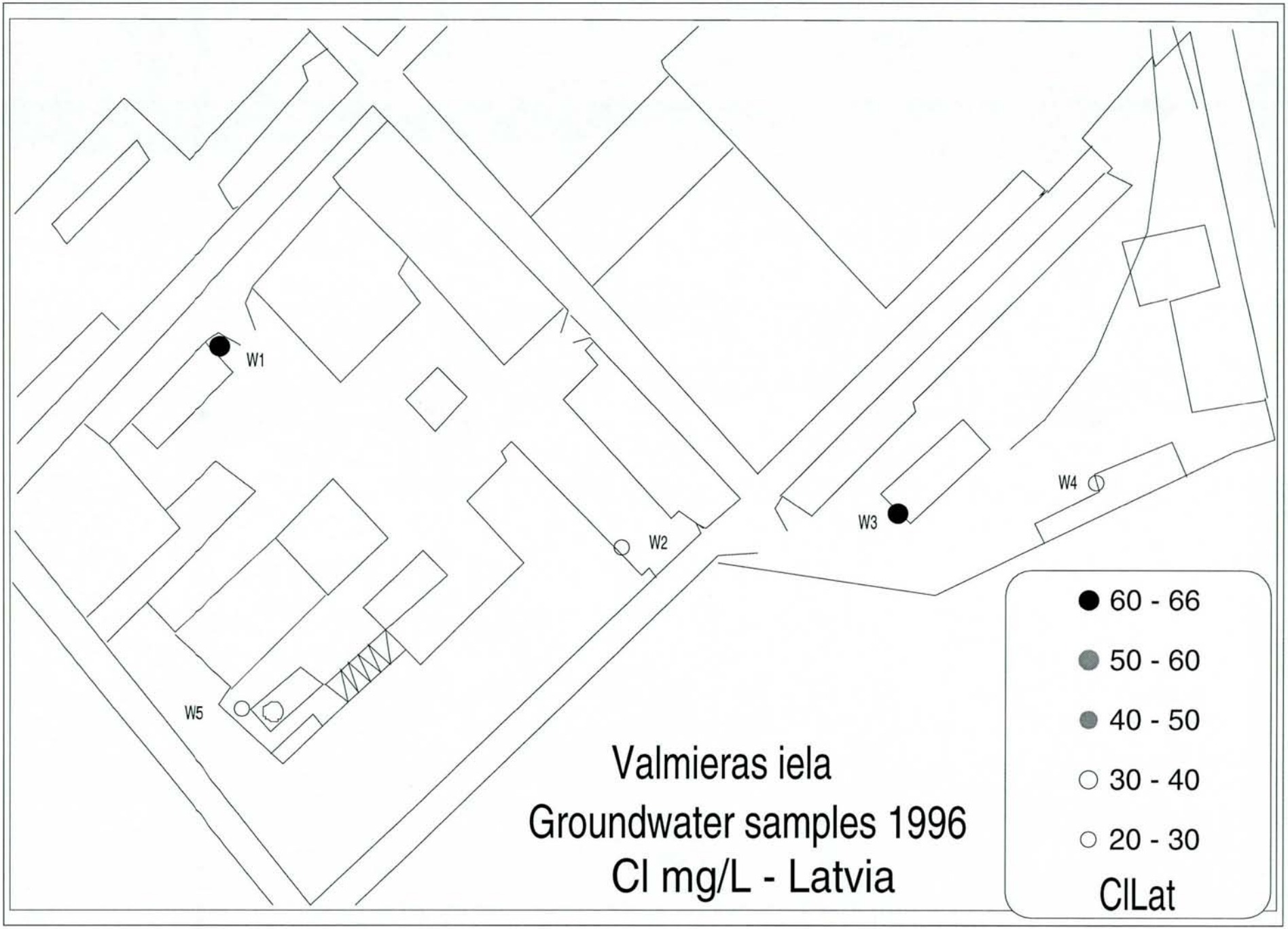

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Ca (mg/L) by ICP - NGU
141.522
124.186
112.661
81.721
42.1829
Ca97NGU

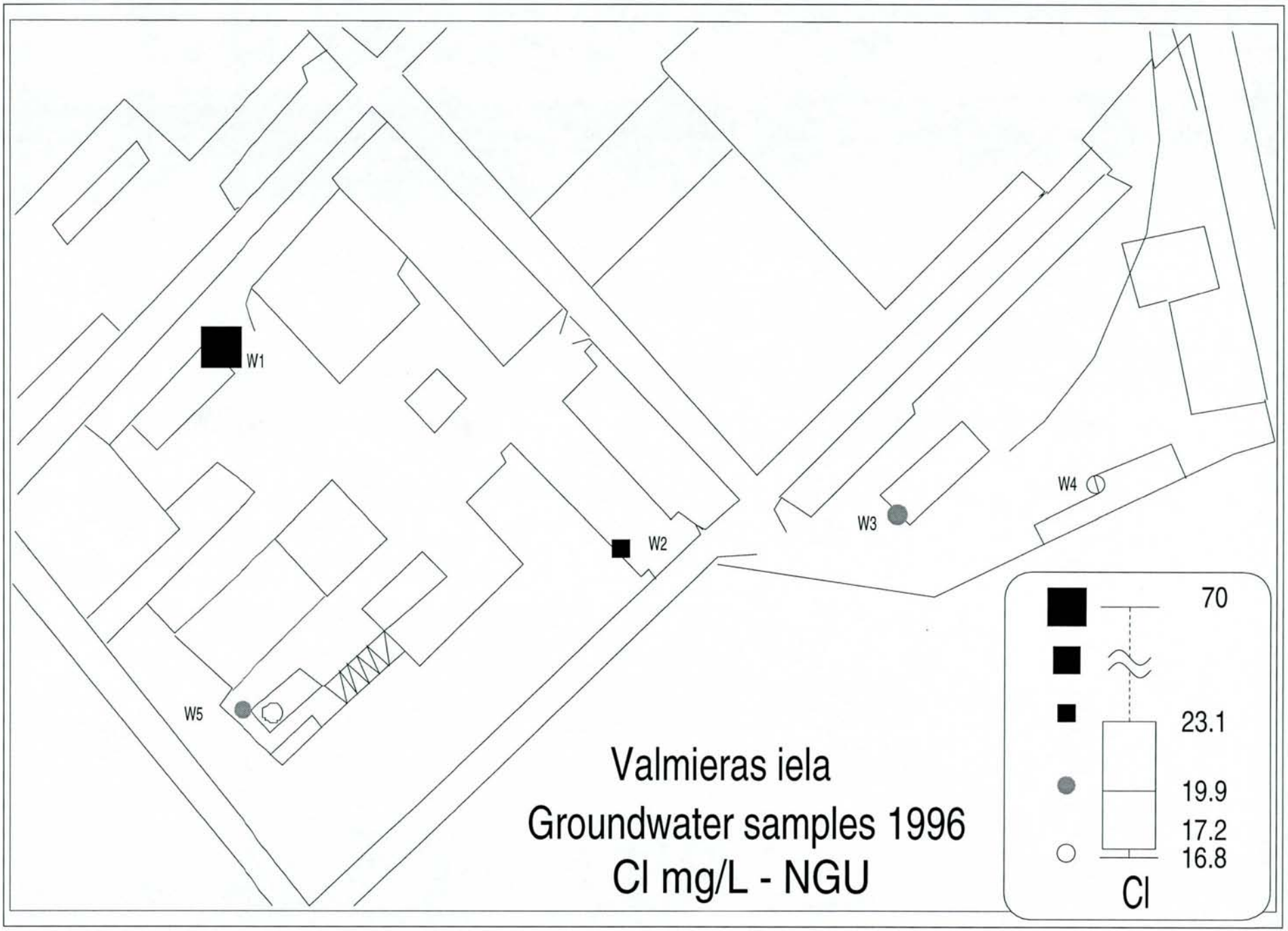

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Cd ug/L - Latvia
1.8
0.9
0.3
0.1
CdLat

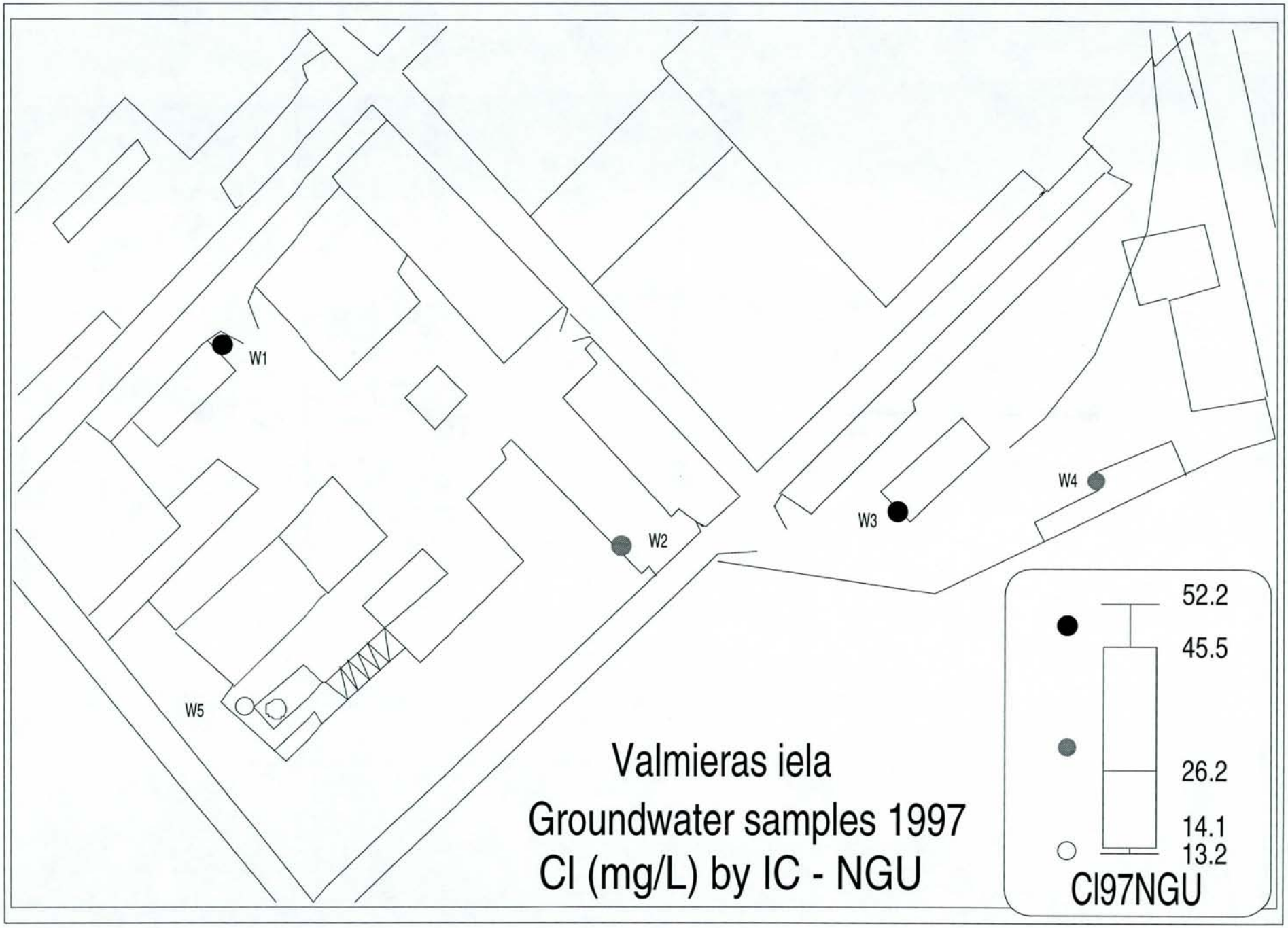

Detection limit = 0.02 ug/L
W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Cd ug/L - NGU
0.22
0.02
0.01
CdAA

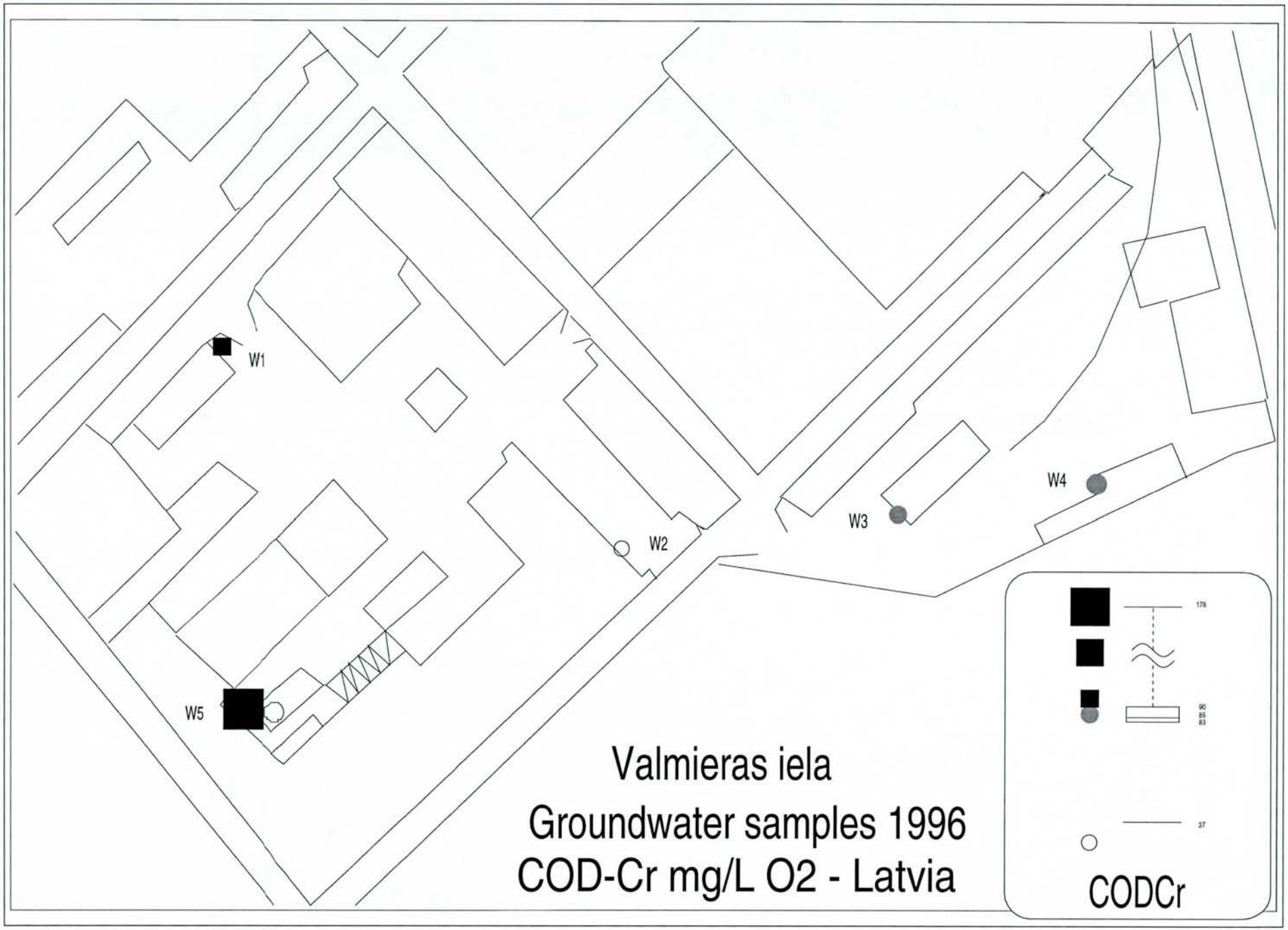

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Cd ug/l - Lat
1.3
0.8
0.5
0.3
Cd97Lv

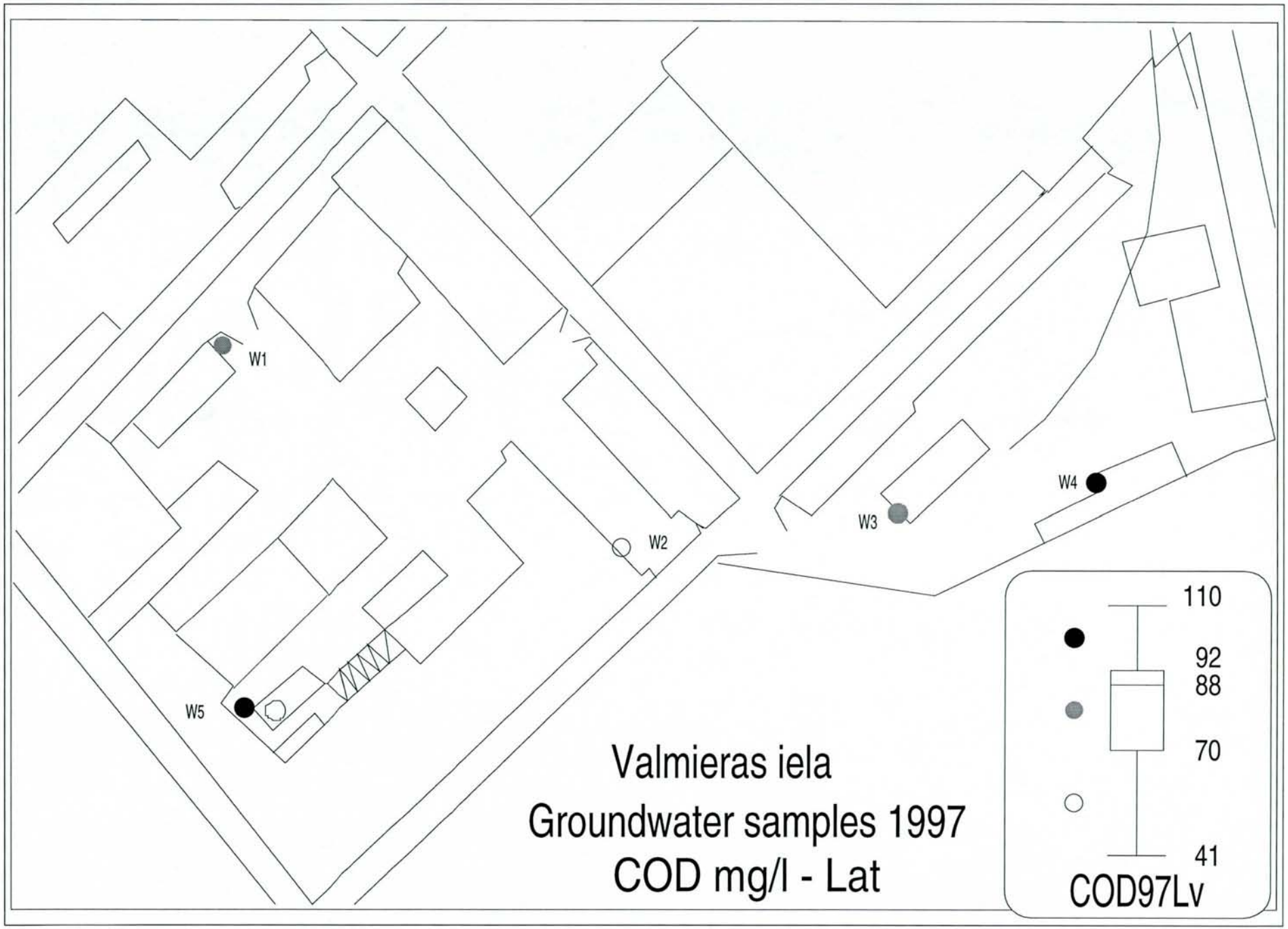

W1
W2
W3
W4
W5
Detection limit = 0.02 ug/L
0.01
Valmieras iela
Groundwater samples 1997
Cd (ug/L) by AA - NGU
CdAA97NGU

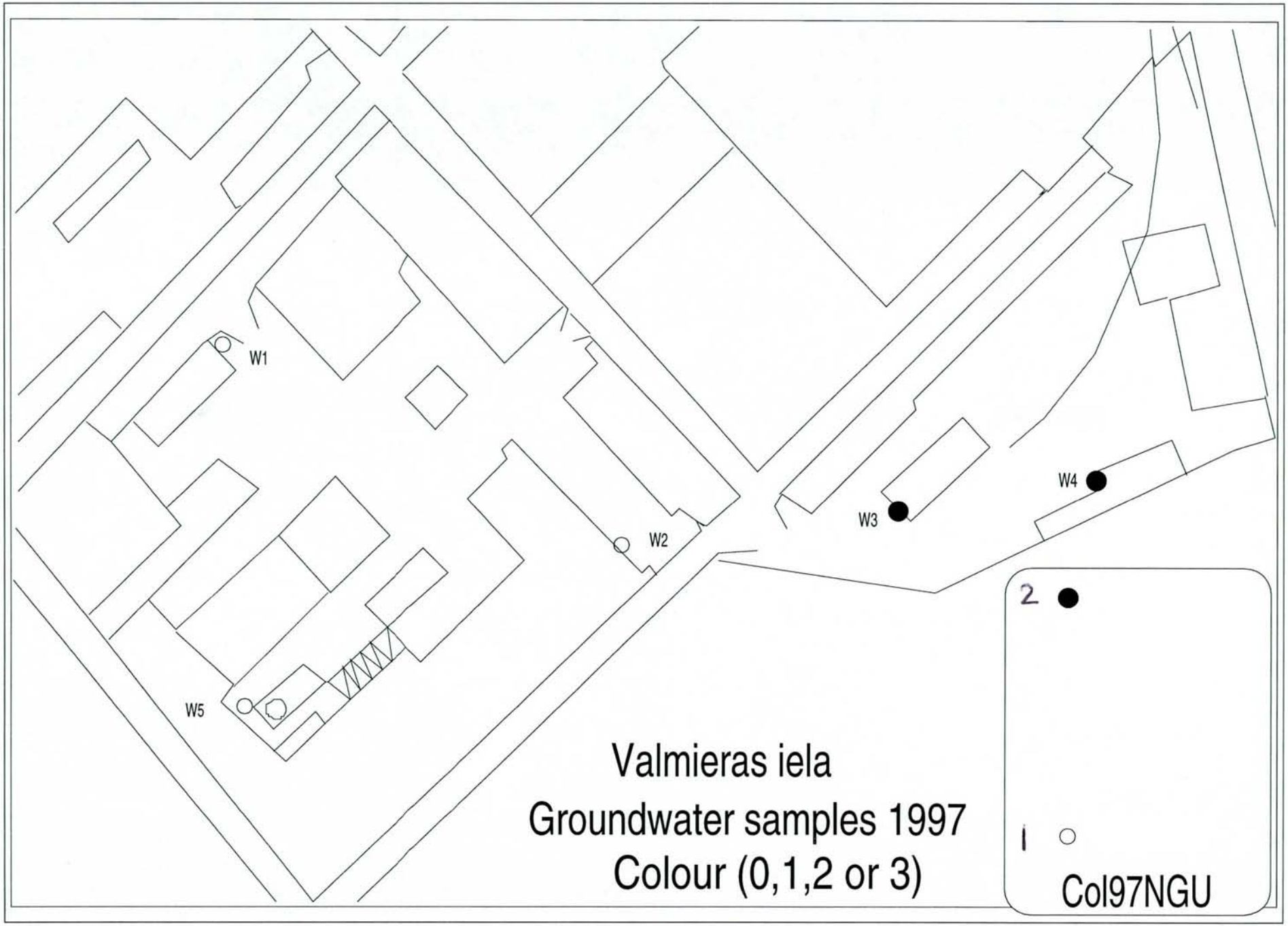

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Cl mg/L - Latvia
60 - 66
50 - 60
40 - 50
30 - 40
20 - 30
ClLat

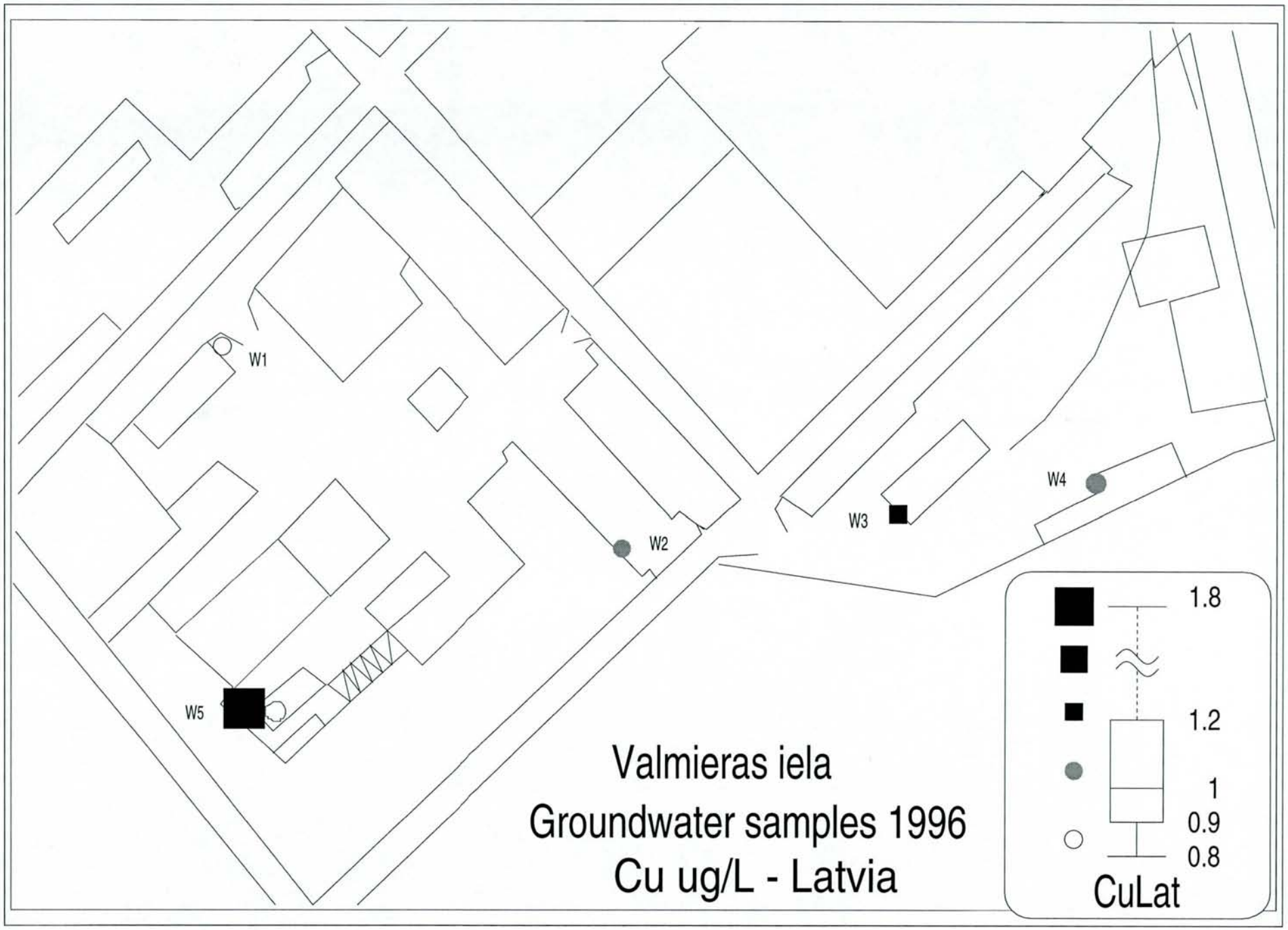

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Cl mg/L - NGU
70
23.1
19.9
17.2
16.8
Cl

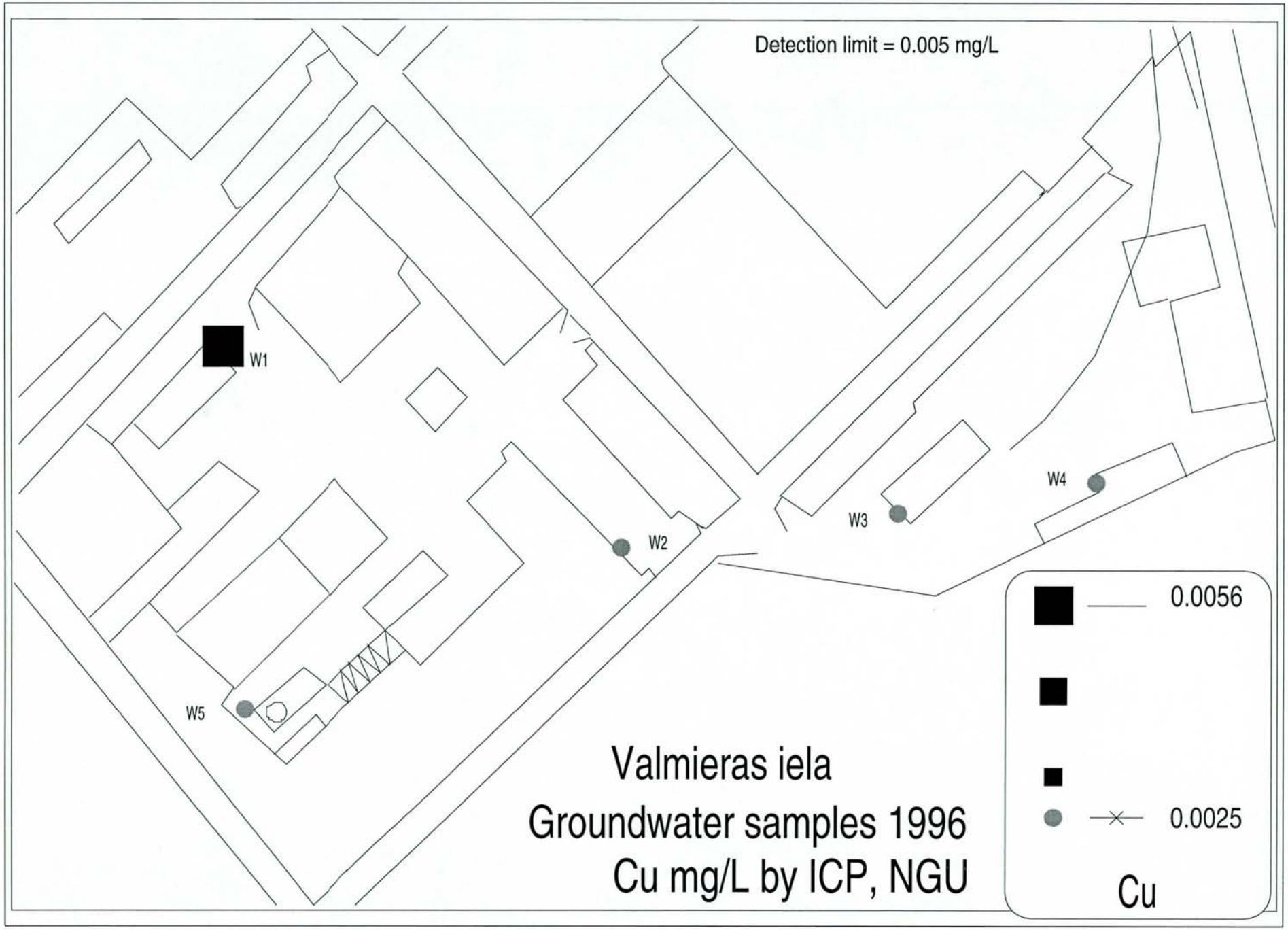

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Cl (mg/L) by IC - NGU
52.2
45.5
26.2
14.1
13.2
Cl97NGU

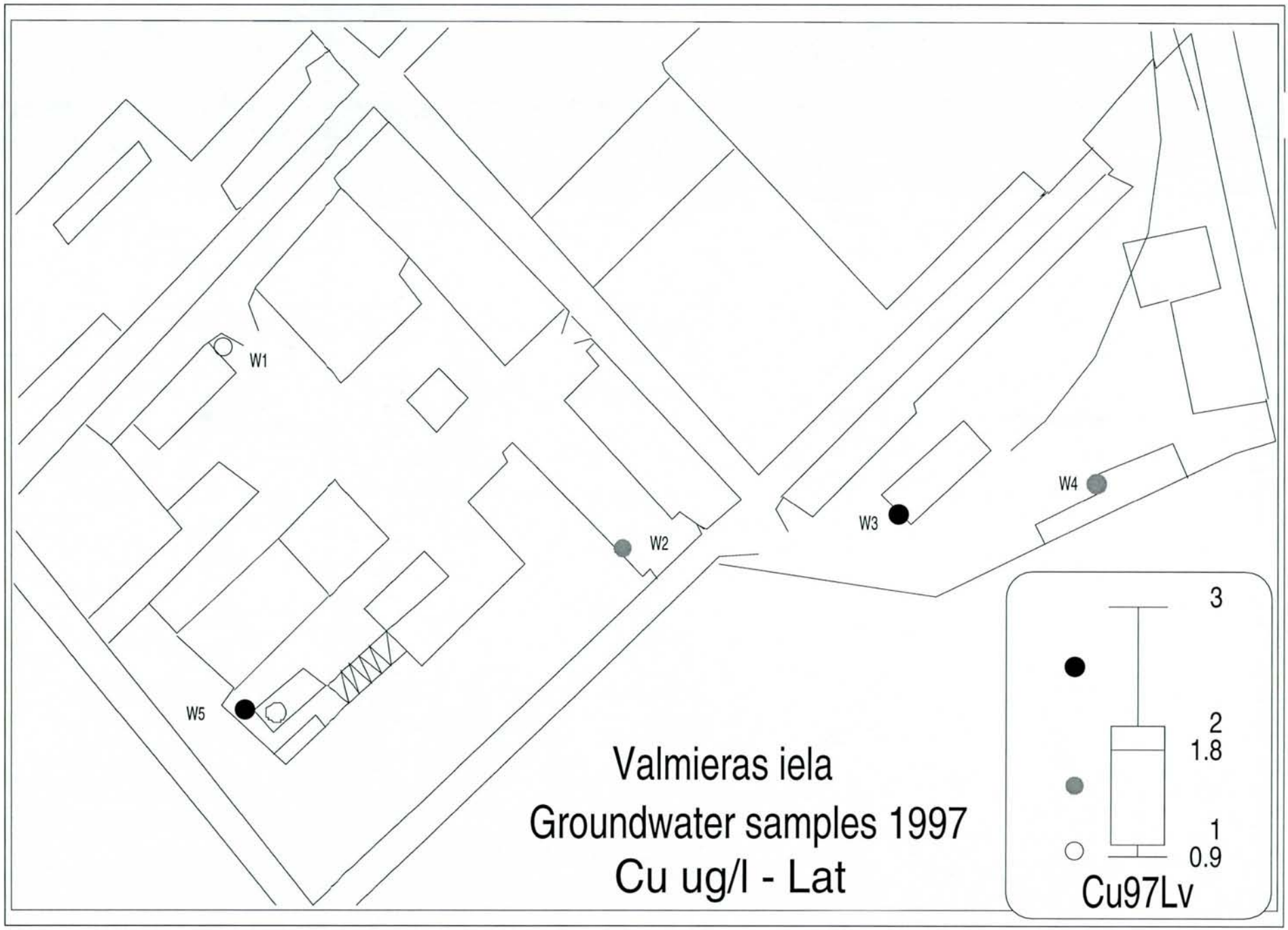

W1
W2
W3
W4
W5
178
90
85
83
37
CODCr
Valmieras iela
Groundwater samples 1996
COD-Cr mg/L O2 - Latvia

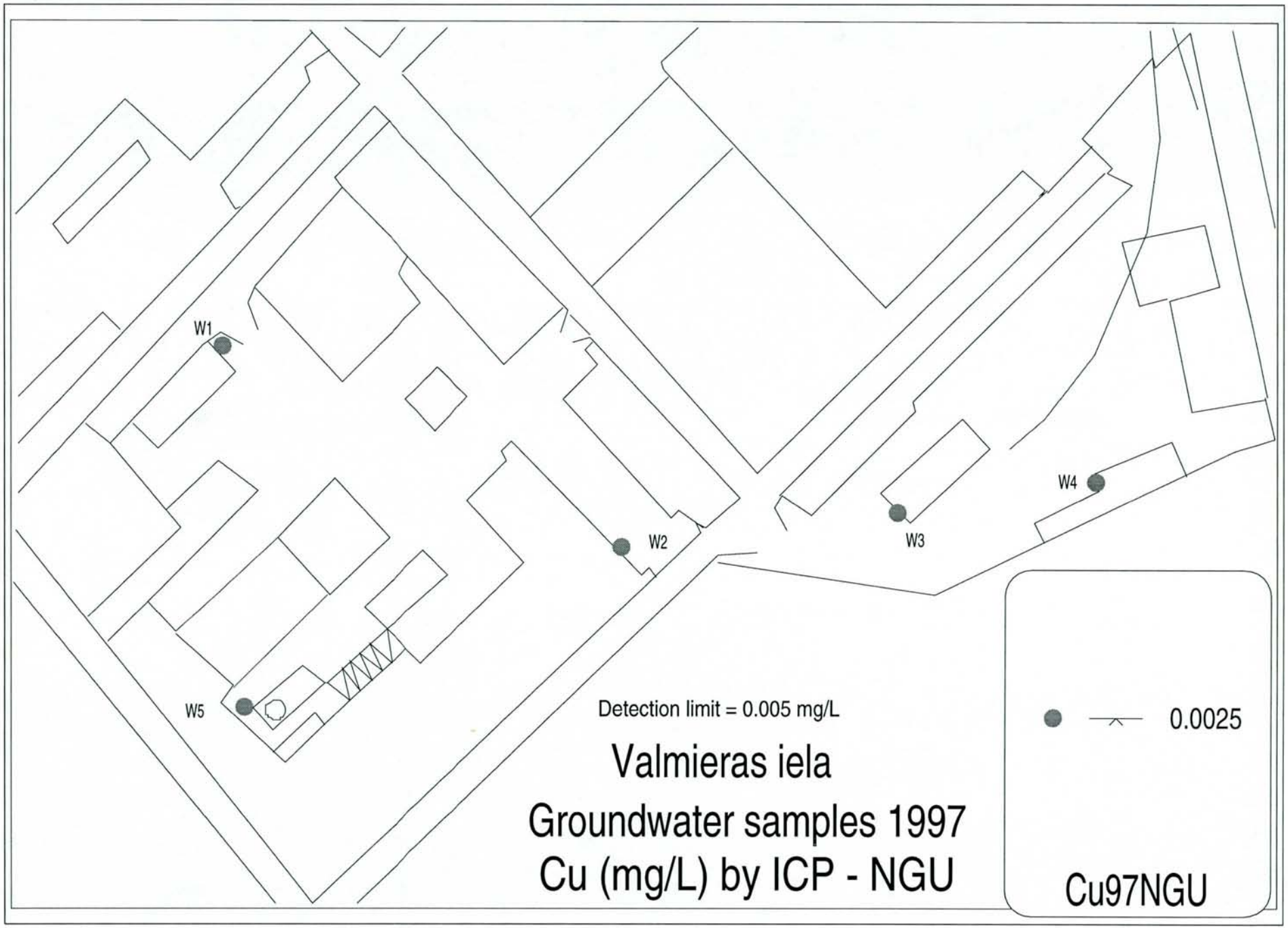

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
COD mg/l - Lat
110
92
88
70
41
COD97Lv

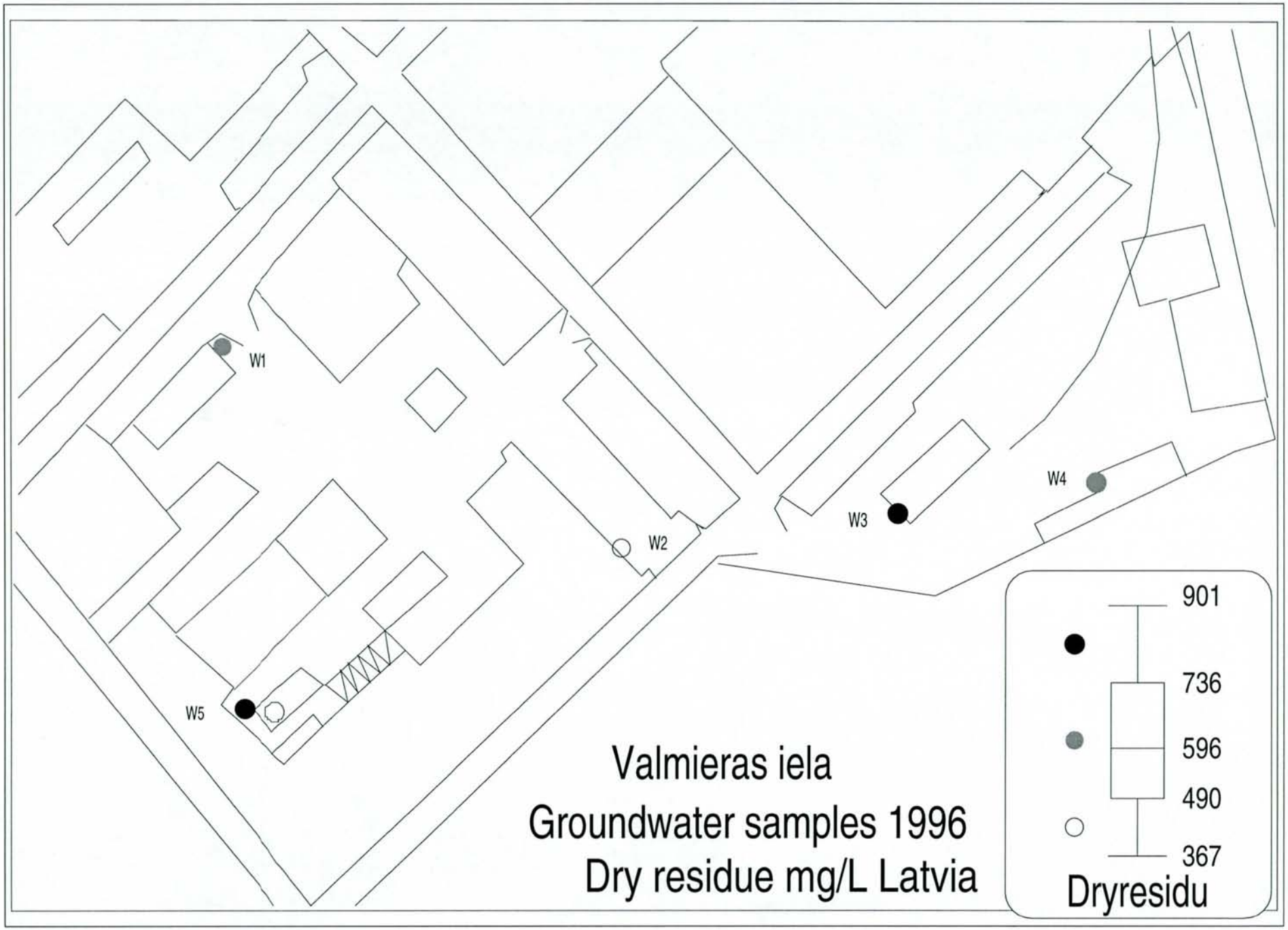

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Colour (0,1,2 or 3)
2
1
Col97NGU

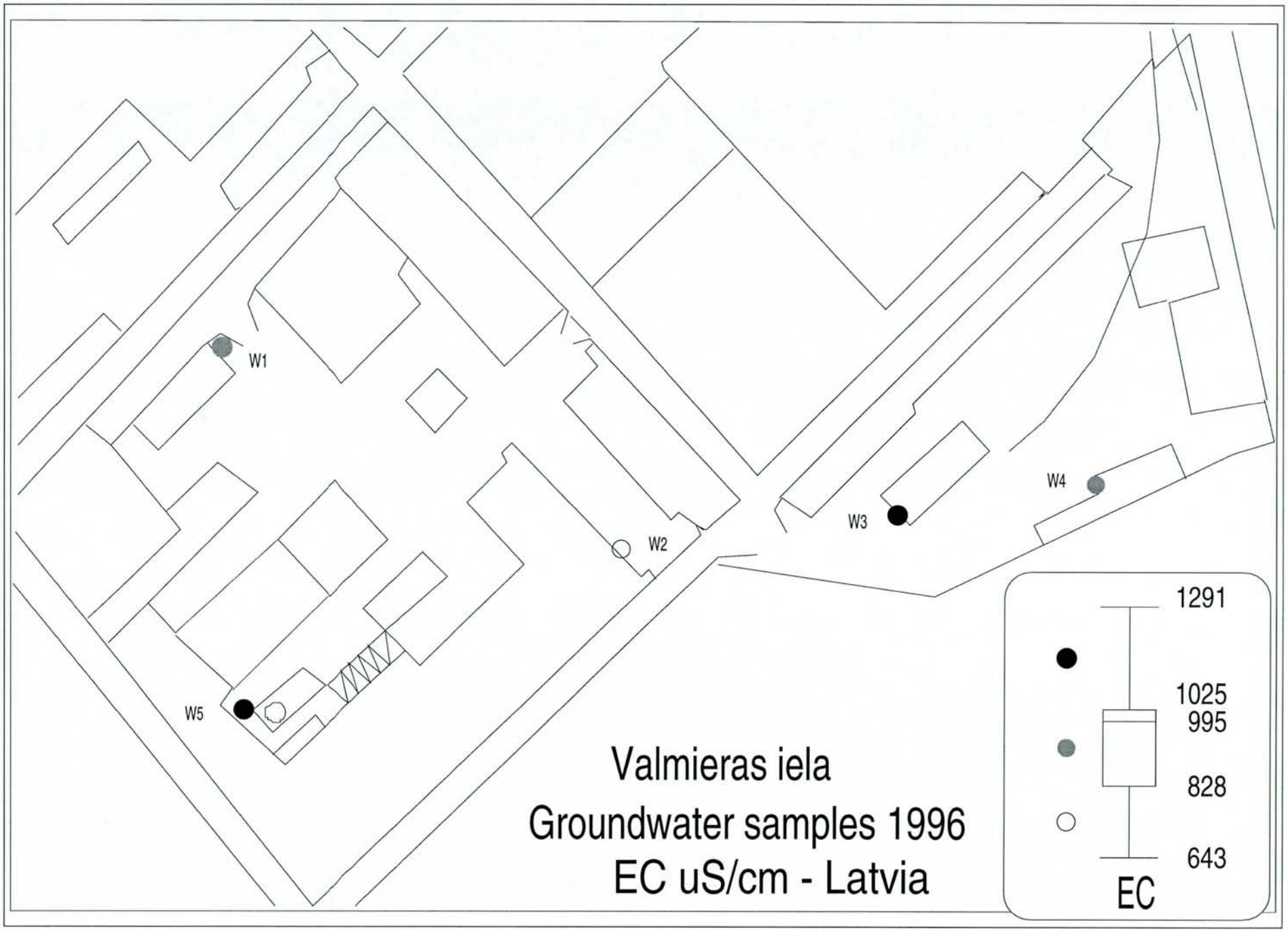

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Cu ug/L - Latvia
1.8
1.2
1
0.9
0.8
CuLat

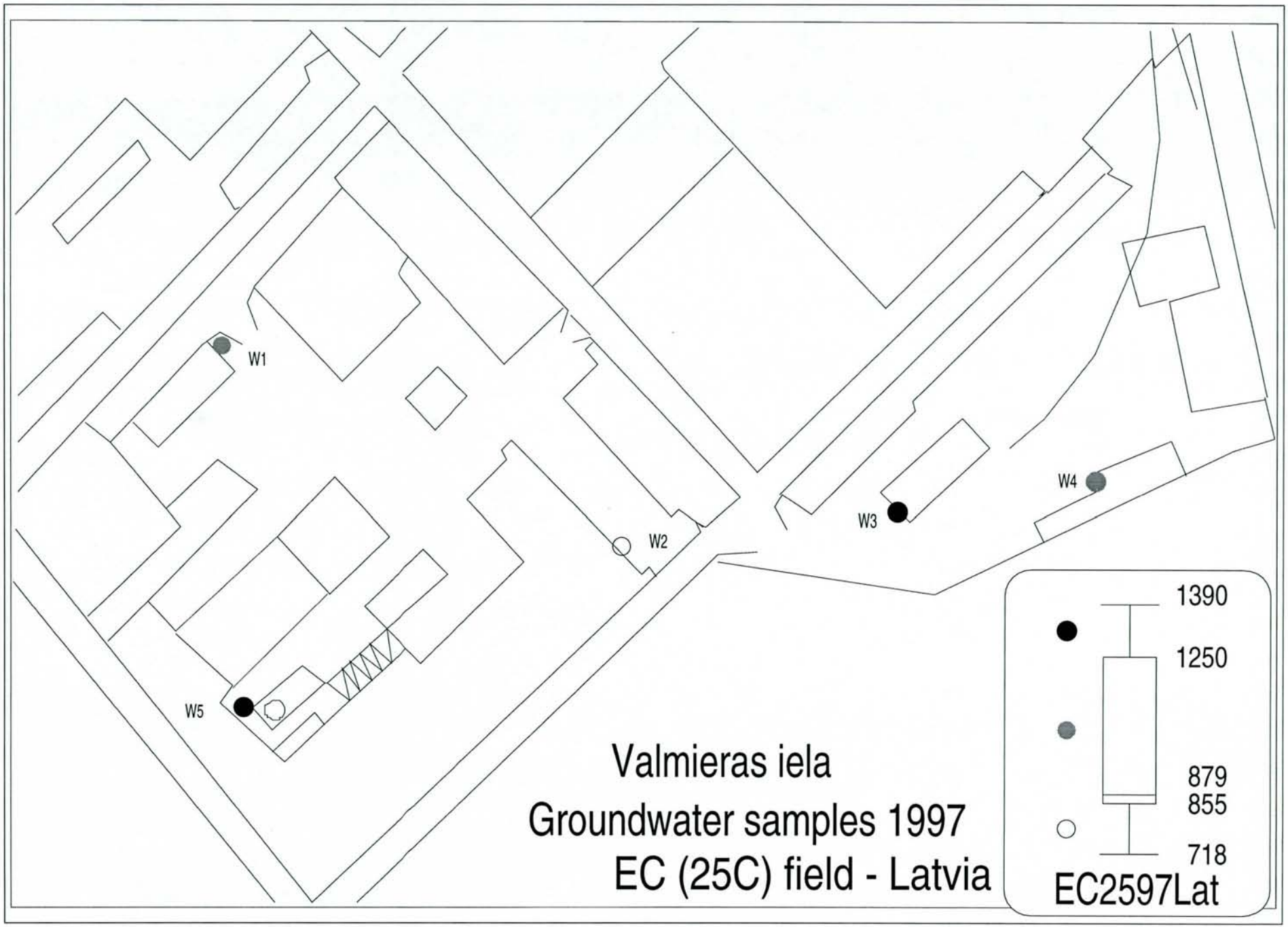

Detection limit = 0.005 mg/L
W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Cu mg/L by ICP, NGU
0.0056
0.0025
Cu

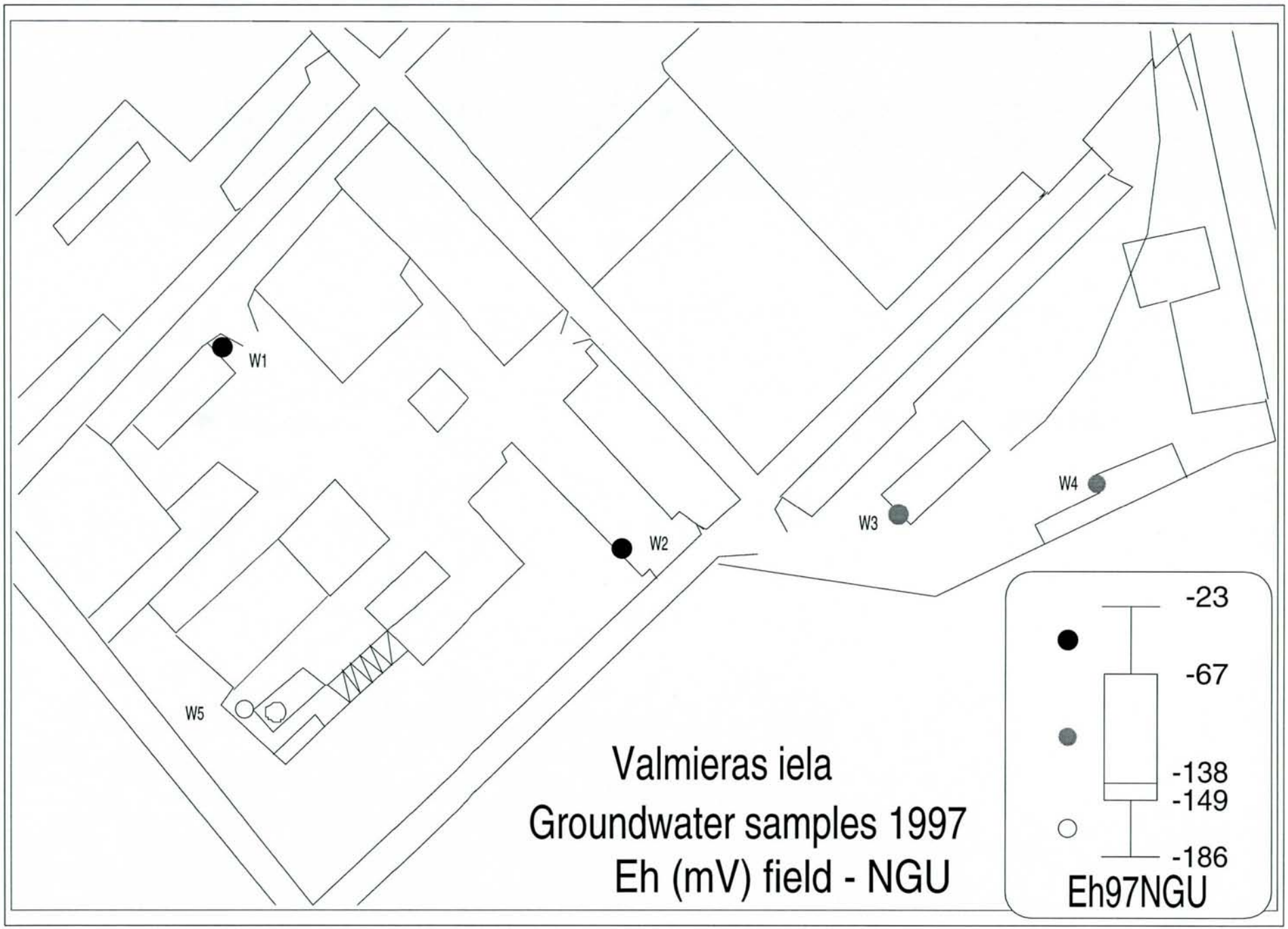

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Cu ug/l - Lat
3
2
1.8
1
0.9
Cu97Lv

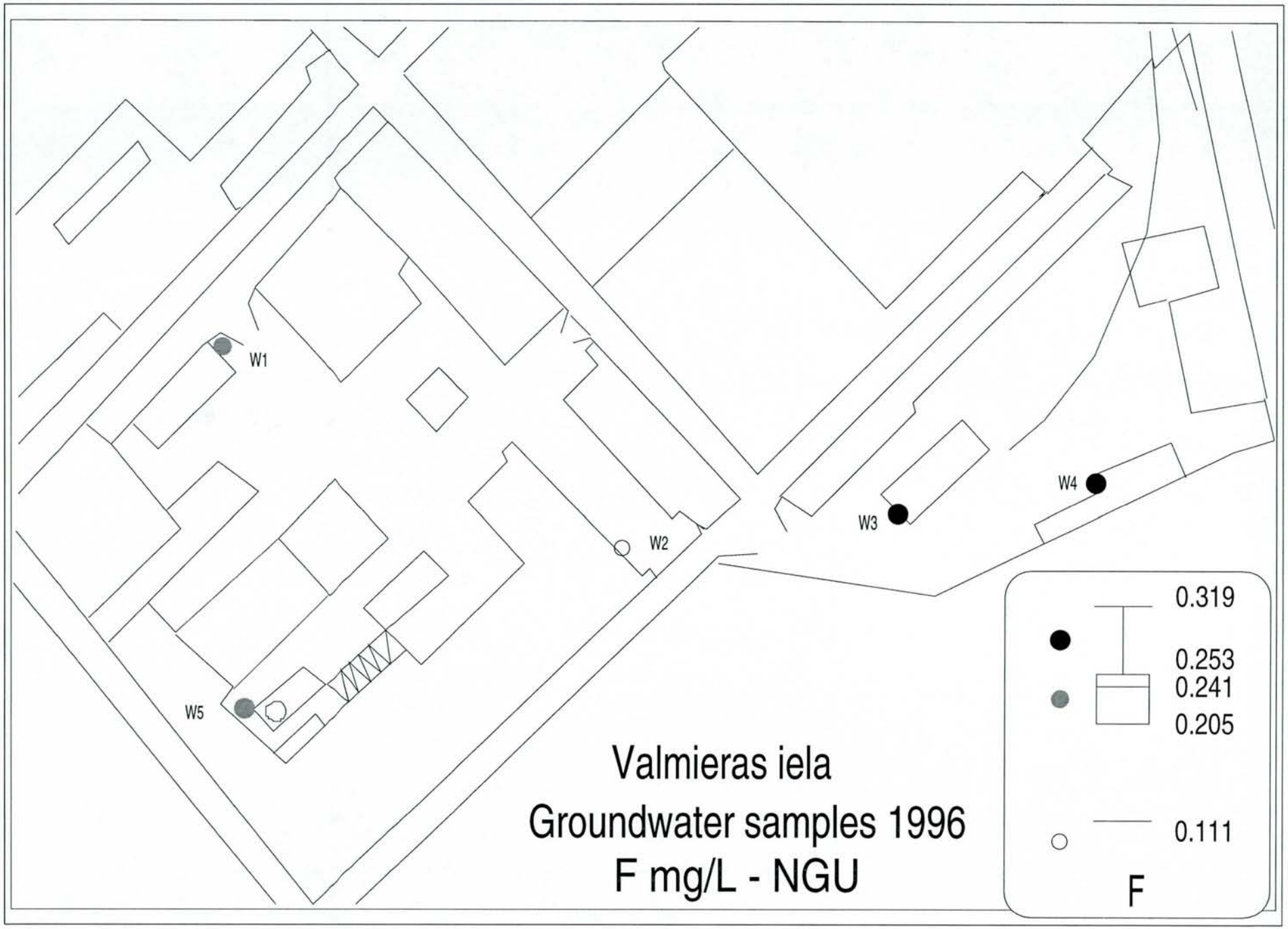

W1
W2
W3
W4
W5
Detection limit = 0.005 mg/L
Valmieras iela
Groundwater samples 1997
Cu (mg/L) by ICP - NGU
0.0025
Cu97NGU

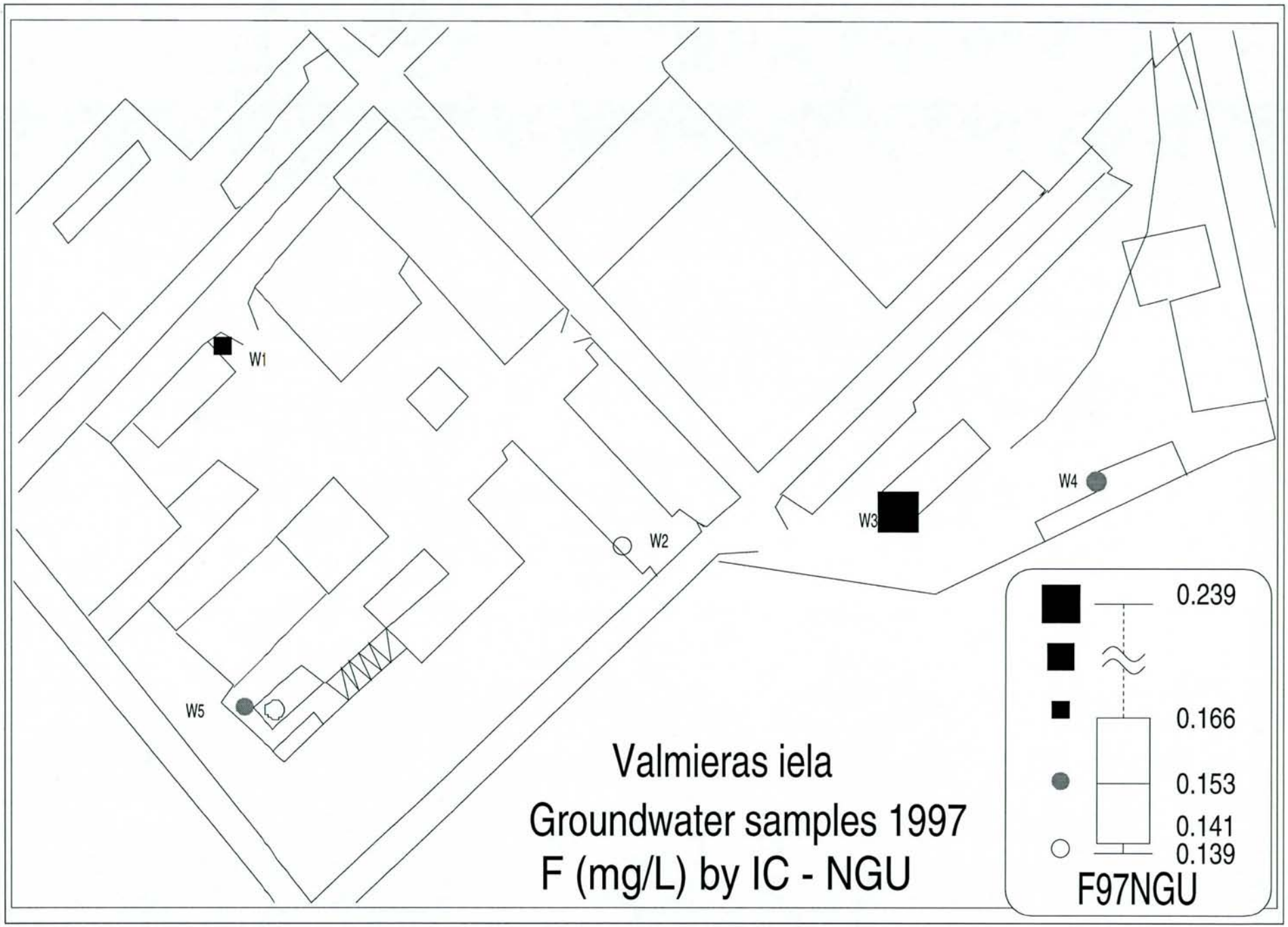

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Dry residue mg/L Latvia
901
736
596
490
367
Dryresidu

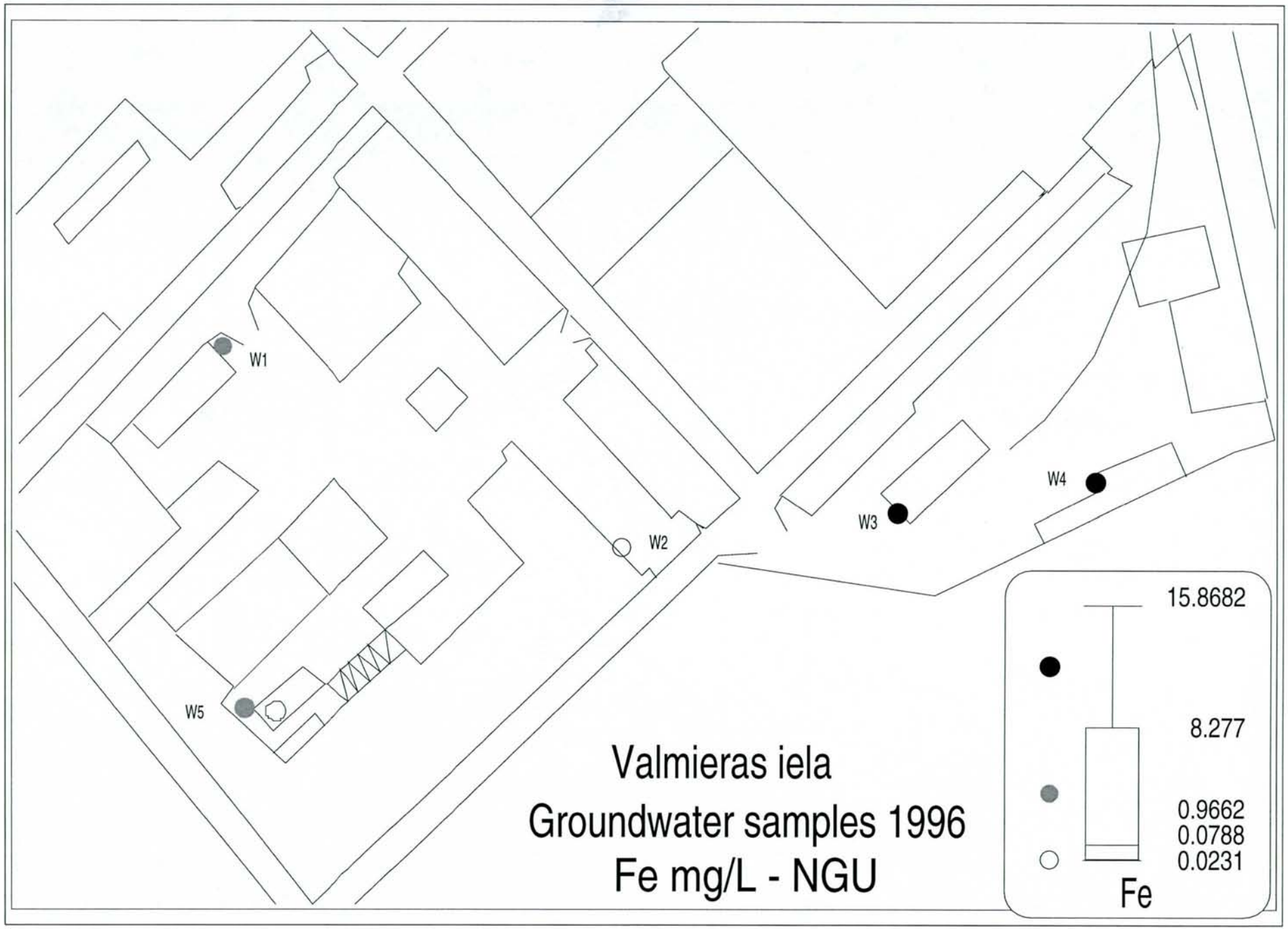

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
EC uS/cm - Latvia
1291
1025
995
828
643
EC

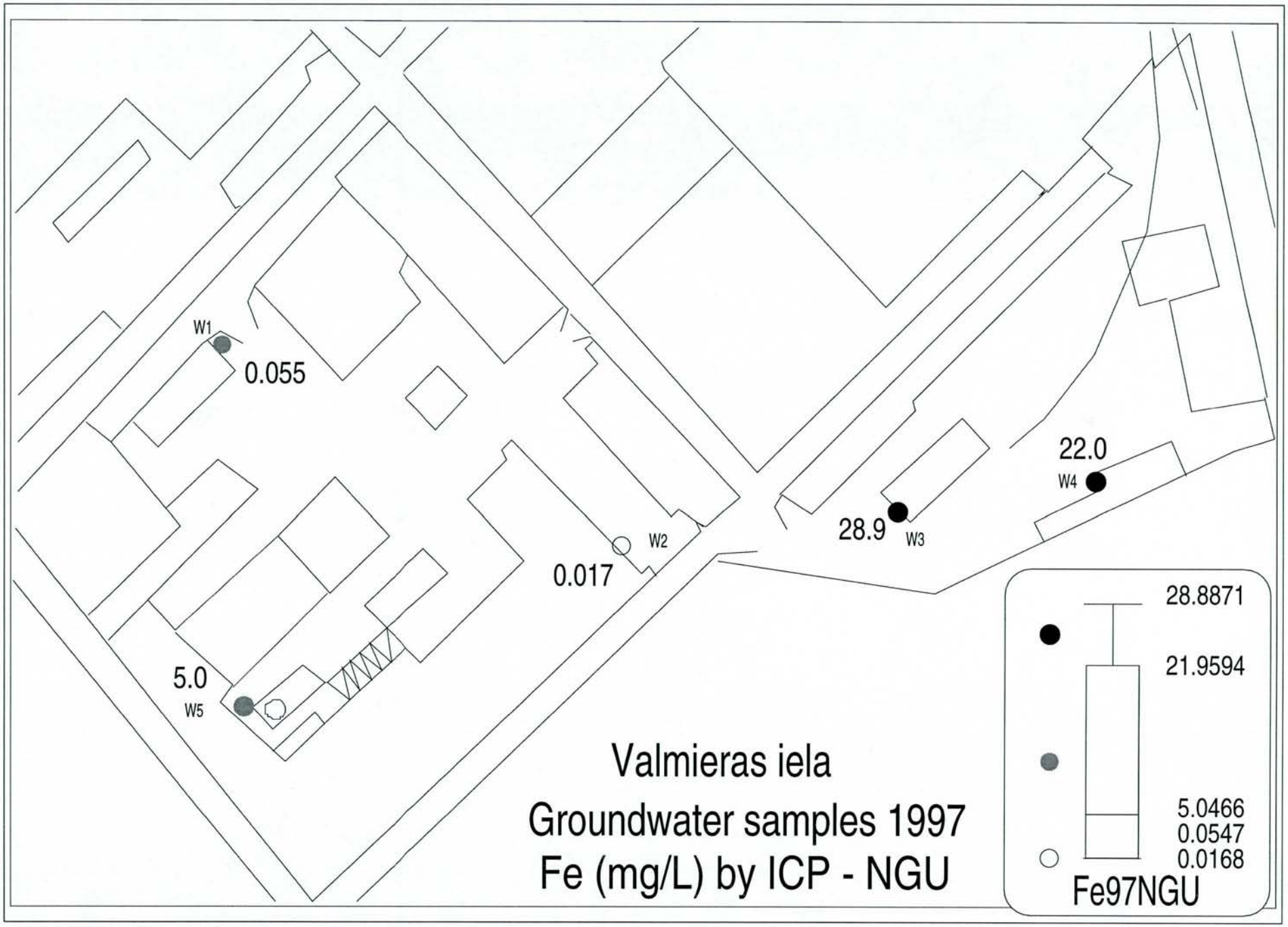

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
EC (25C) field - Latvia
1390
1250
879
855
718
EC2597Lat

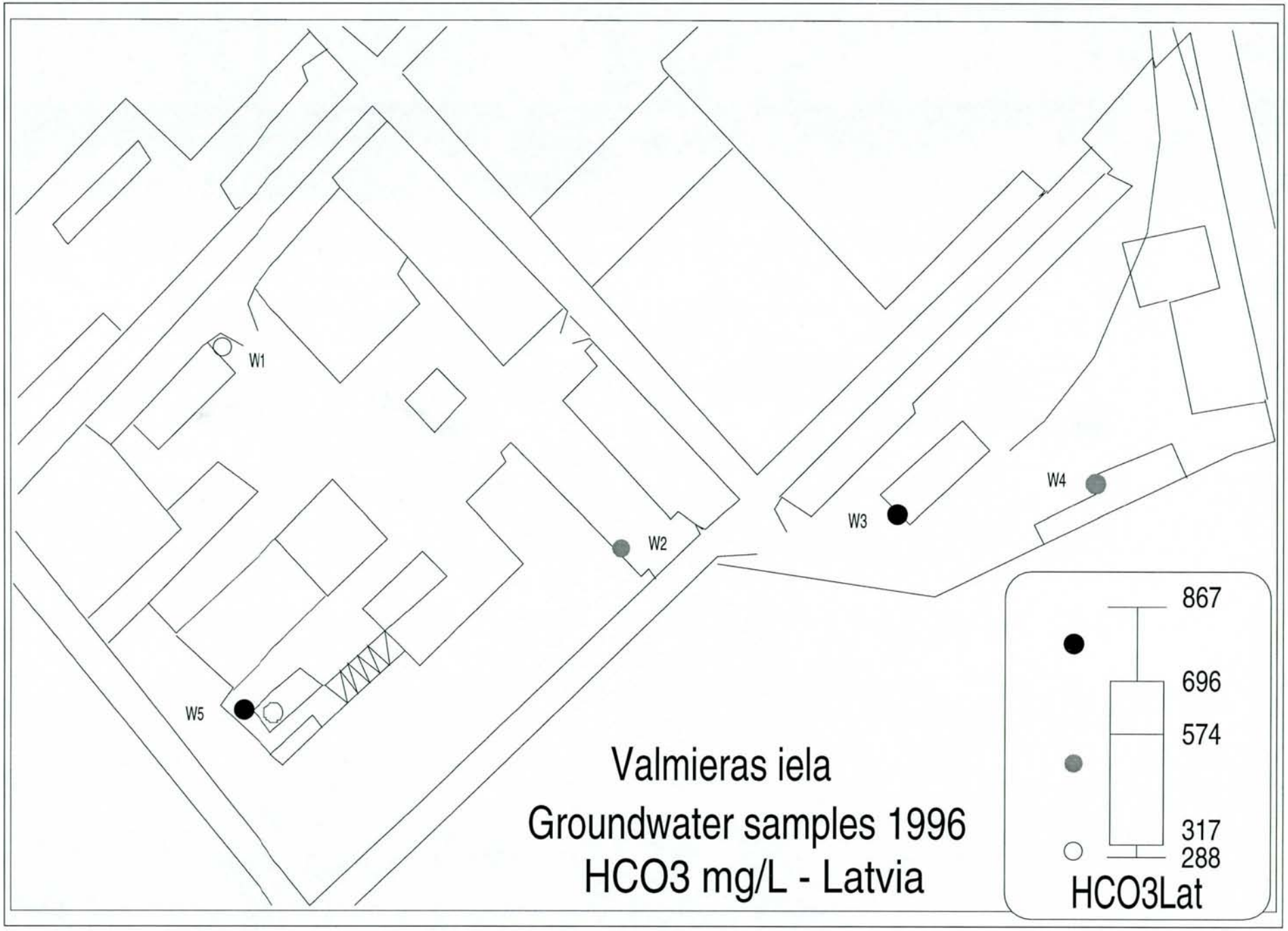

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Eh (mV) field - NGU
-23
-67
-138
-149
-186
Eh97NGU

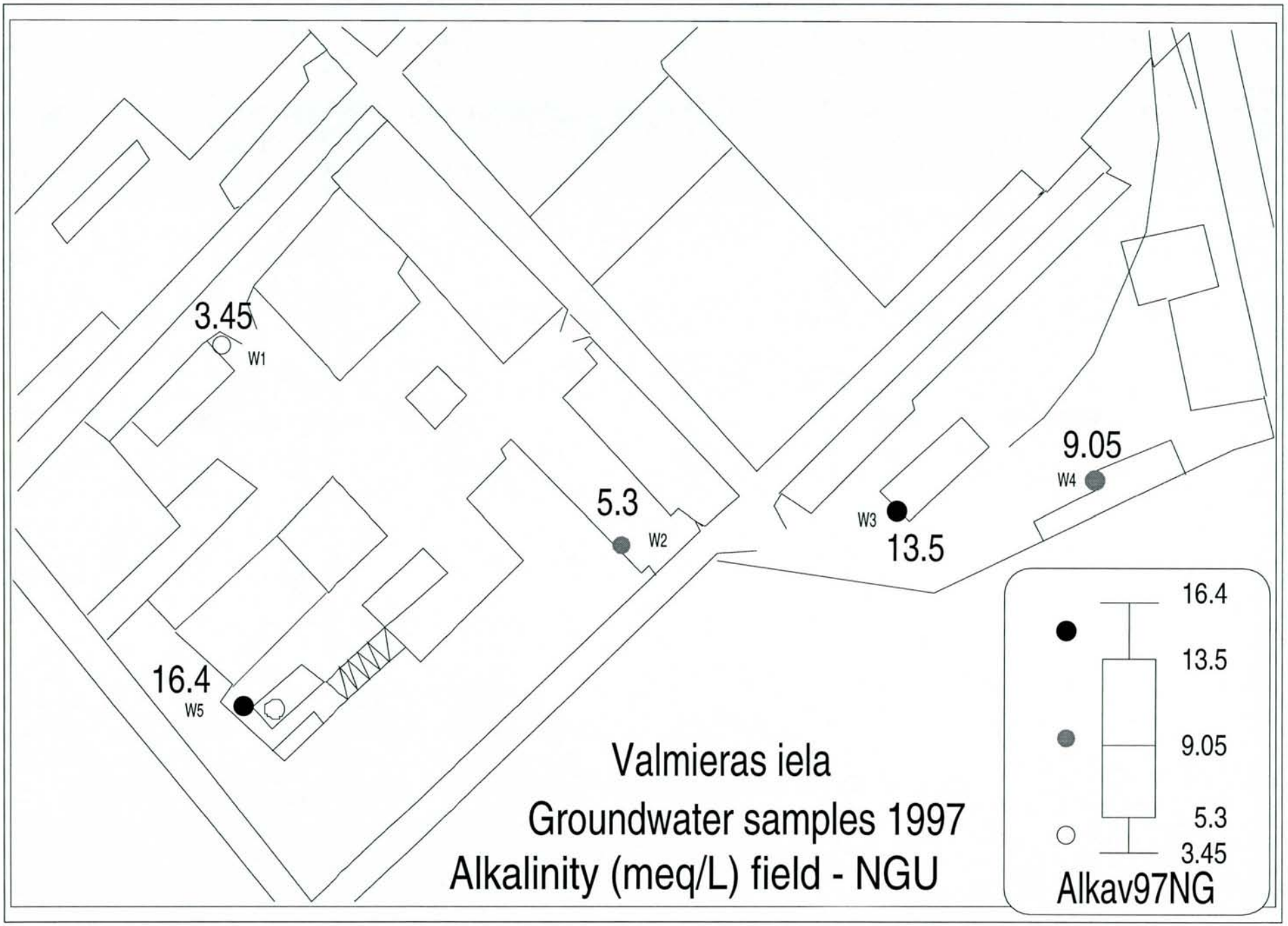

W1
W2
W3
W4
W5
0.319
0.253
0.241
0.205
0.111
F
Valmieras iela
Groundwater samples 1996
F mg/L - NGU

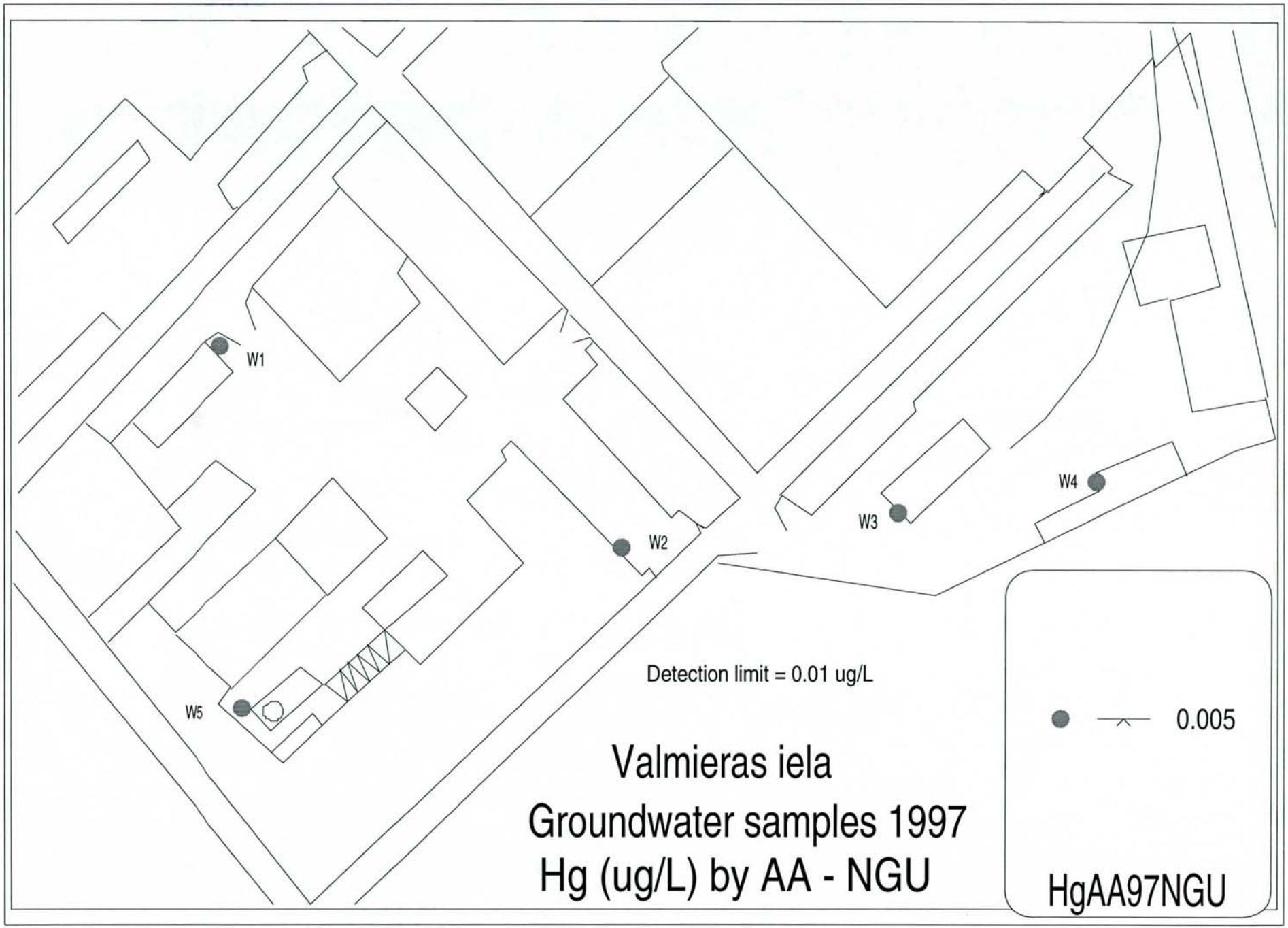

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
F (mg/L) by IC - NGU
0.239
0.166
0.153
0.141
0.139
F97NGU

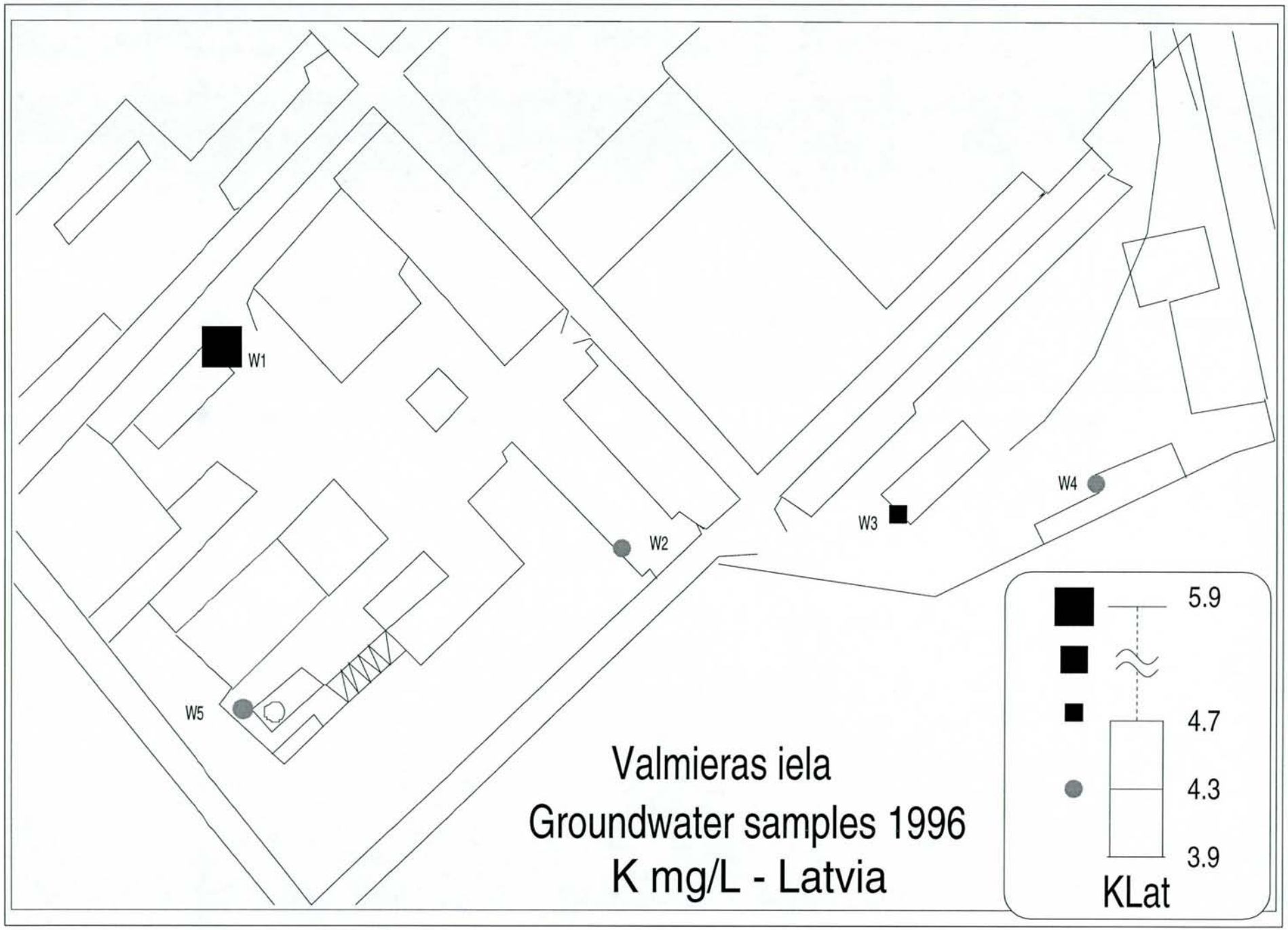

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Fe mg/L - NGU
15.8682
8.277
0.9662
0.0788
0.0231
Fe

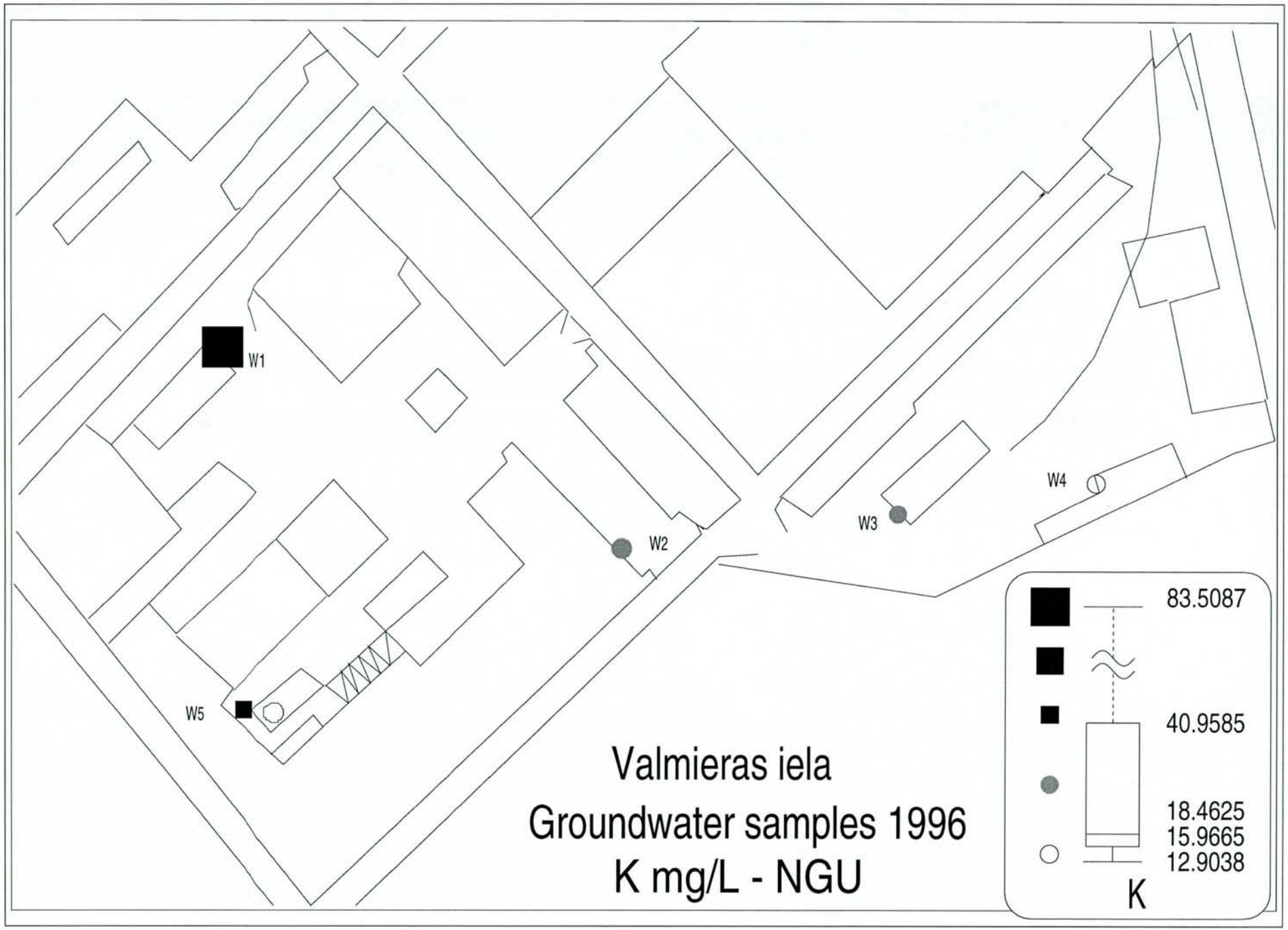

W1
0.055
W2
0.017
28.9
W3
22.0
W4
5.0
W5
Valmieras iela
Groundwater samples 1997
Fe (mg/L) by ICP - NGU
28.8871
21.9594
5.0466
0.0547
0.0168
Fe97NGU

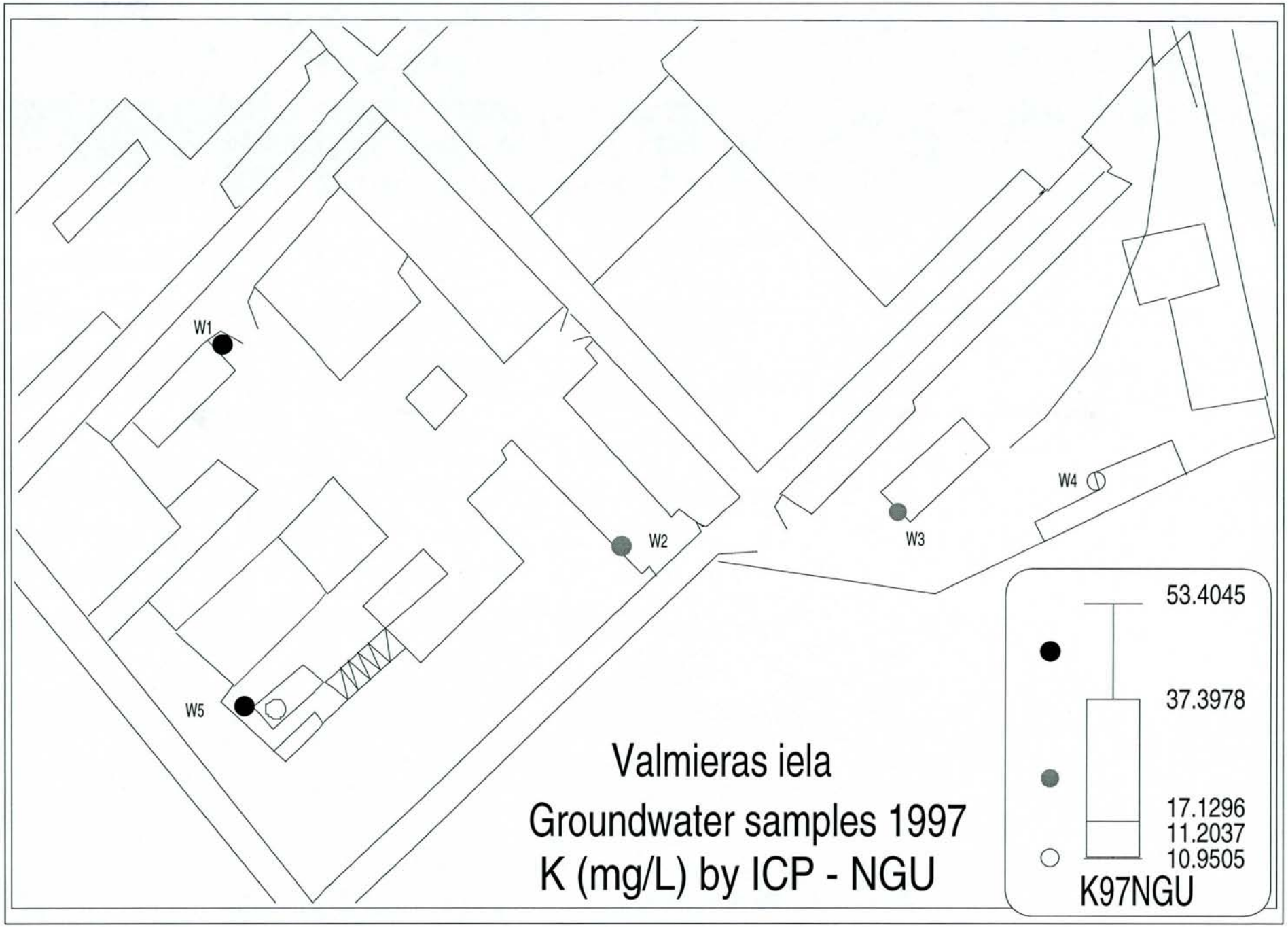

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
HCO3 mg/L - Latvia
867
696
574
317
288
HCO3Lat

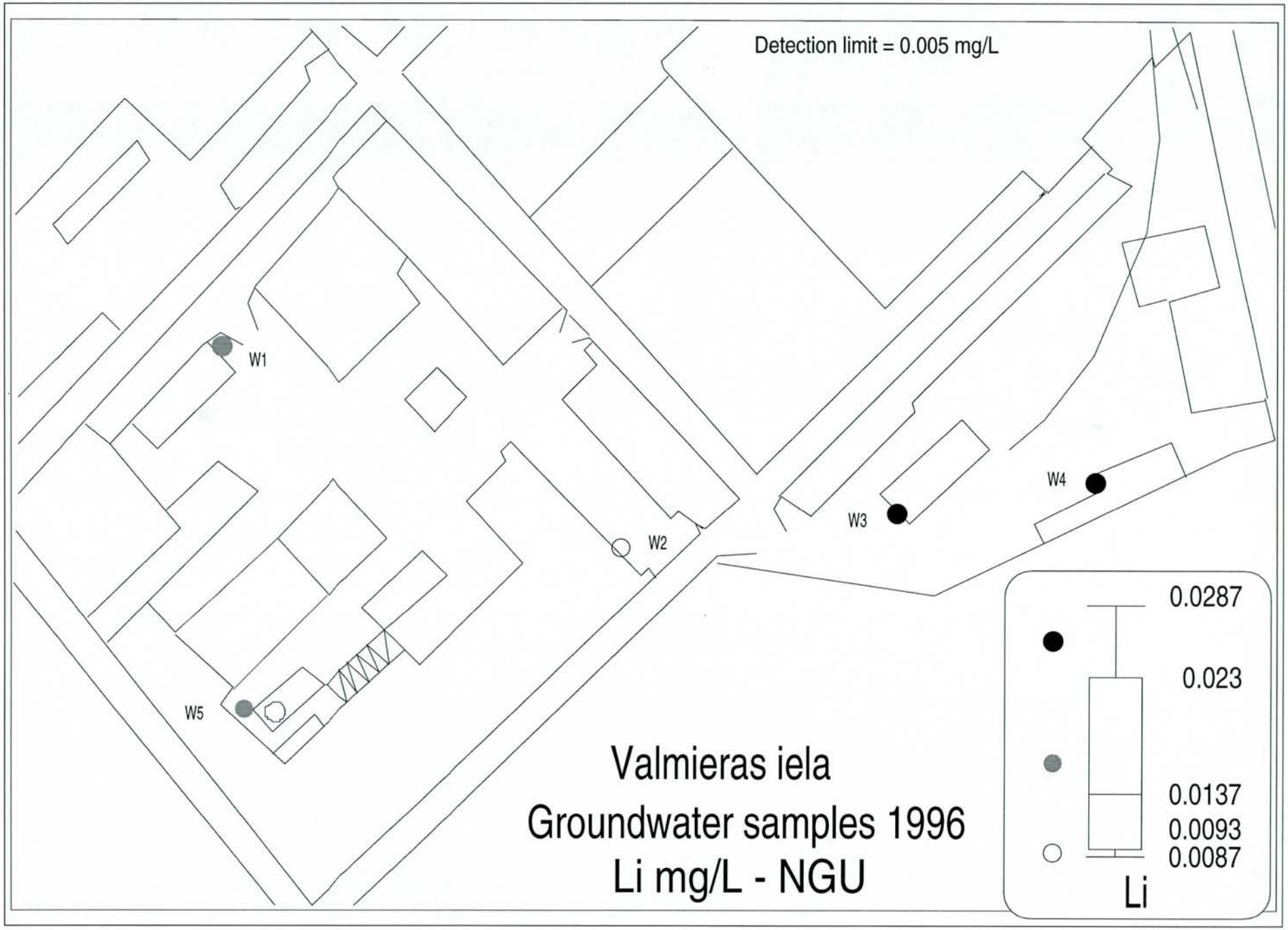

3.45
W1
5.3
W2
W3
13.5
9.05
W4
16.4
W5
Valmieras iela
Groundwater samples 1997
Alkalinity (meq/L) field - NGU
16.4
13.5
9.05
5.3
3.45
Alkav97NG

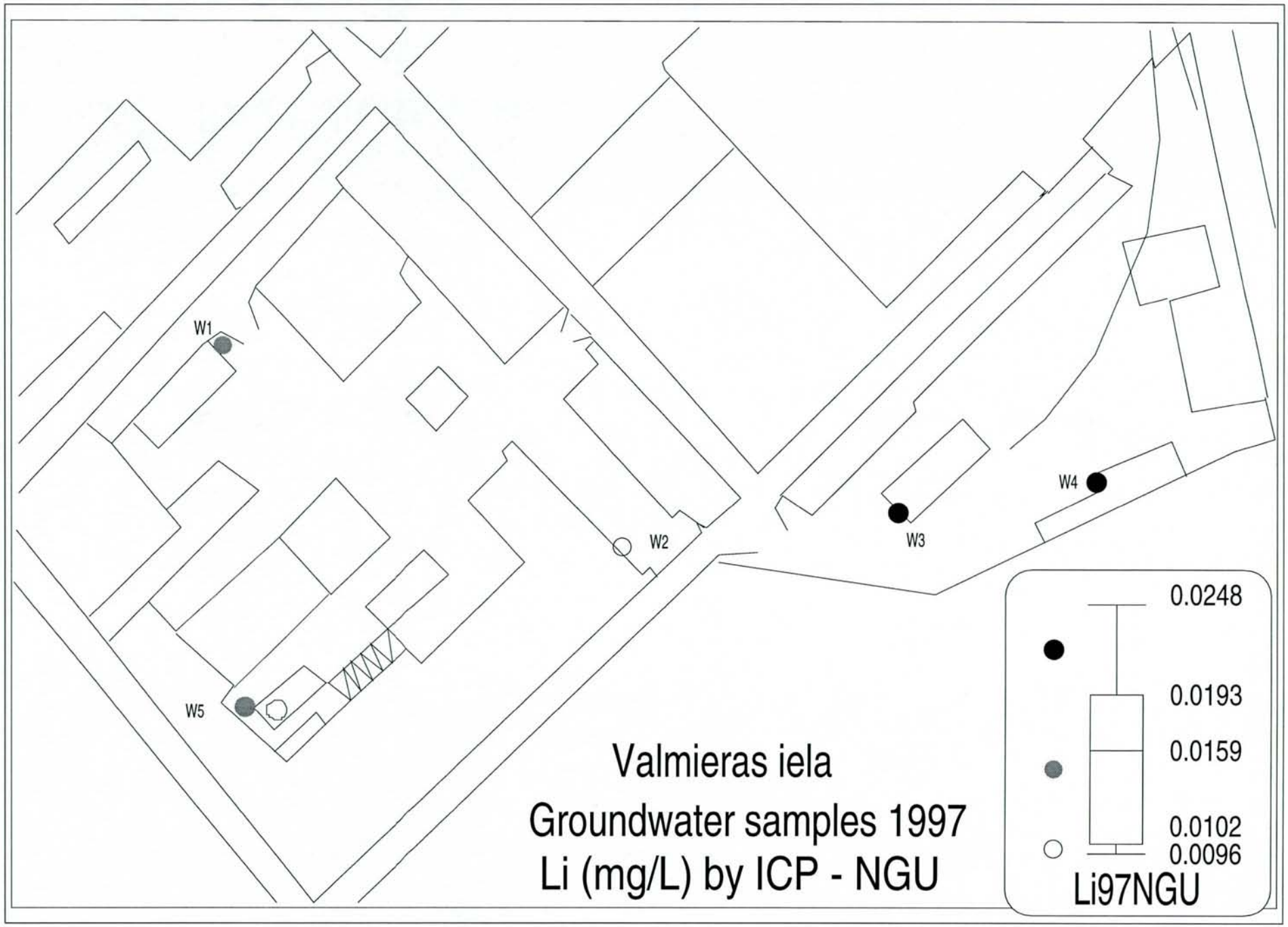

W1
W2
W3
W4
W5
Detection limit = 0.01 ug/L
0.005
Valmieras iela
Groundwater samples 1997
Hg (ug/L) by AA - NGU
HgAA97NGU

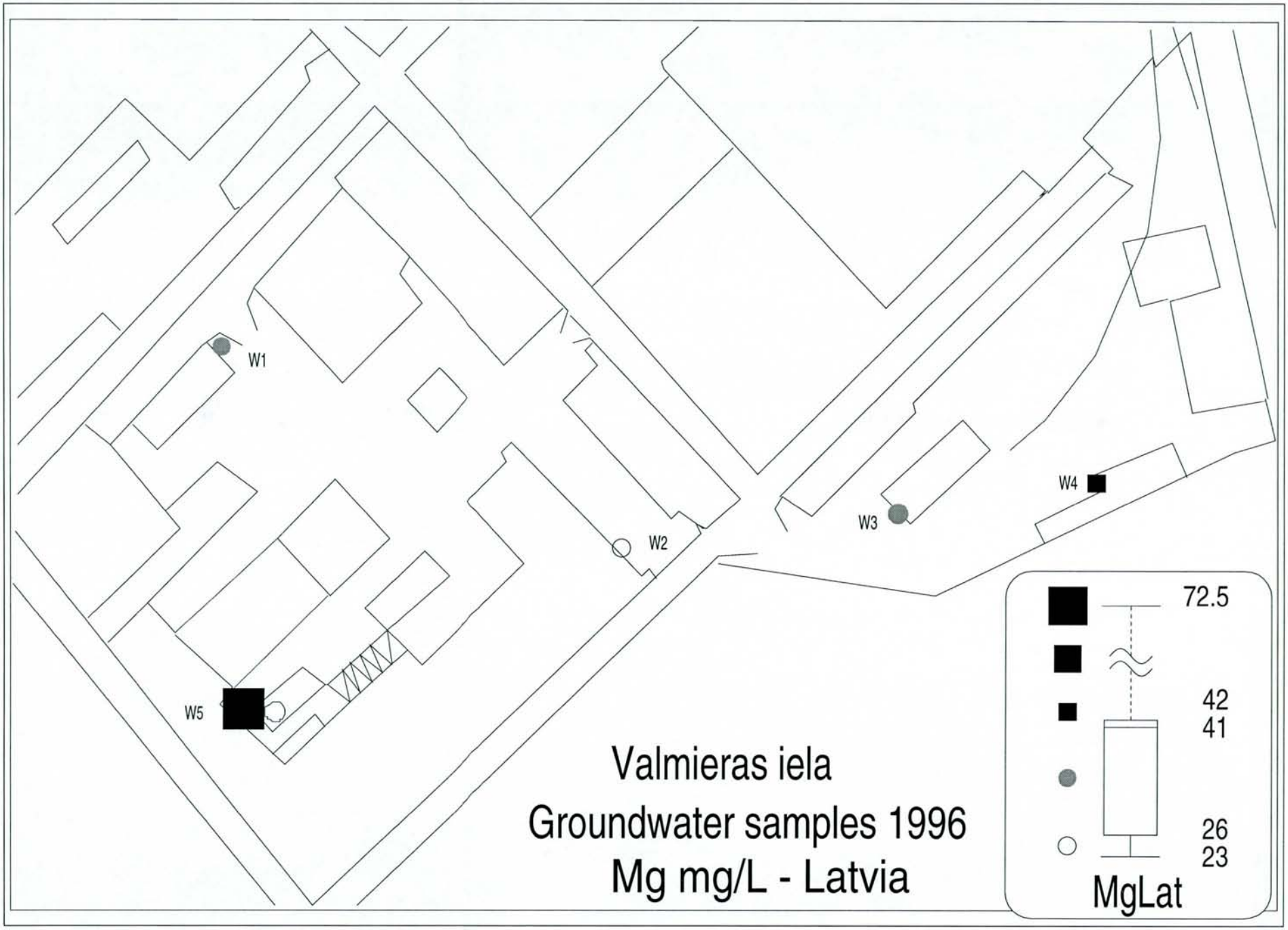

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
K mg/L - Latvia
5.9
4.7
4.3
3.9
KLat

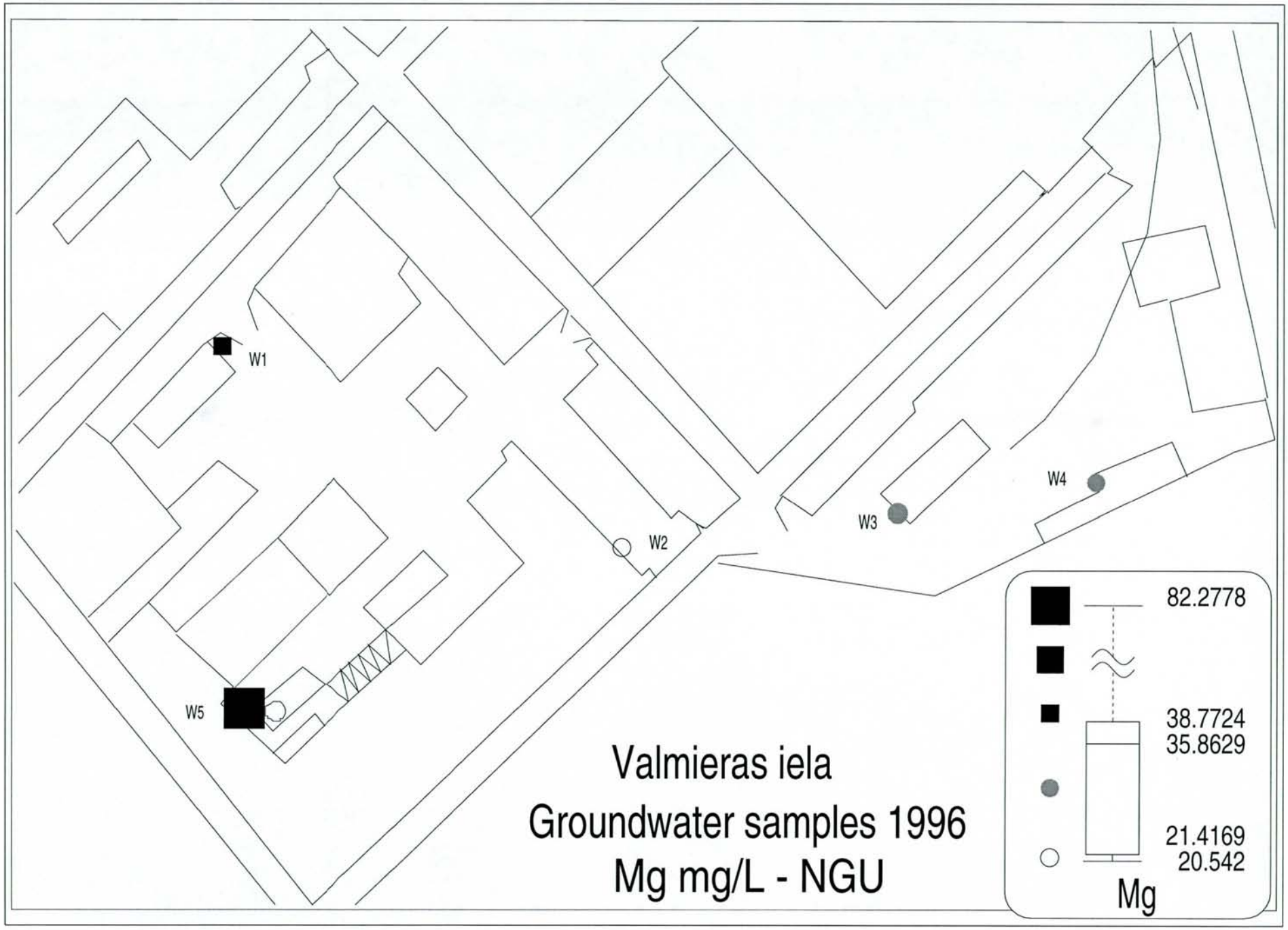

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
K mg/L - NGU
83.5087
40.9585
18.4625
15.9665
12.9038
K

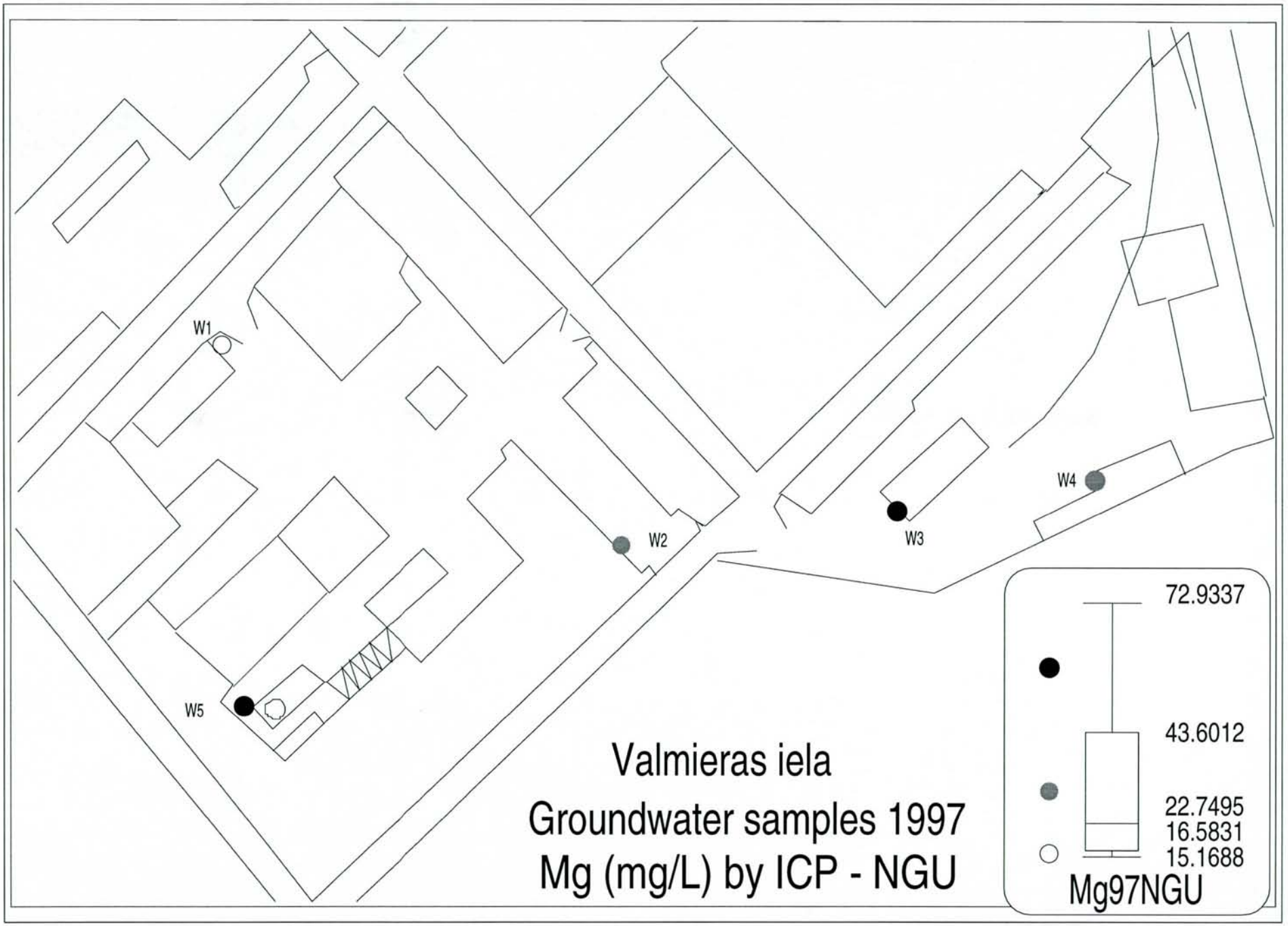

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
K (mg/L) by ICP - NGU
53.4045
37.3978
17.1296
11.2037
10.9505
K97NGU

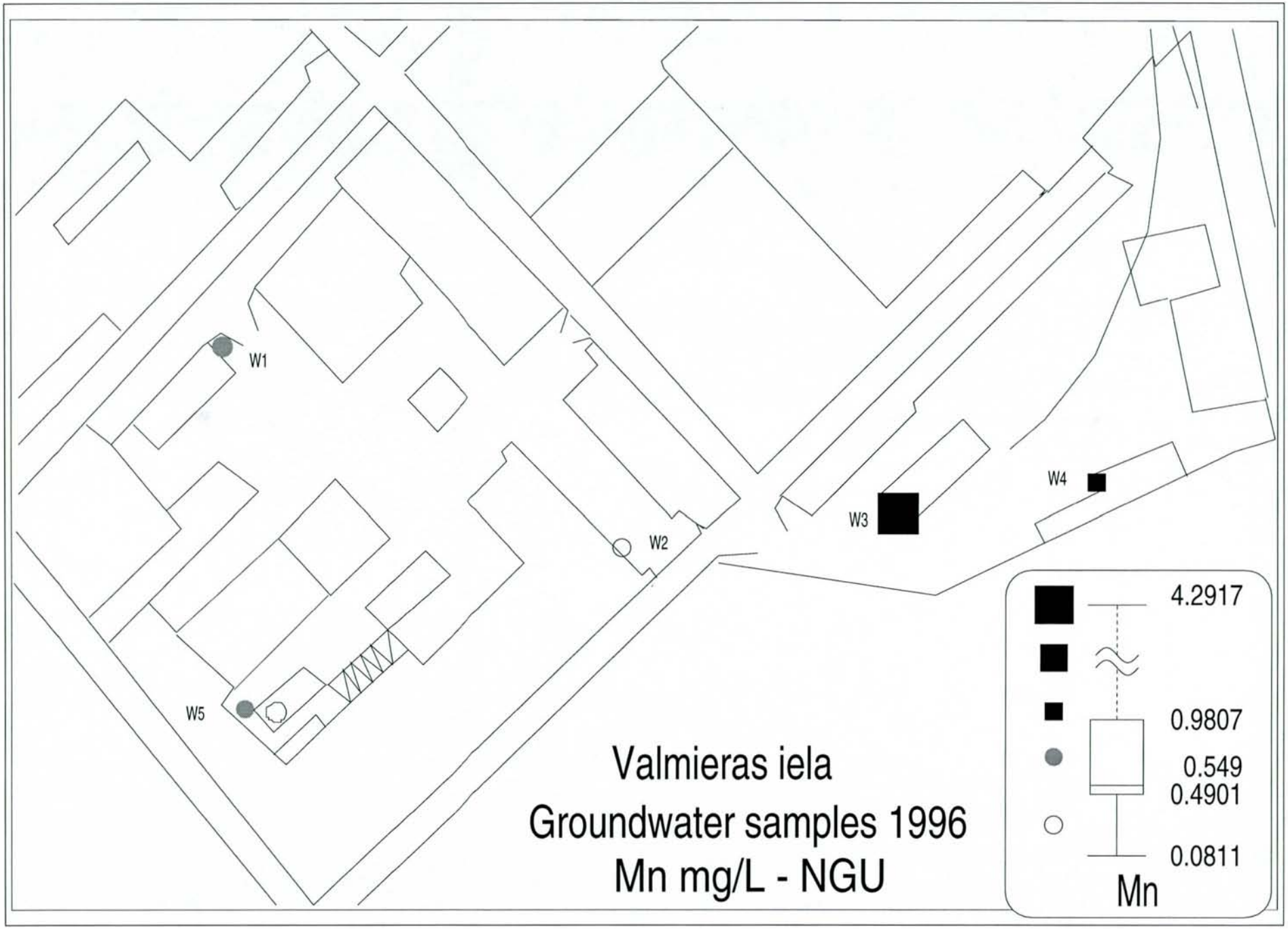

Detection limit = 0.005 mg/L
W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Li mg/L - NGU
0.0287
0.023
0.0137
0.0093
0.0087
Li

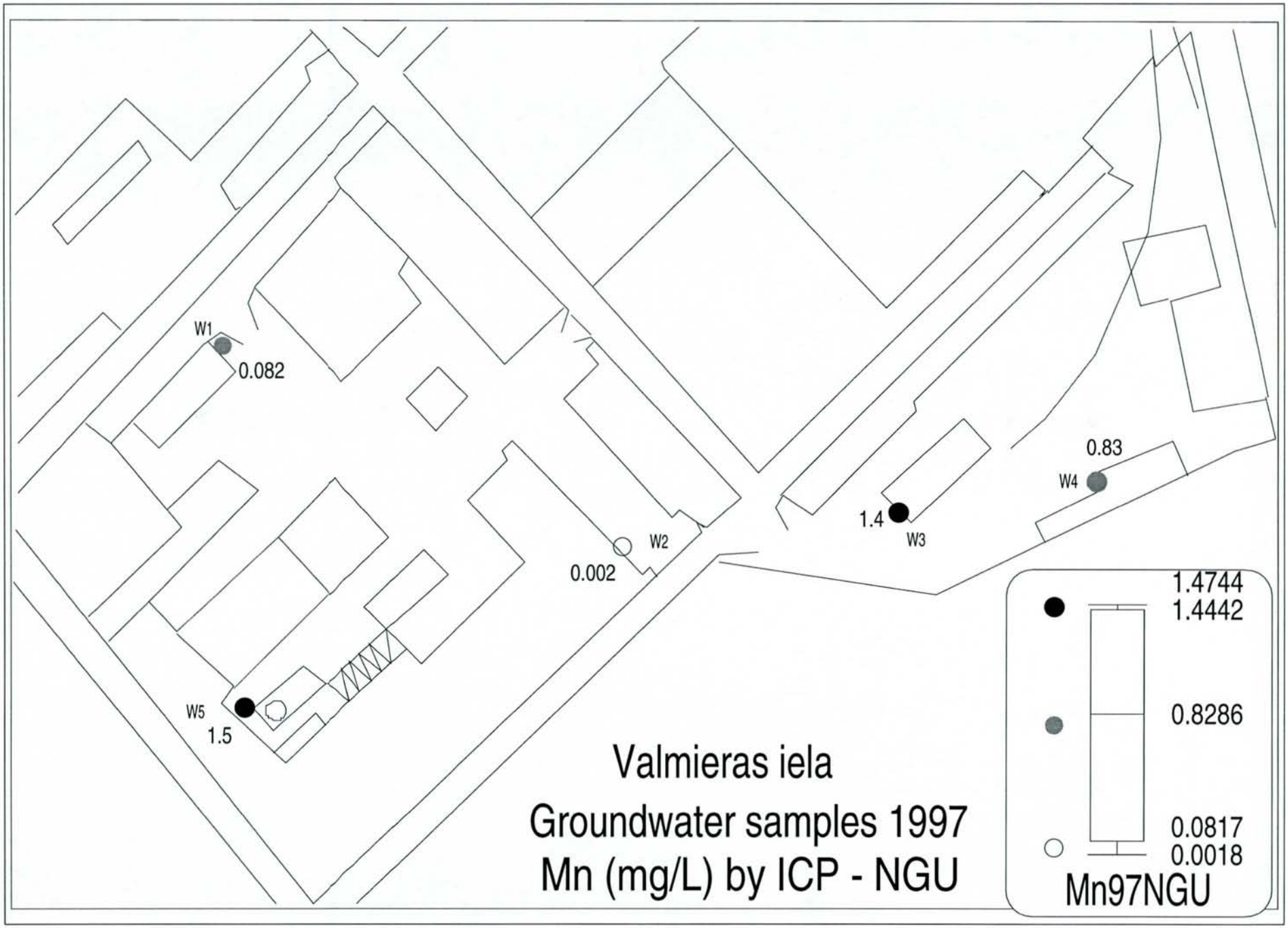

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Li (mg/L) by ICP - NGU
0.0248
0.0193
0.0159
0.0102
0.0096
Li97NGU

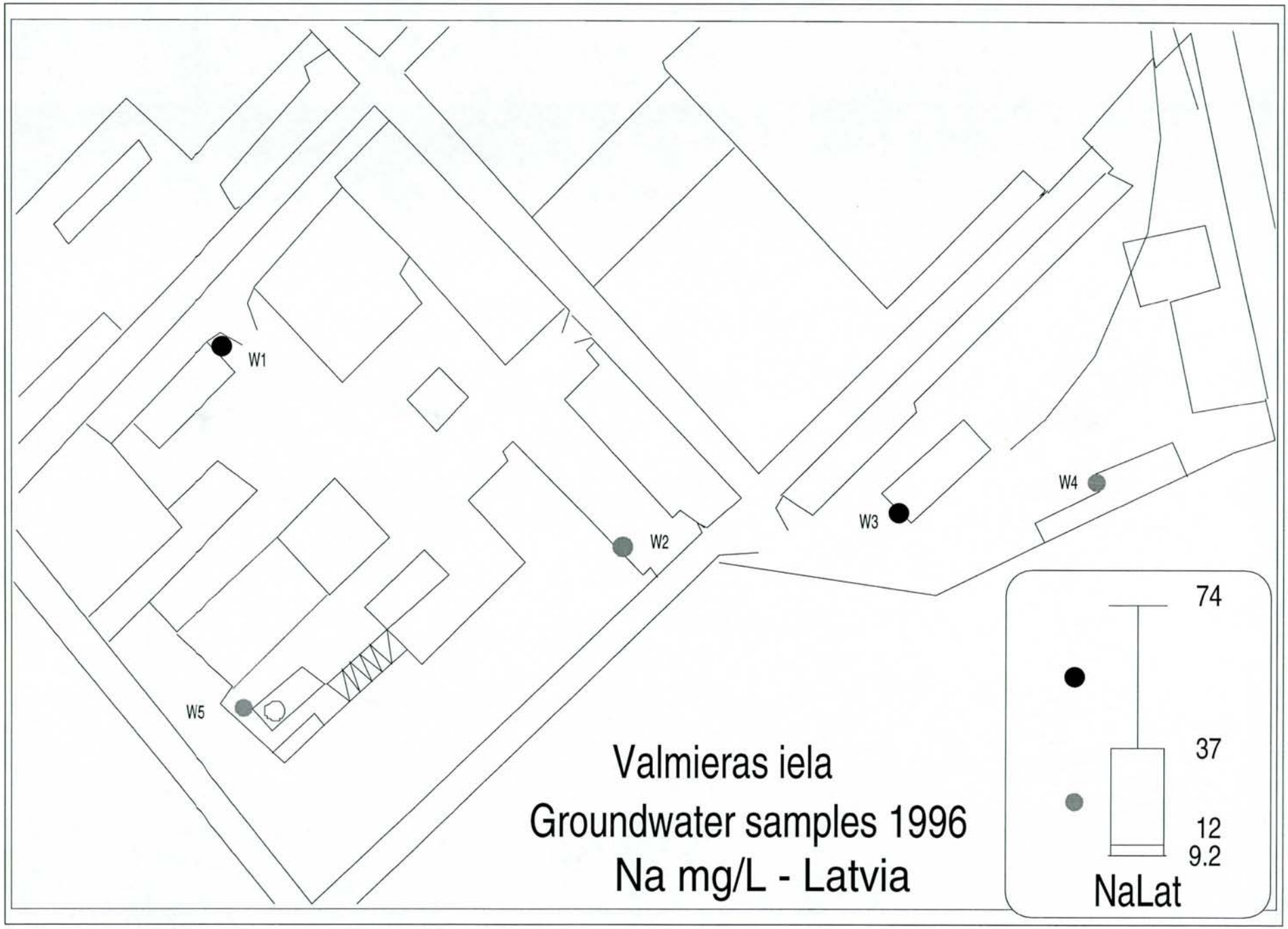

W1
W2
W3
W4
W5
72.5
42
41
26
23
MgLat
Valmieras iela
Groundwater samples 1996
Mg mg/L - Latvia

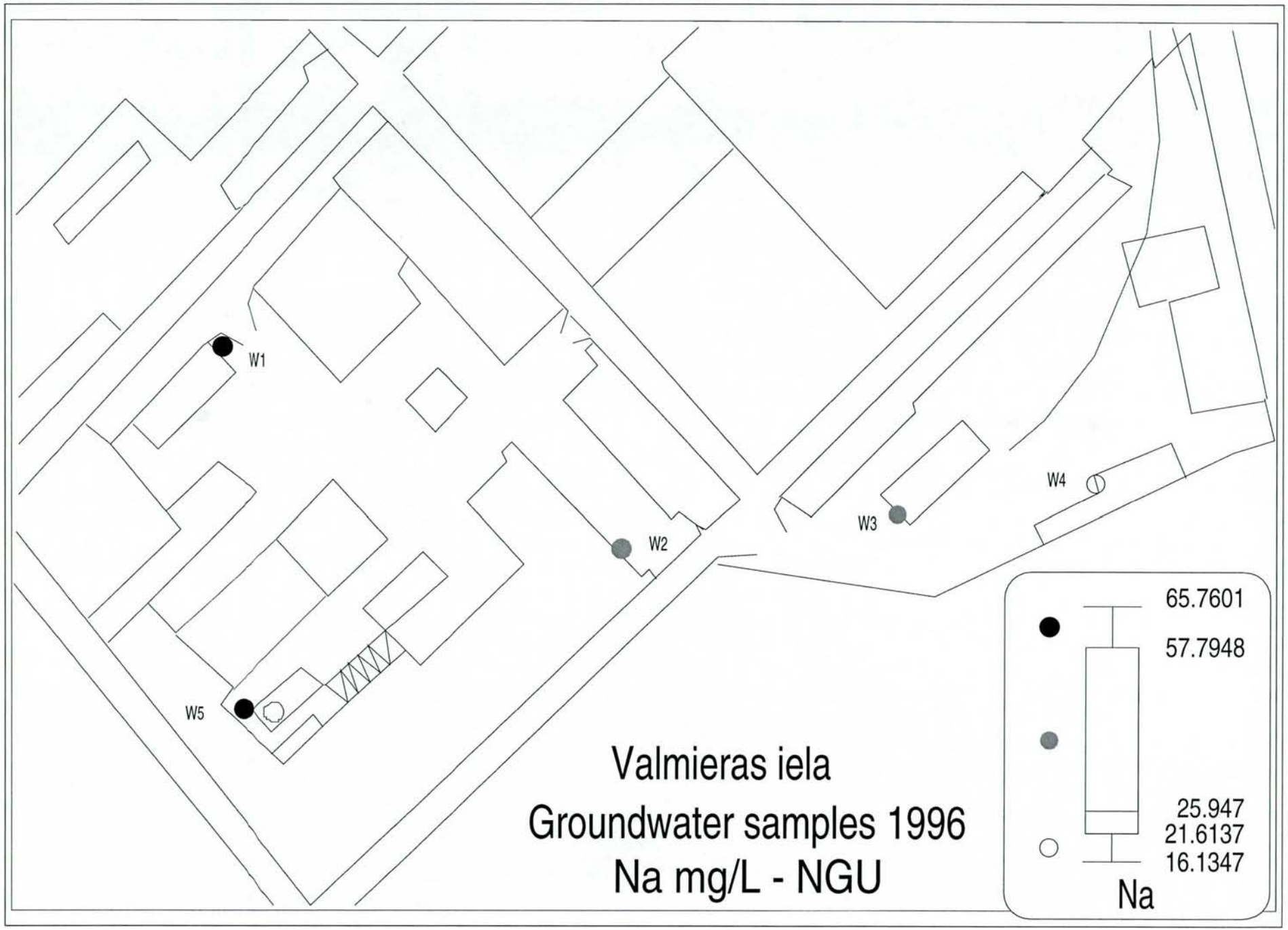

W1
W2
W3
W4
W5
82.2778
38.7724
35.8629
21.4169
20.542
Mg
Valmieras iela
Groundwater samples 1996
Mg mg/L - NGU

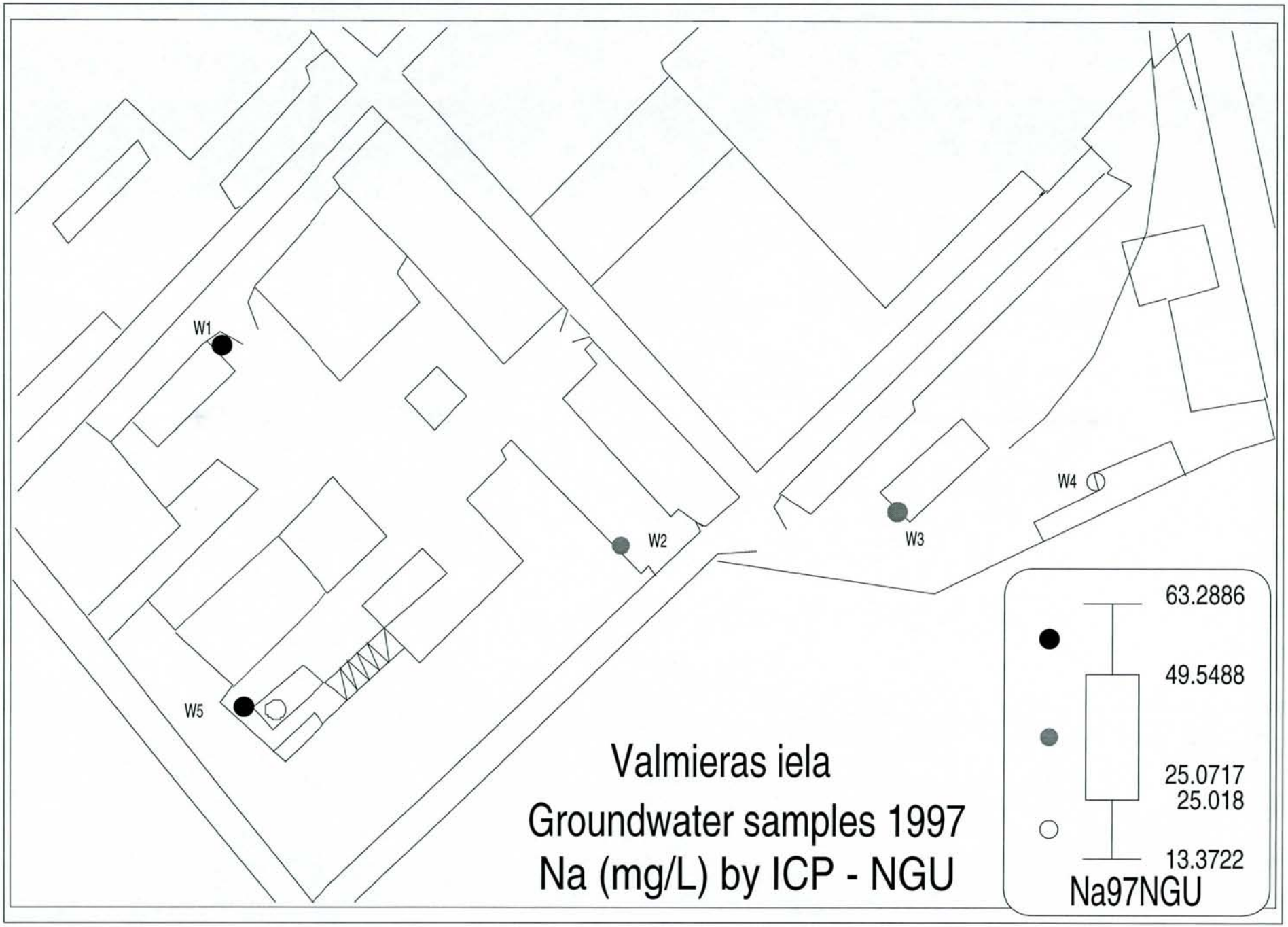

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Mg (mg/L) by ICP - NGU
72.9337
43.6012
22.7495
16.5831
15.1688
Mg97NGU

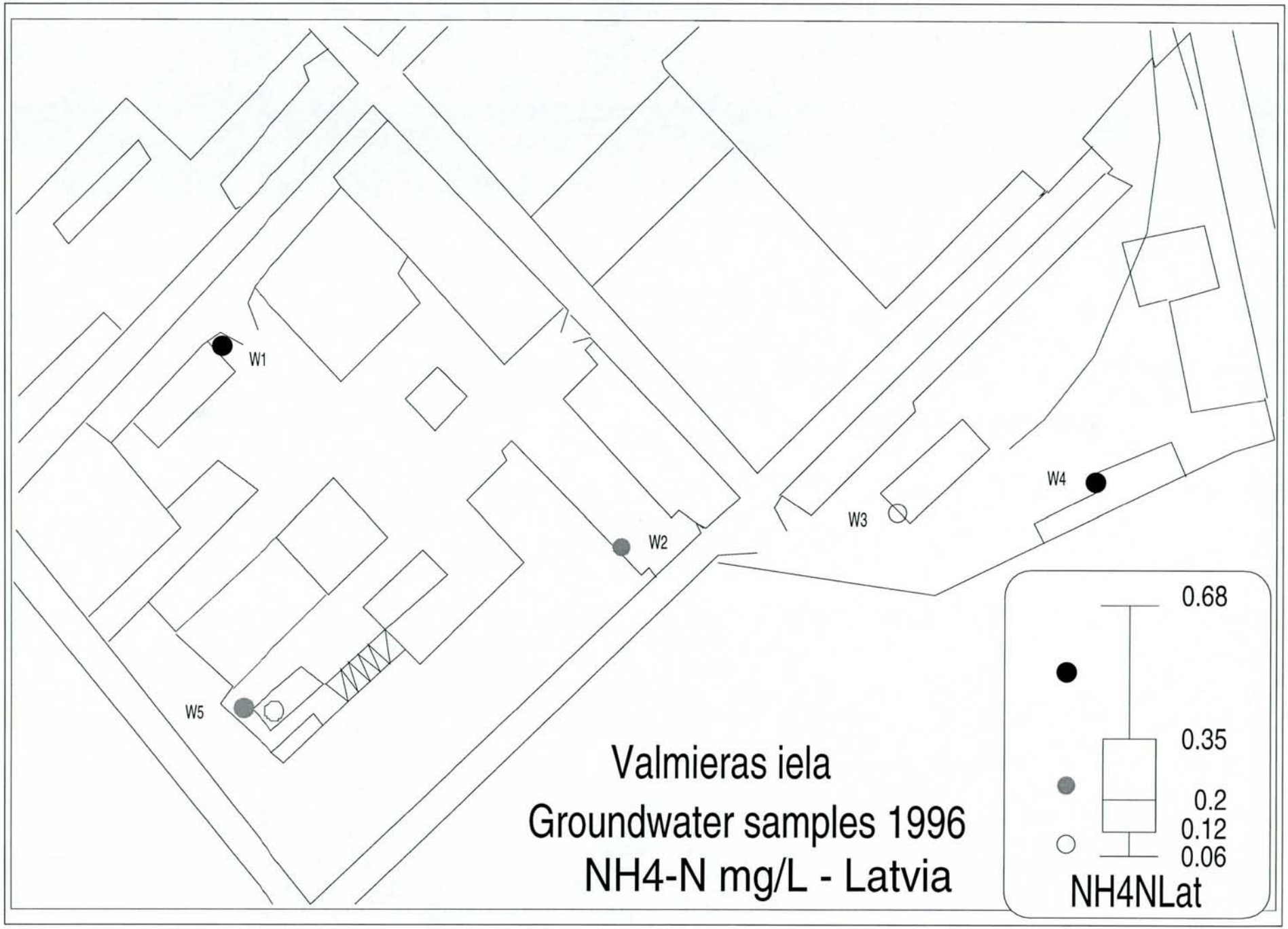

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Mn mg/L - NGU
4.2917
0.9807
0.549
0.4901
0.0811
Mn

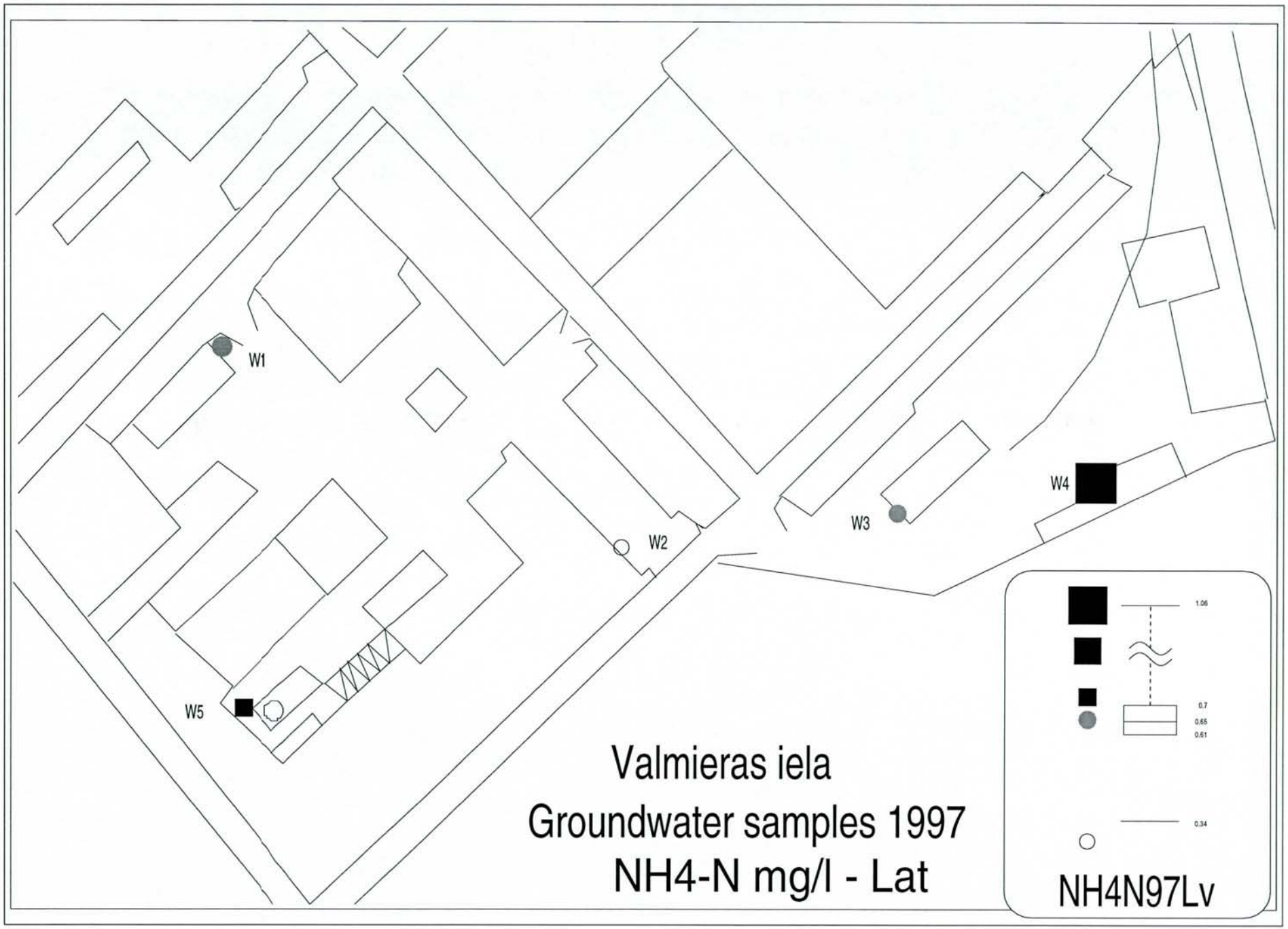

W1
0.082
W2
0.002
W3
1.4
W4
0.83
W5
1.5
Valmieras iela
Groundwater samples 1997
Mn (mg/L) by ICP - NGU
1.4744
1.4442
0.8286
0.0817
0.0018
Mn97NGU

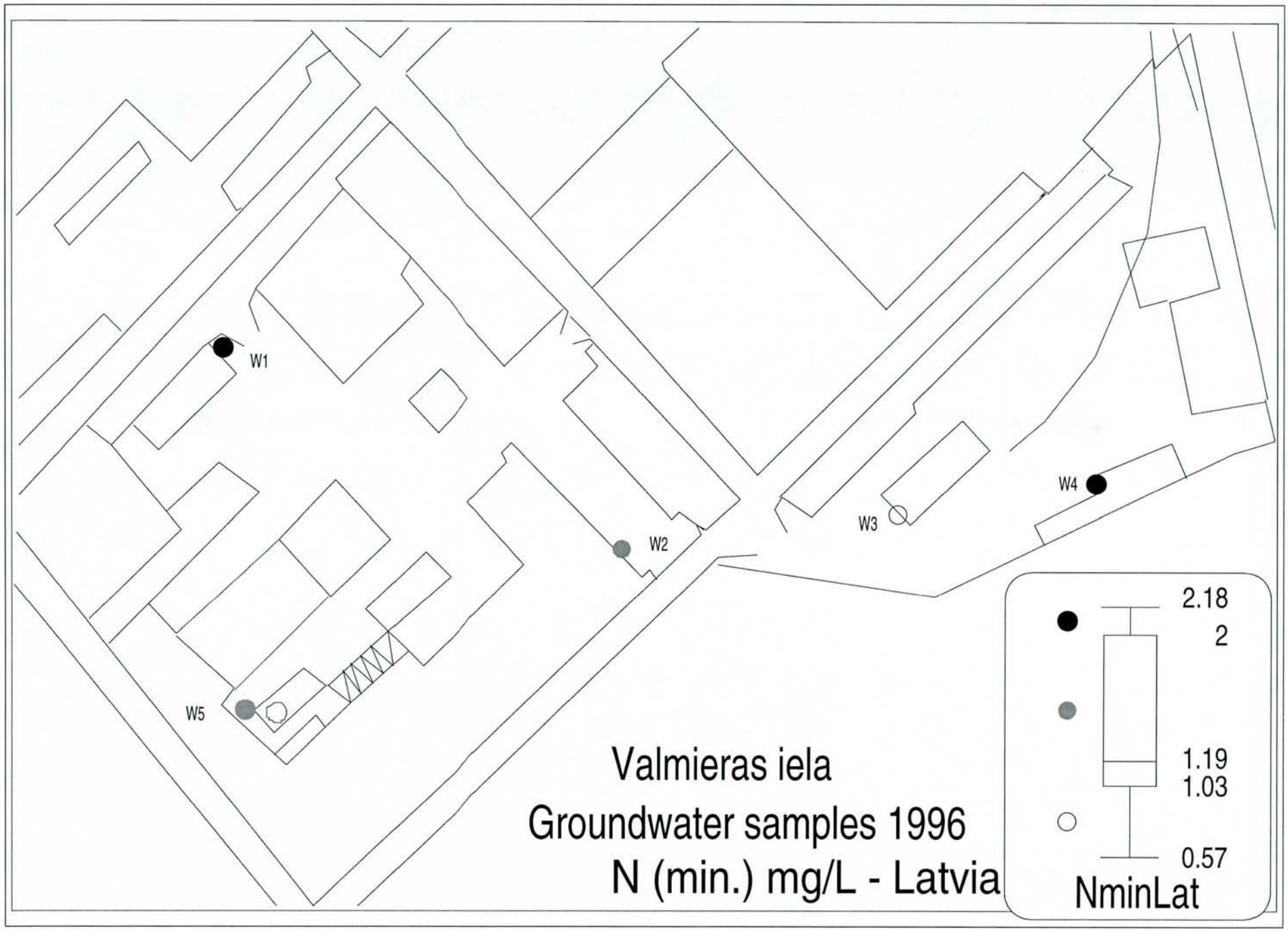

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Na mg/L - Latvia
74
37
12
9.2
NaLat

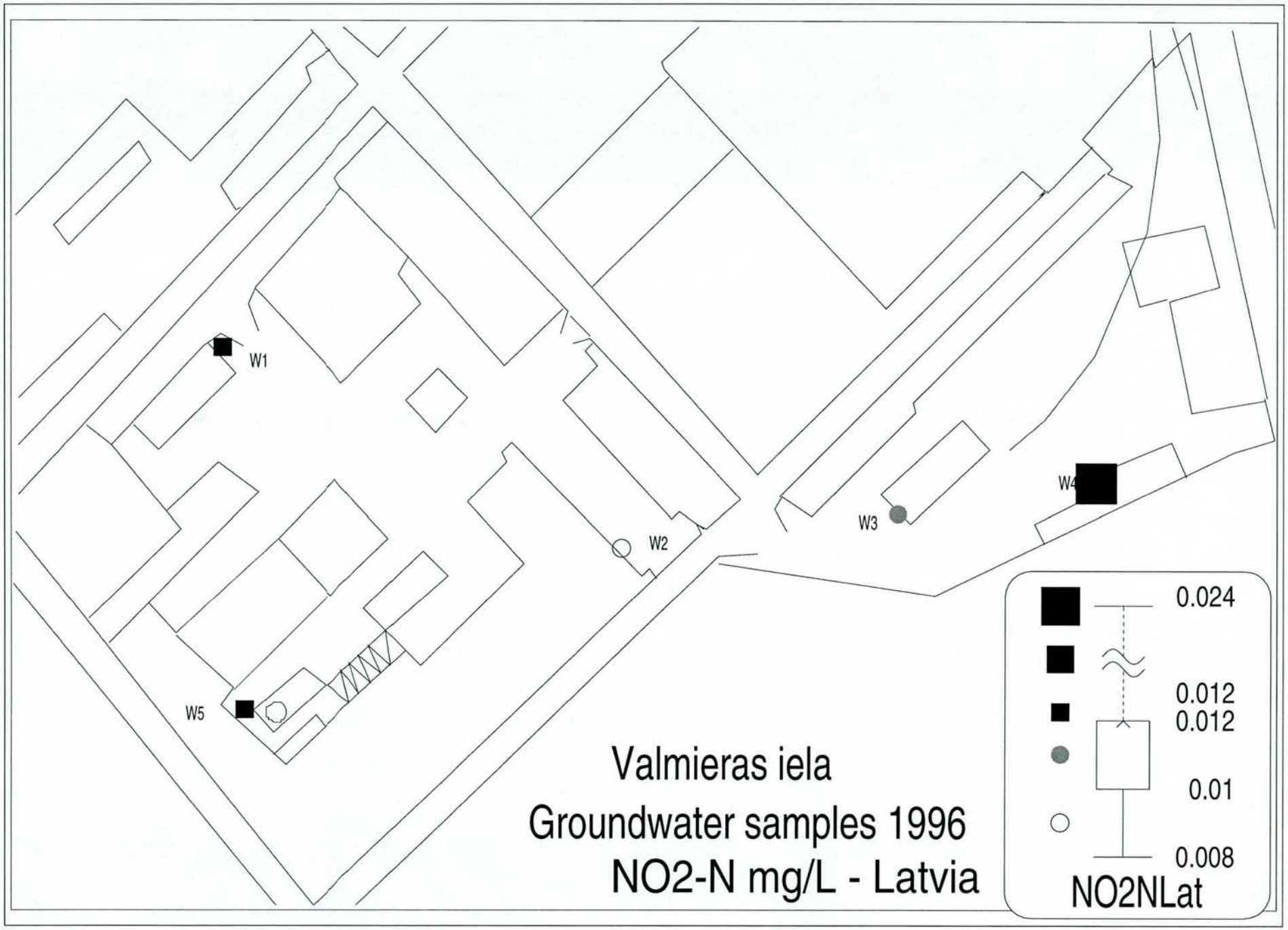

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Na mg/L - NGU
65.7601
57.7948
25.947
21.6137
16.1347
Na

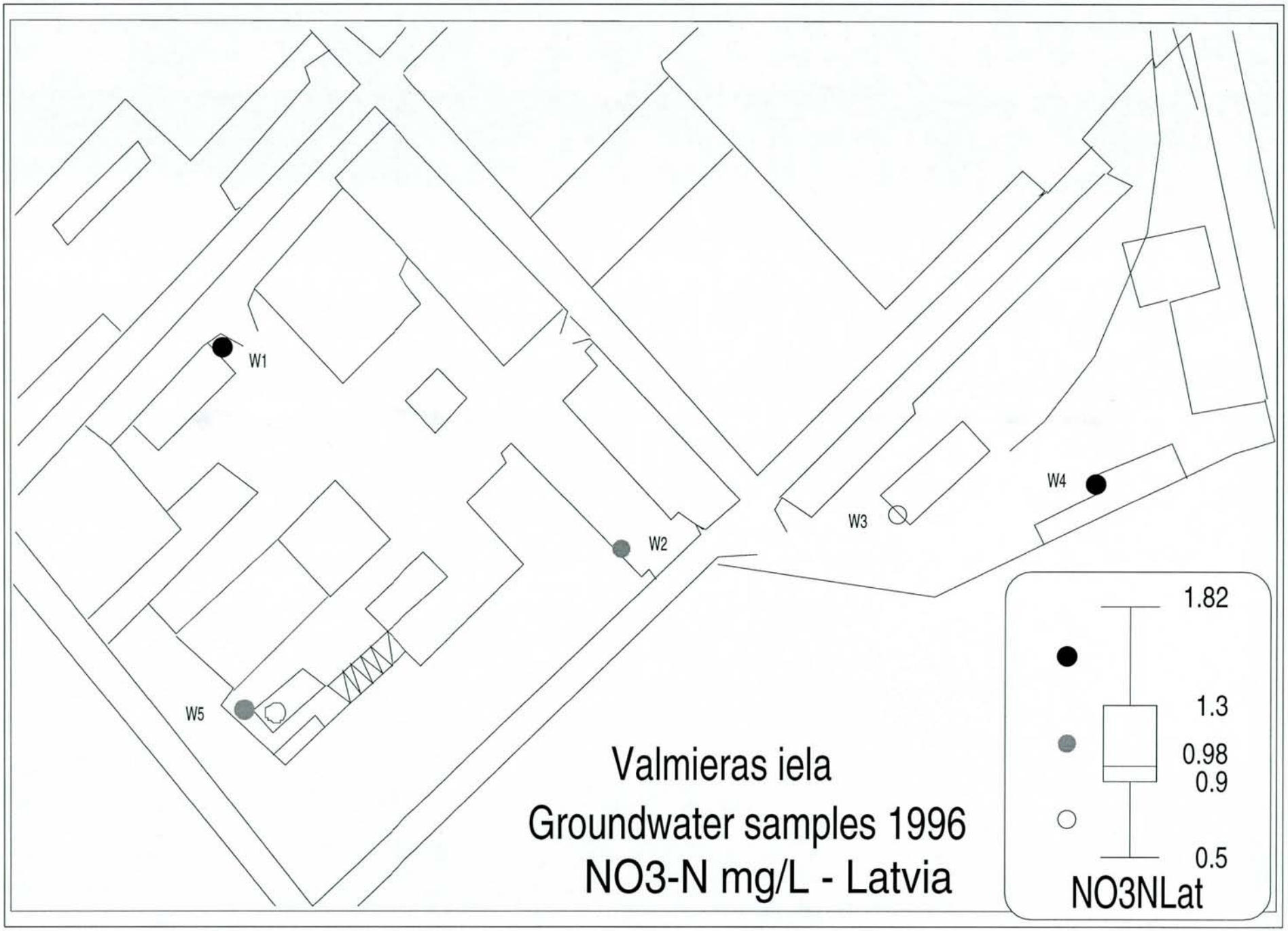

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Na (mg/L) by ICP - NGU
63.2886
49.5488
25.0717
25.018
13.3722
Na97NGU

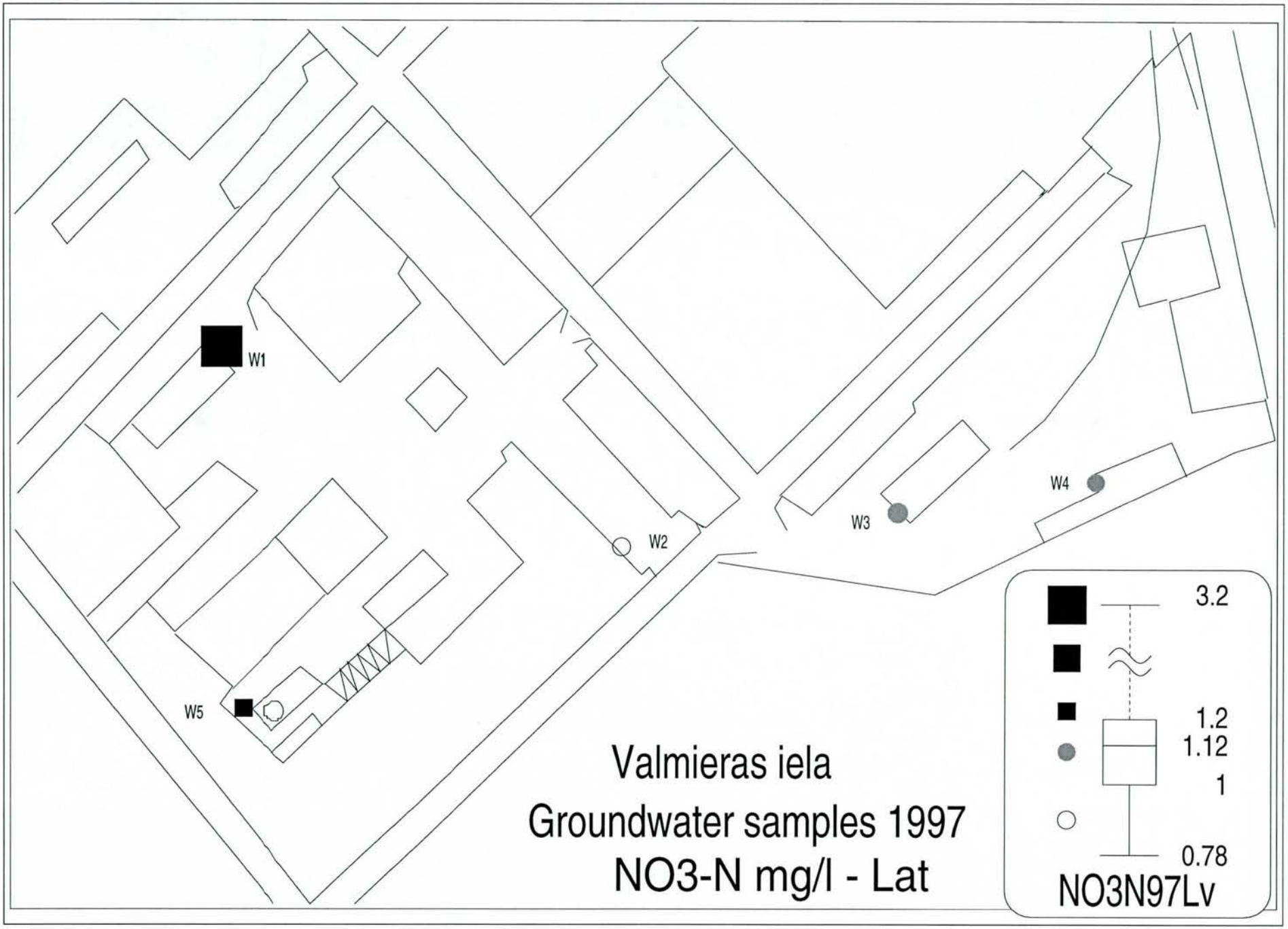

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
NH4-N mg/L - Latvia
0.68
0.35
0.2
0.12
0.06
NH4NLat

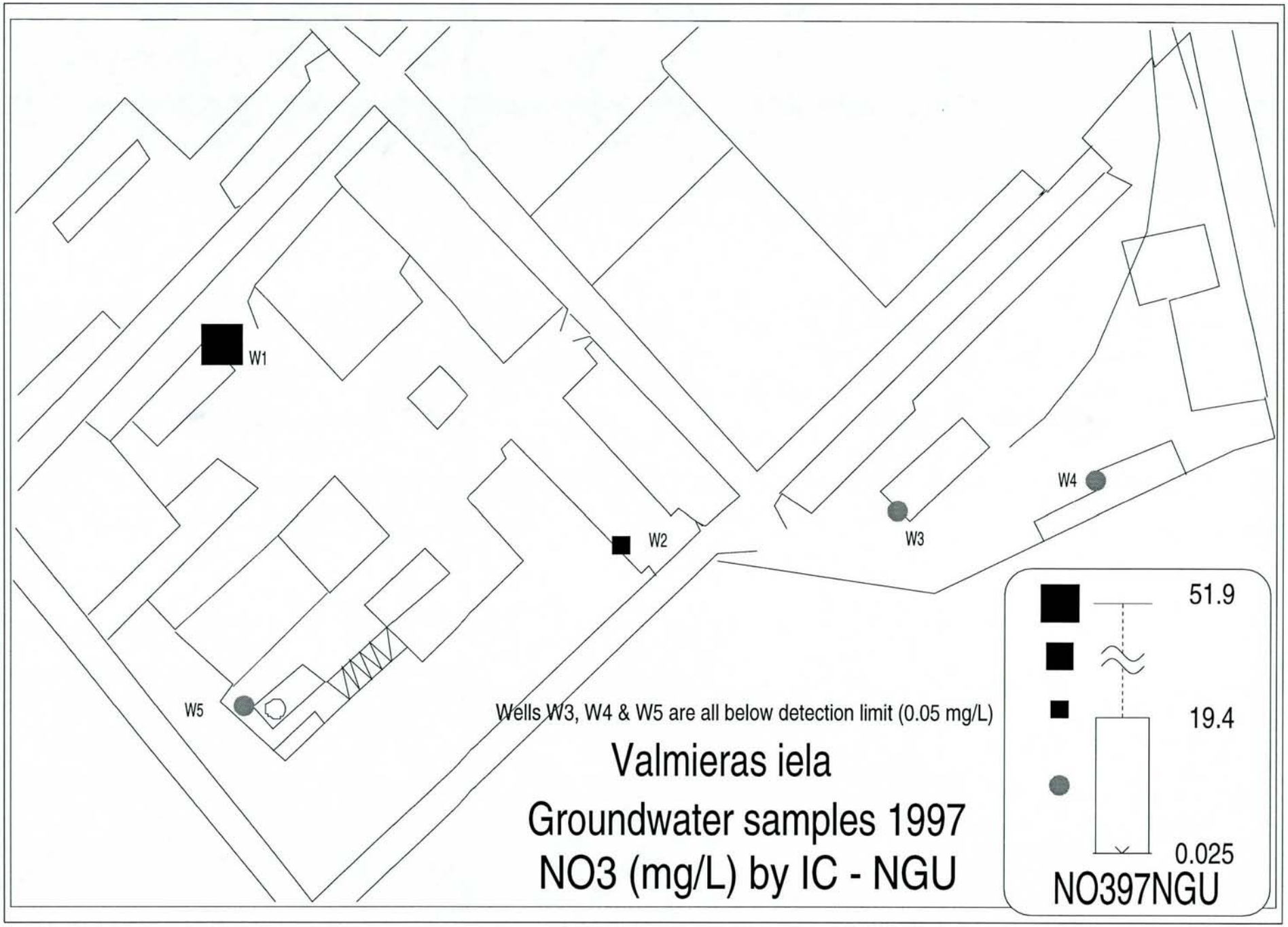

W1
W2
W3
W4
W5
1.06
0.7
0.65
0.61
0.34
Valmieras iela
Groundwater samples 1997
NH4-N mg/l - Lat
NH4N97Lv

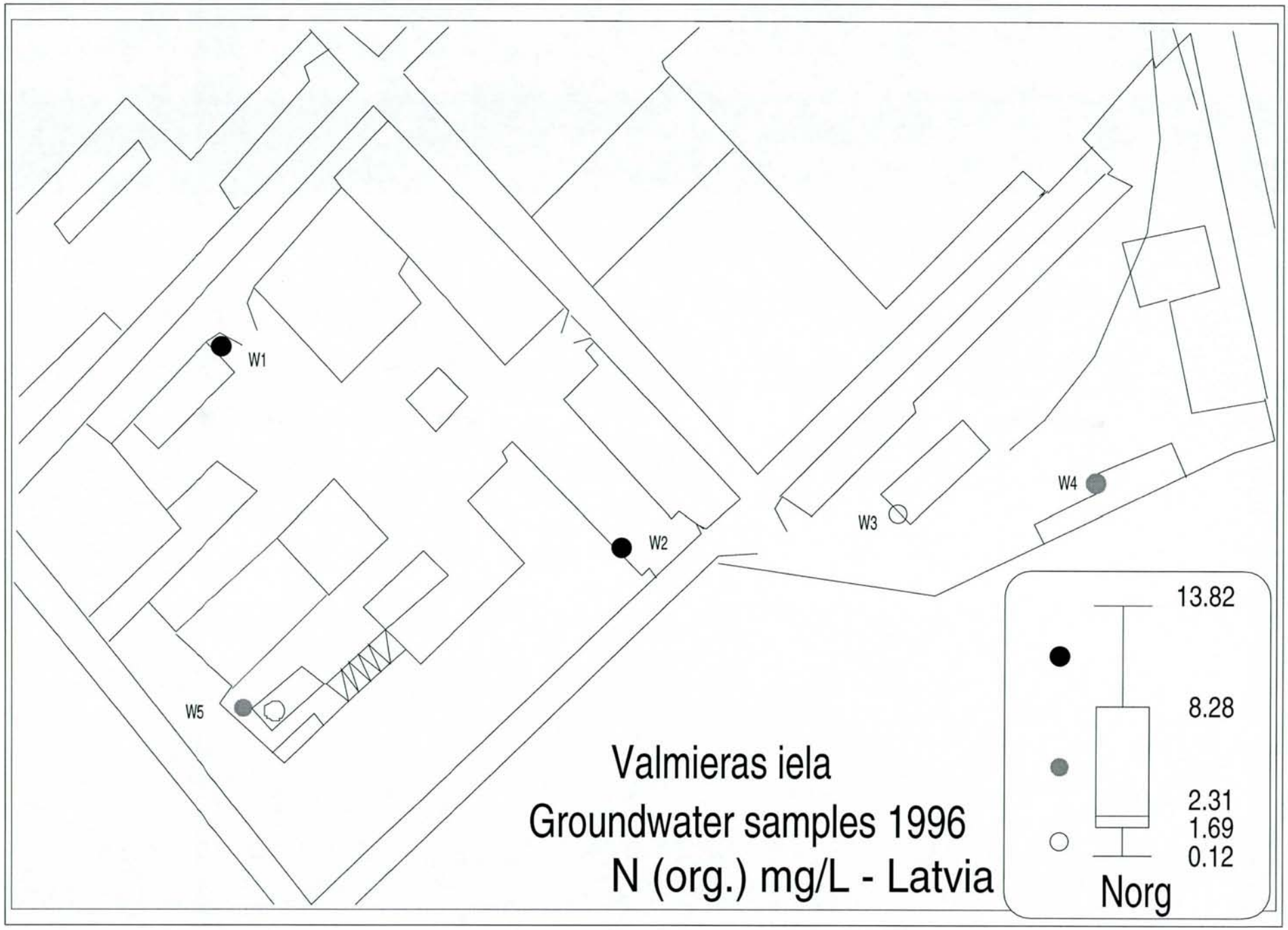

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
N (min.) mg/L - Latvia
2.18
2
1.19
1.03
0.57
NminLat

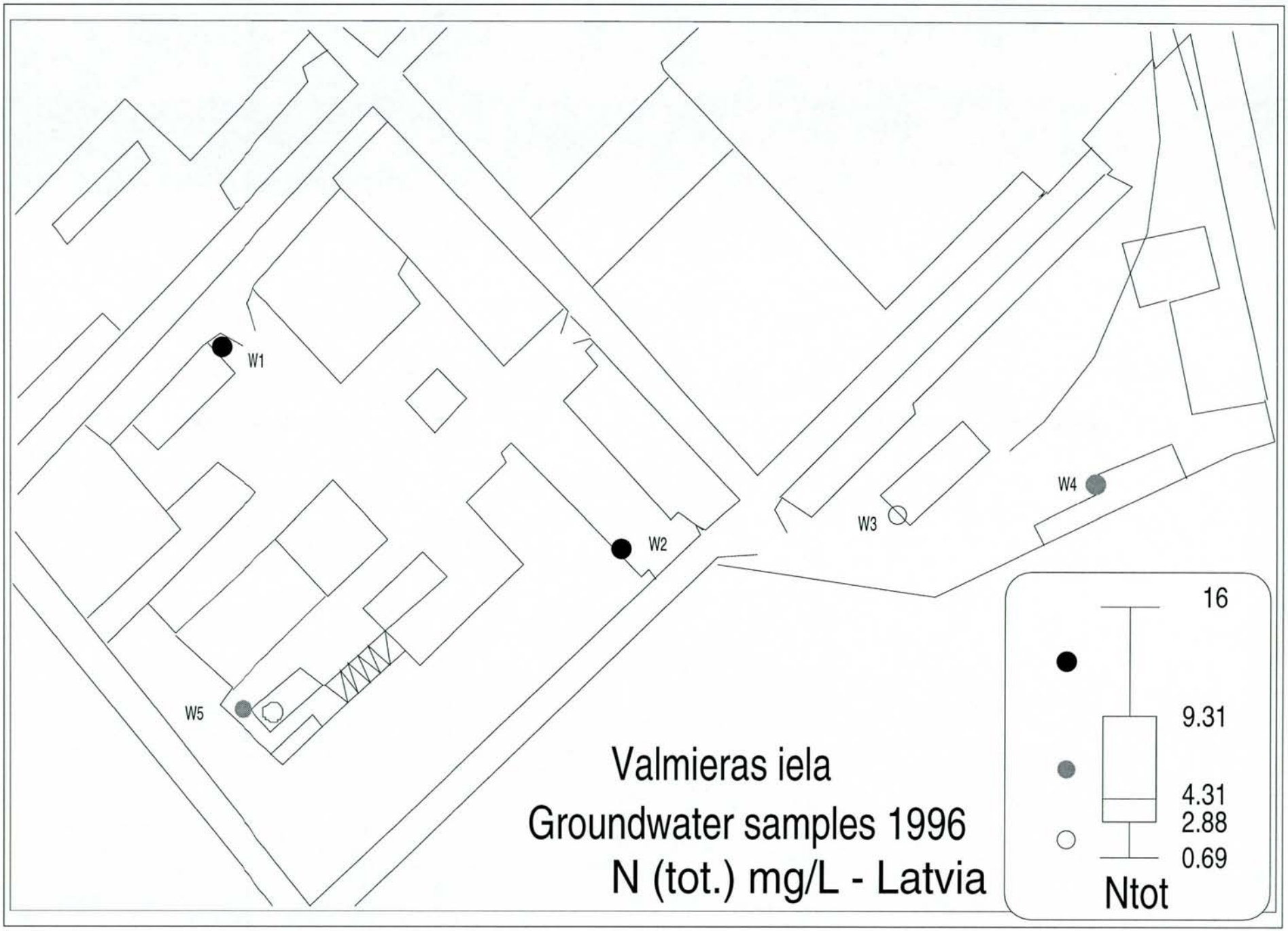

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
NO2-N mg/L - Latvia
0.024
0.012
0.012
0.01
0.008
NO2NLat

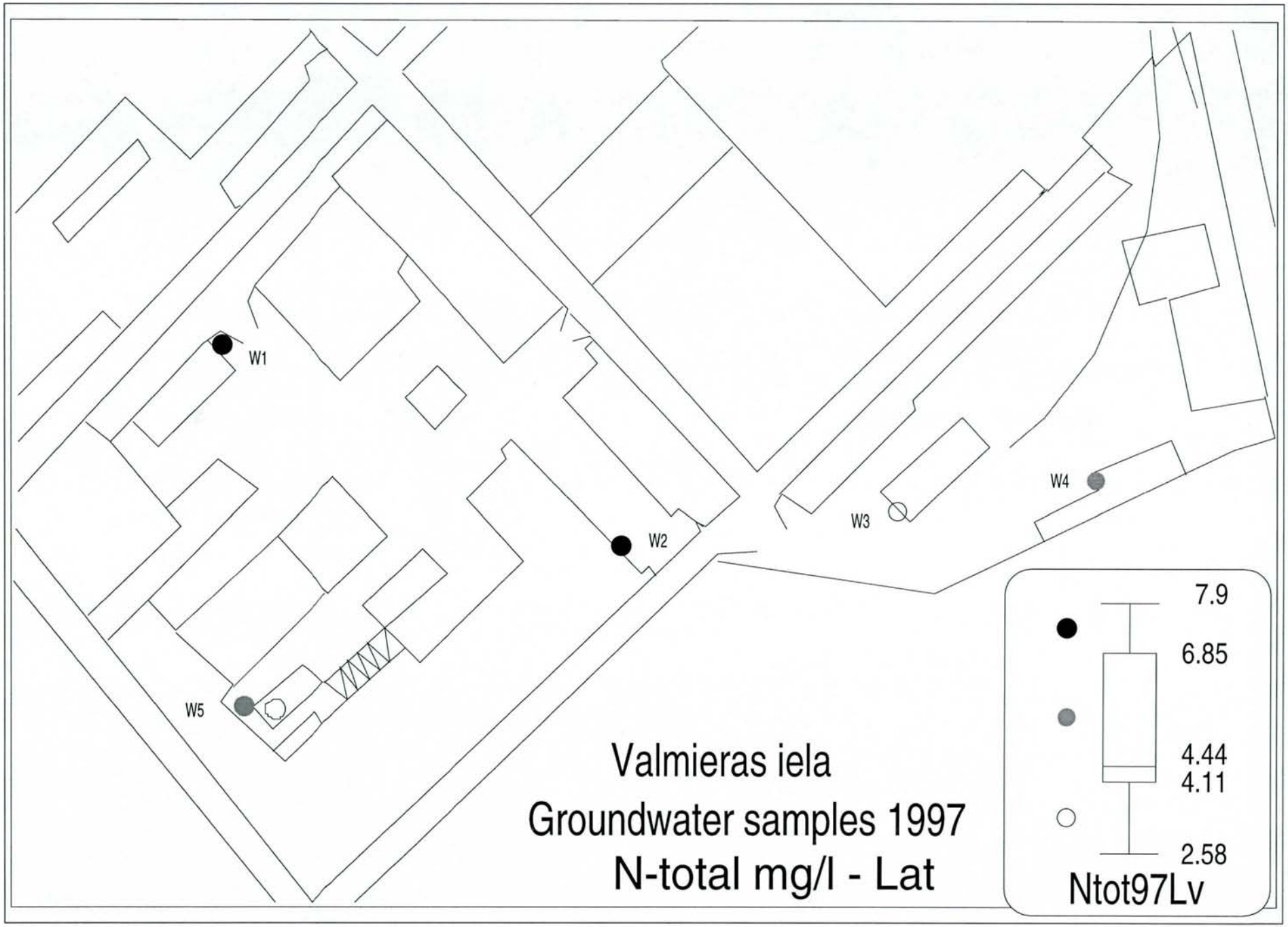

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
NO3-N mg/L - Latvia
1.82
1.3
0.98
0.9
0.5
NO3NLat

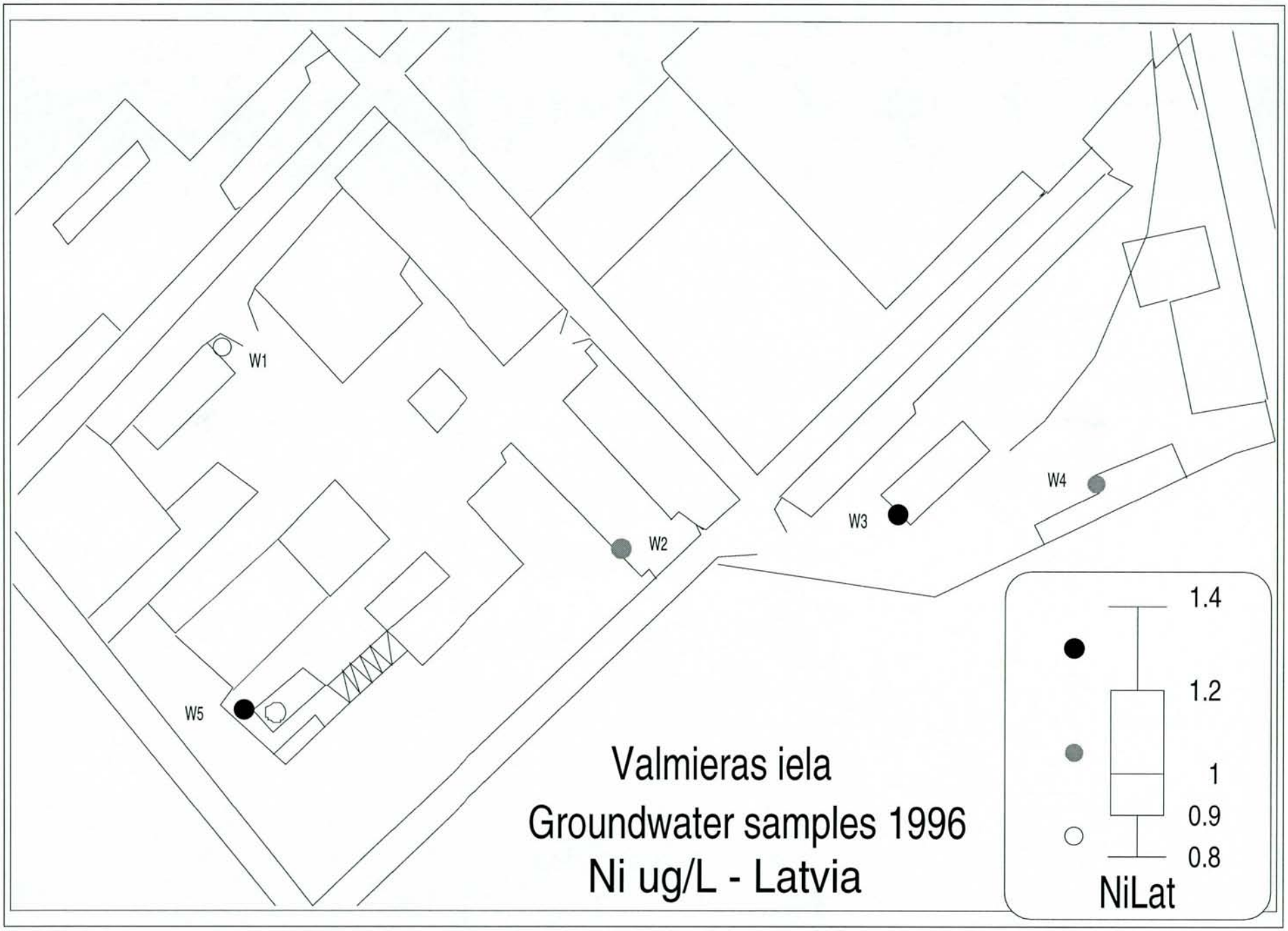

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
NO3-N mg/l - Lat
3.2
1.2
1.12
1
0.78
NO3N97Lv

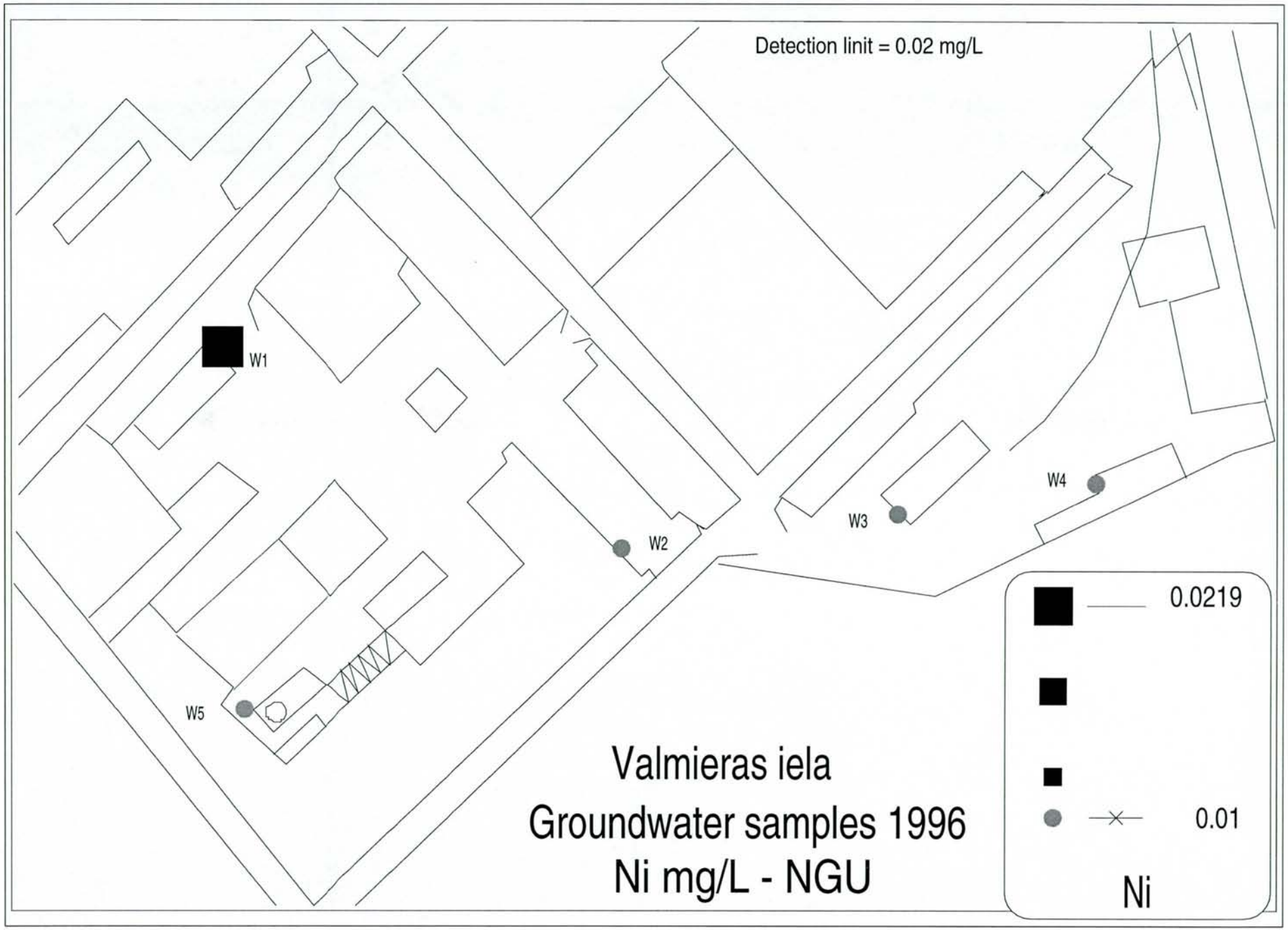

W1
W2
W3
W4
W5
Wells W3, W4 & W5 are all below detection limit (0.05 mg/L)
Valmieras iela
Groundwater samples 1997
NO3 (mg/L) by IC - NGU
51.9
19.4
0.025
NO397NGU

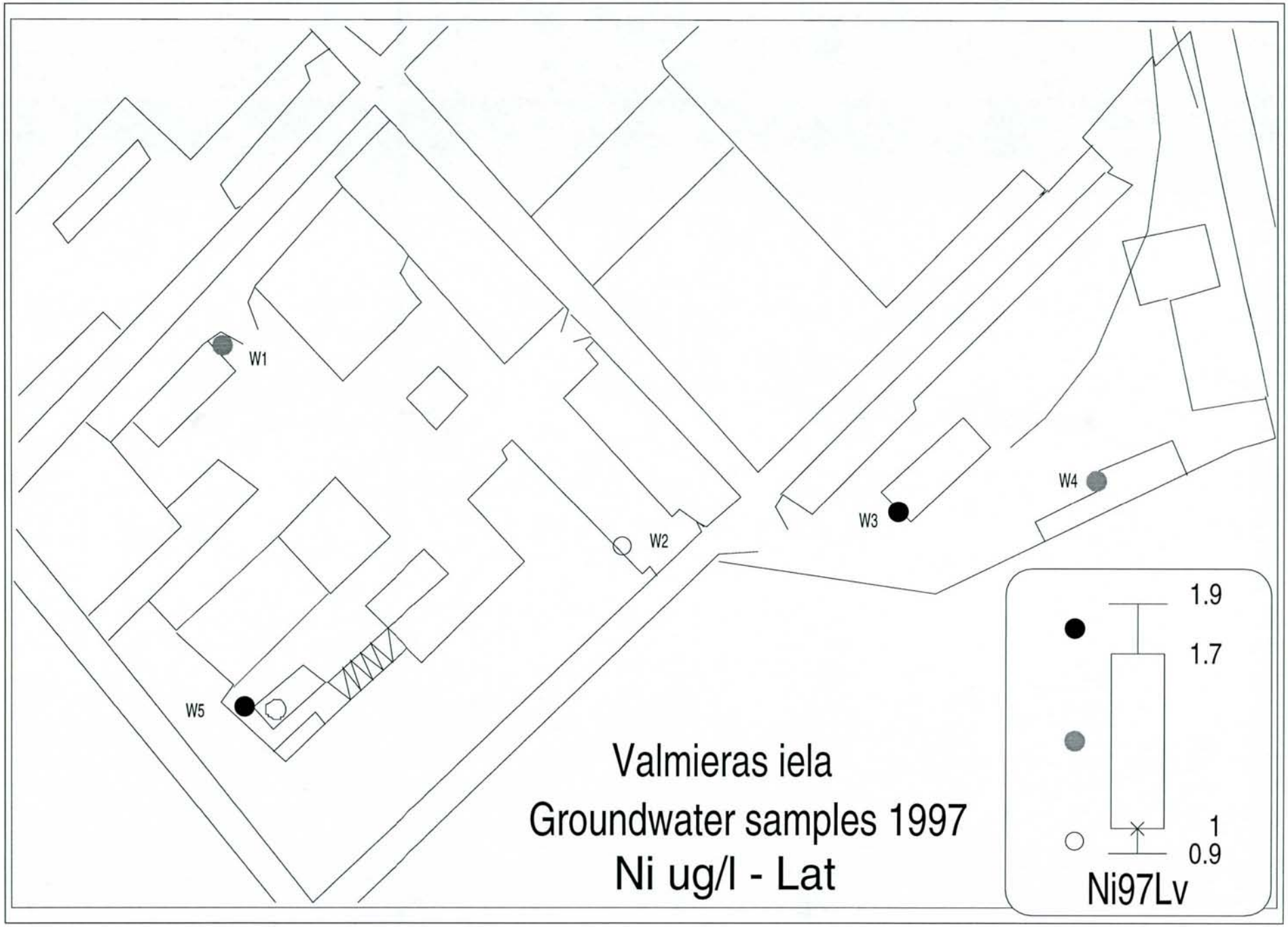

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
N (org.) mg/L - Latvia
13.82
8.28
2.31
1.69
0.12
Norg

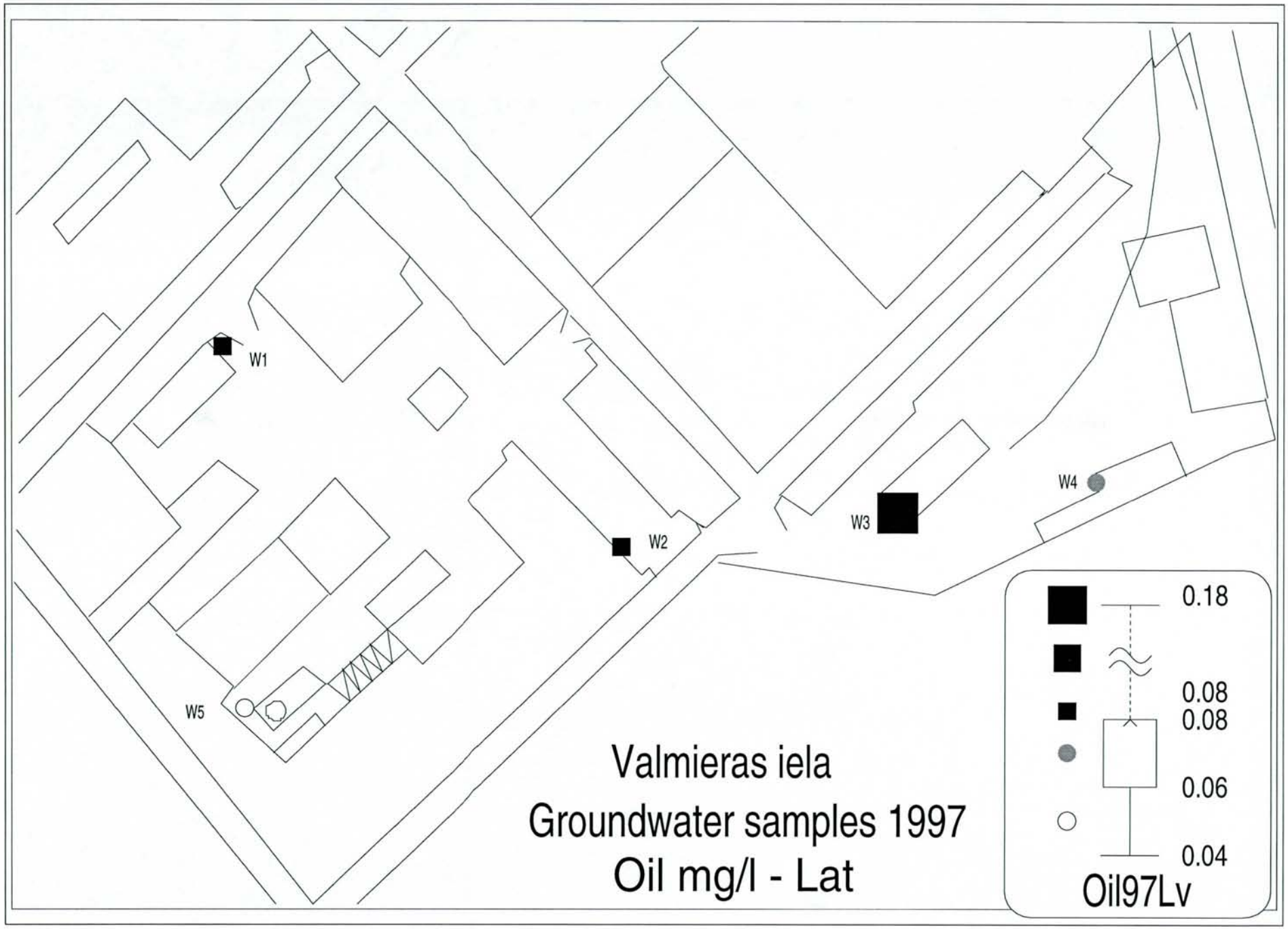

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
N (tot.) mg/L - Latvia
16
9.31
4.31
2.88
0.69
Ntot

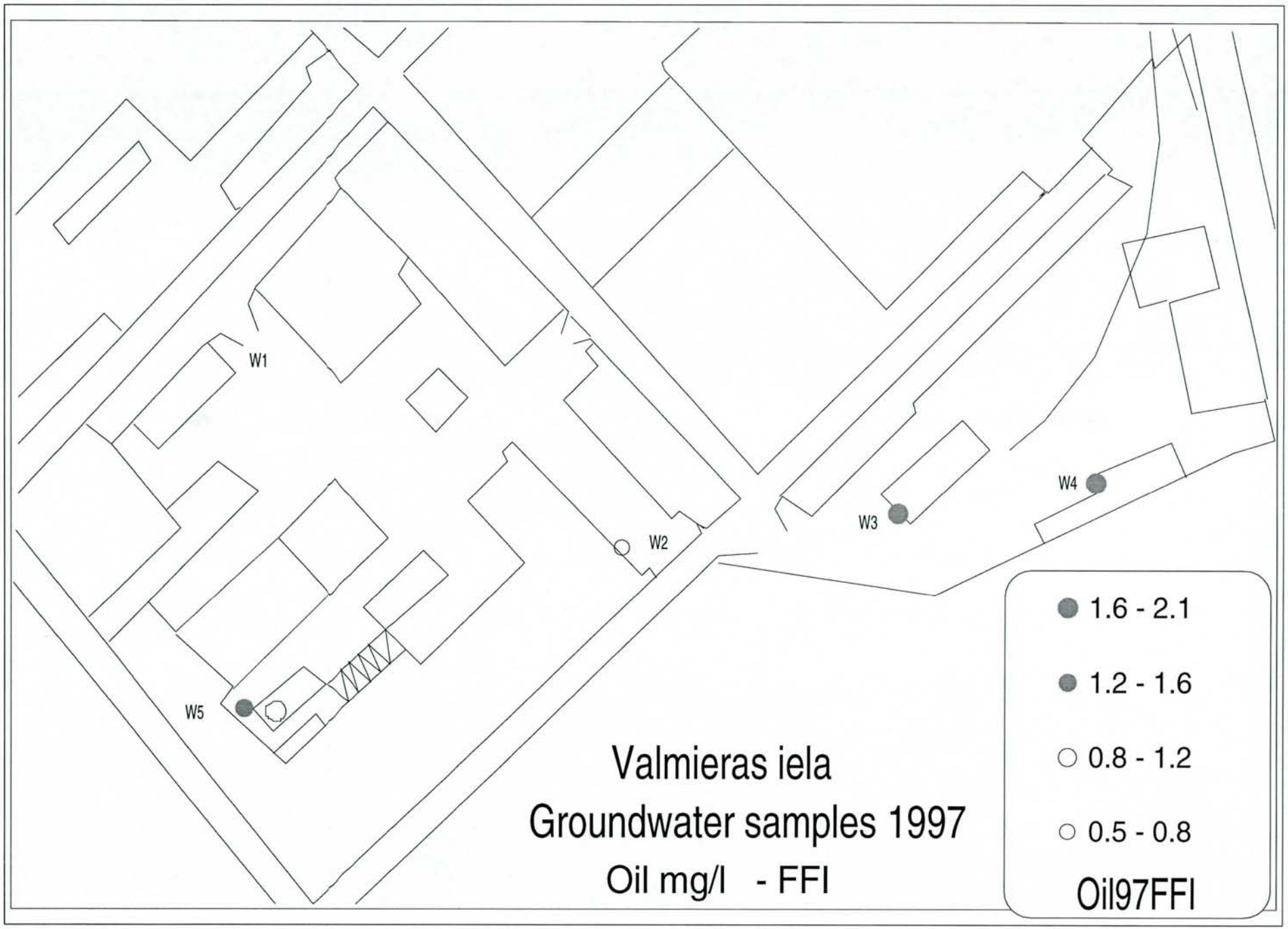

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
N-total mg/l - Lat
7.9
6.85
4.44
4.11
2.58
Ntot97Lv


W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Ni ug/L - Latvia
1.4
1.2
1
0.9
0.8
NiLat


Detection linit = 0.02 mg/L
W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Ni mg/L - NGU
0.0219
0.01
Ni


W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Ni ug/l - Lat
1.9
1.7
1
0.9
Ni97Lv

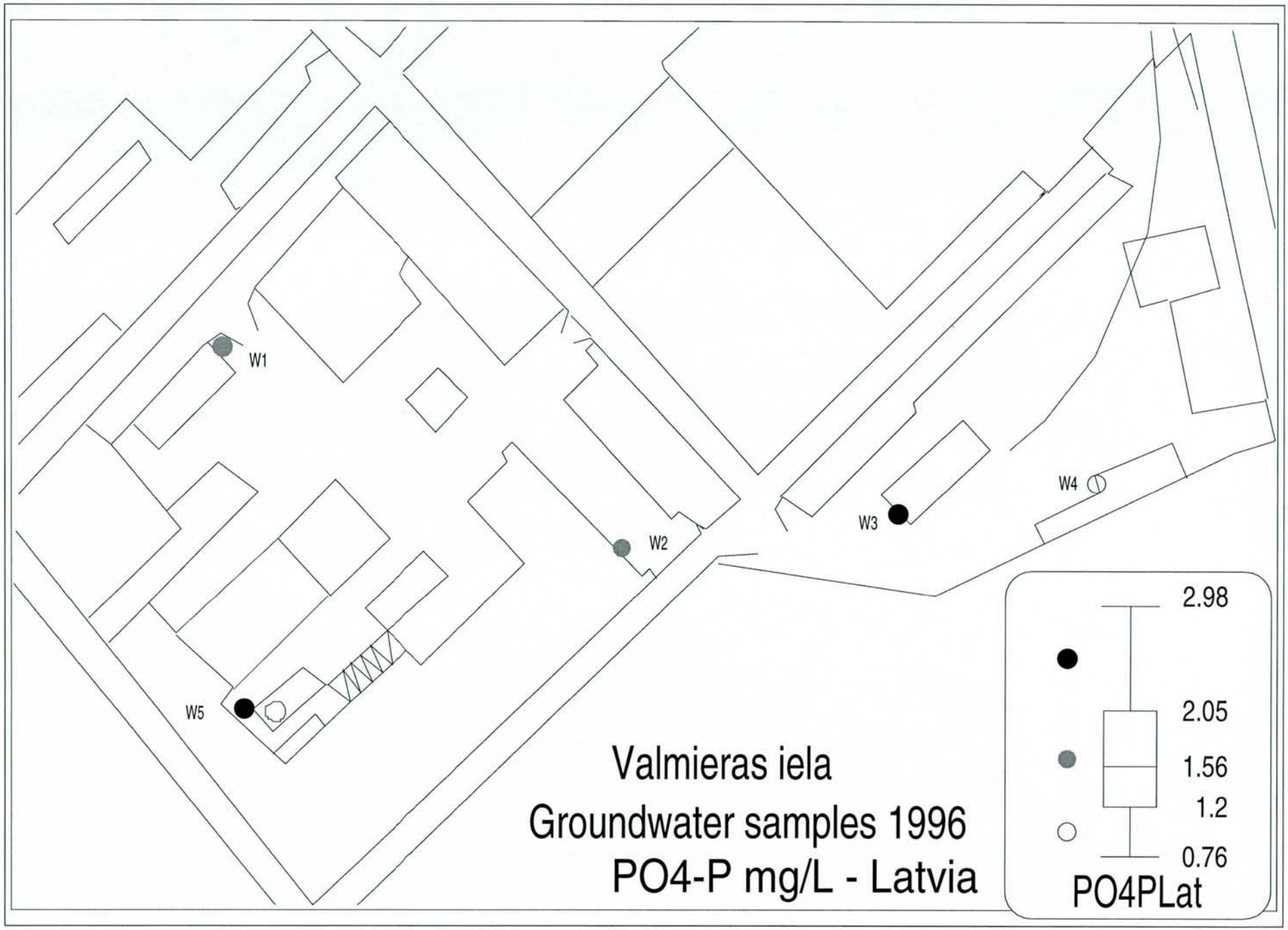

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Oil mg/l - Lat
0.18
0.08
0.08
0.06
0.04
Oil97Lv

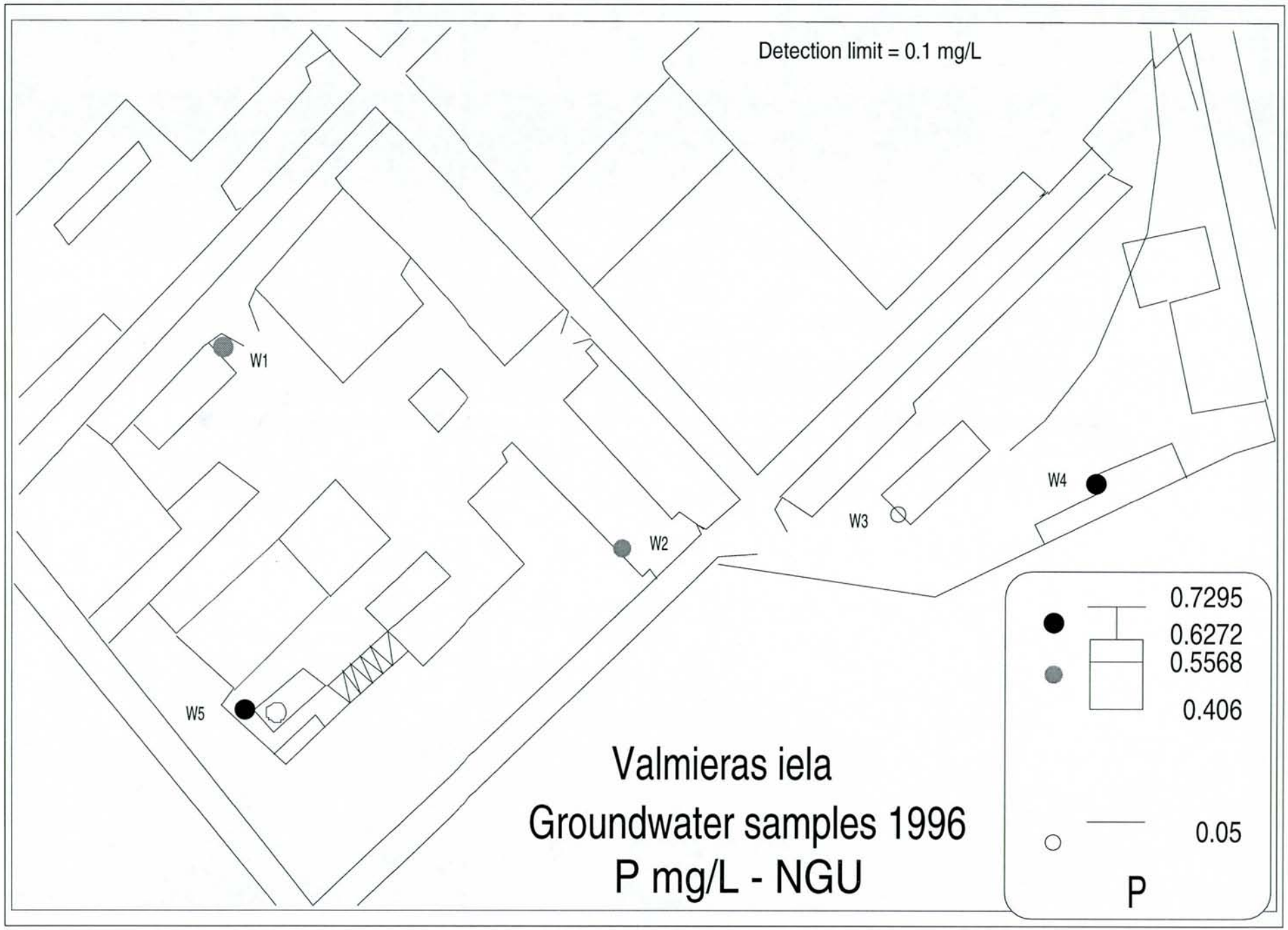


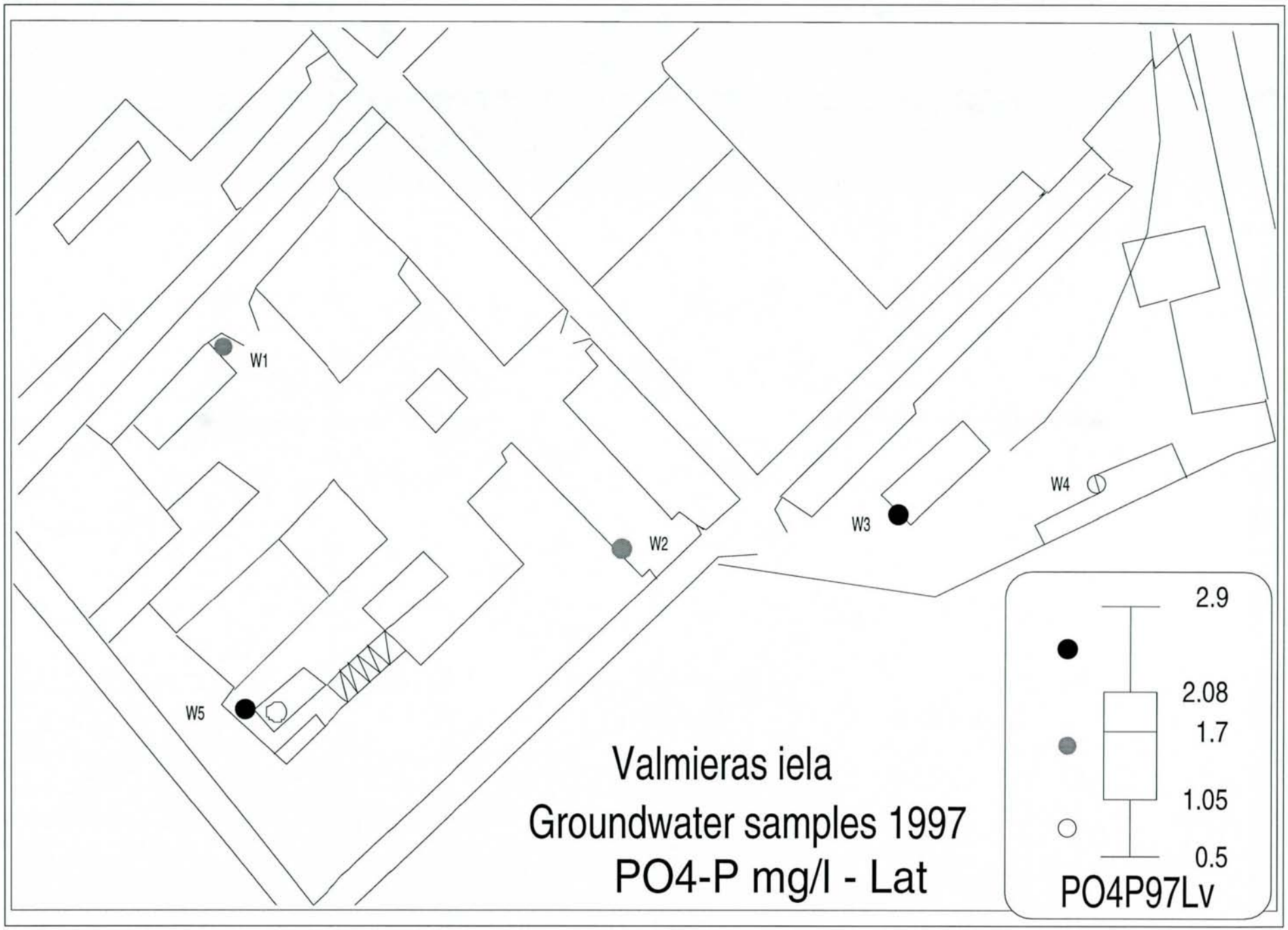
Valmieras iela

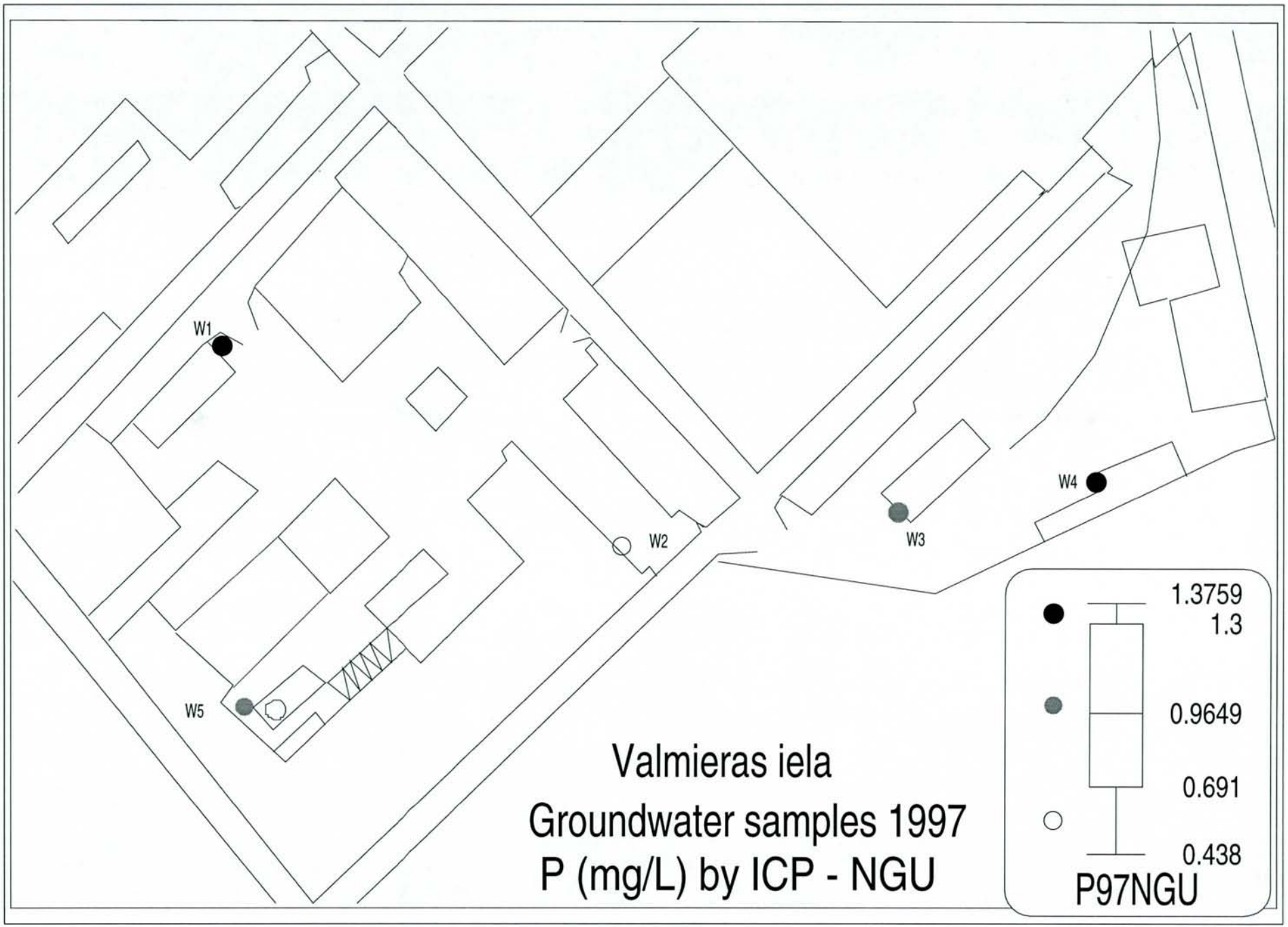
Groundwater samples 1997

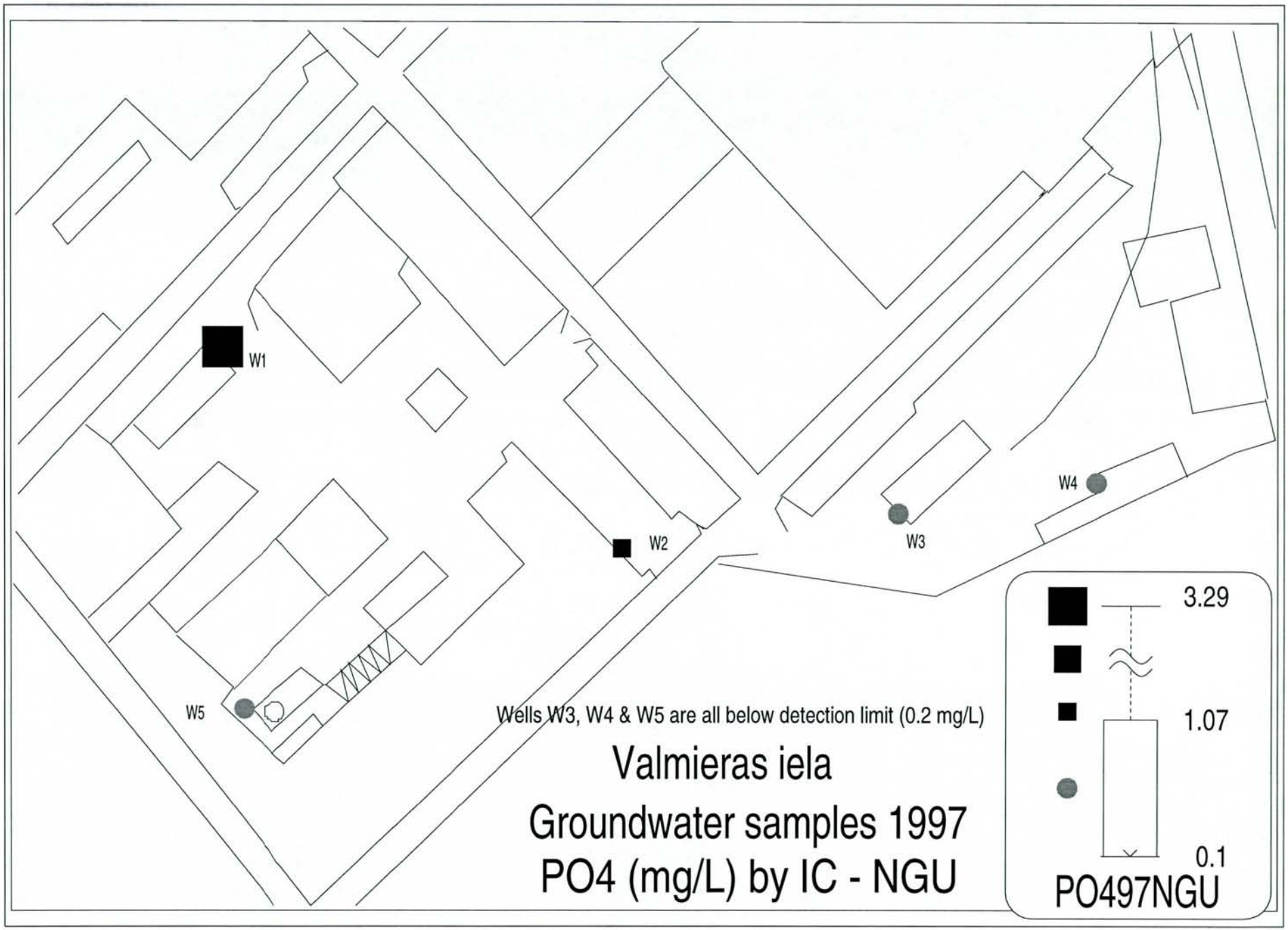
Oil mg/l - FFI

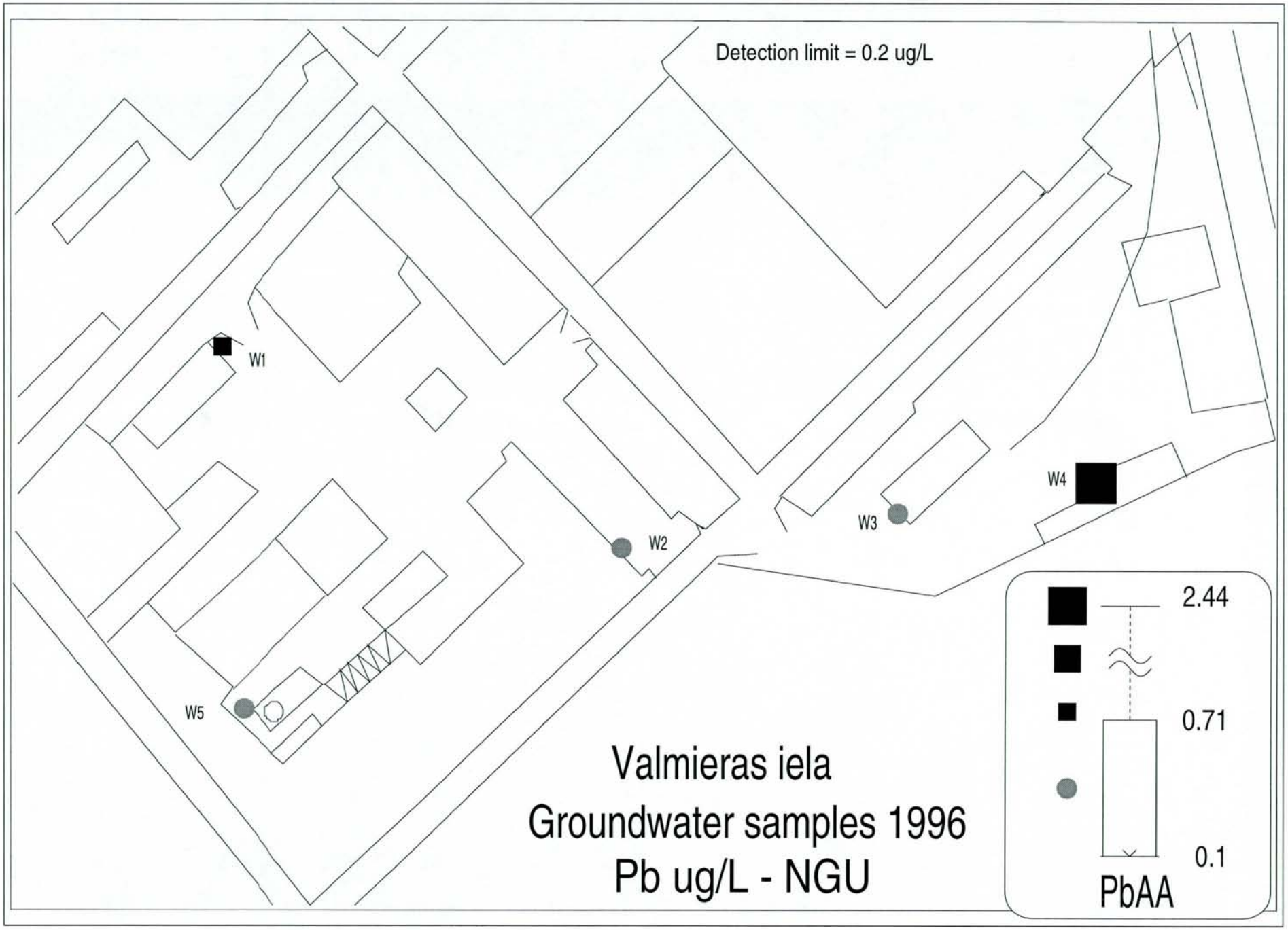

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
PO4-P mg/L - Latvia
2.98
2.05
1.56
1.2
0.76
PO4PLat

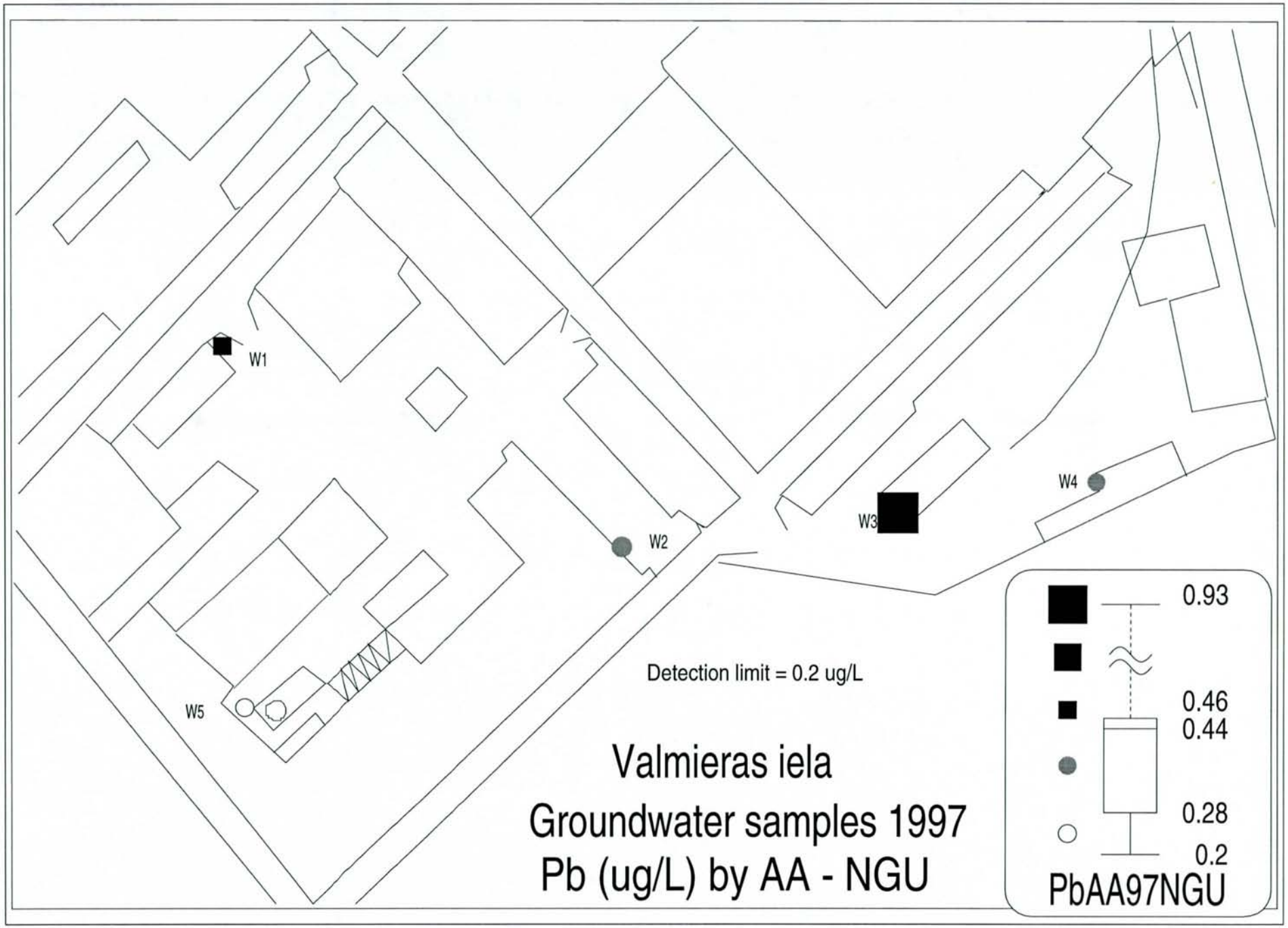

Detection limit = 0.1 mg/L
W1
W2
W3
W4
W5
0.7295
0.6272
0.5568
0.406
0.05
P
Valmieras iela
Groundwater samples 1996
P mg/L - NGU

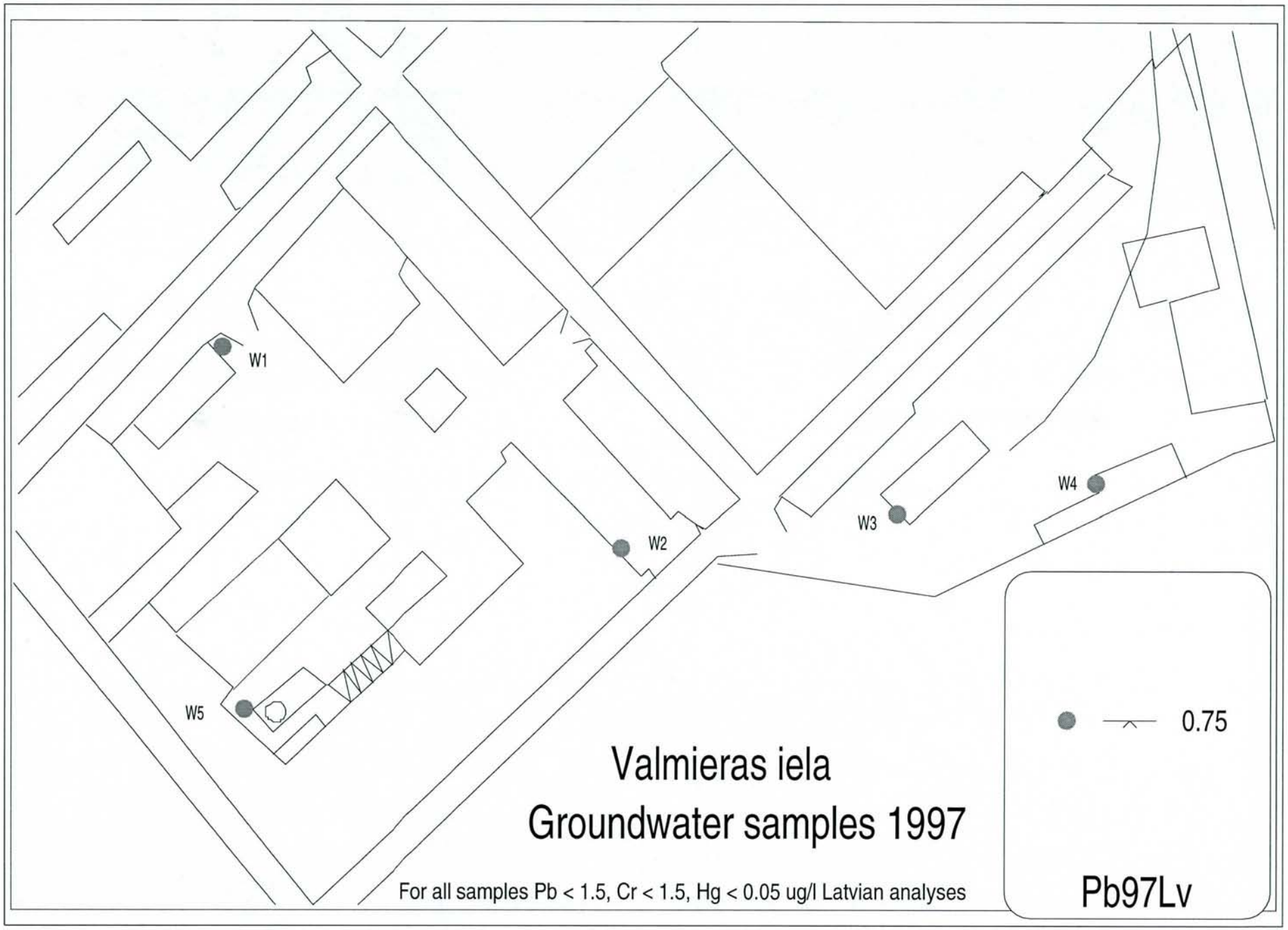

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
PO4-P mg/l - Lat
2.9
2.08
1.7
1.05
0.5
PO4P97Lv

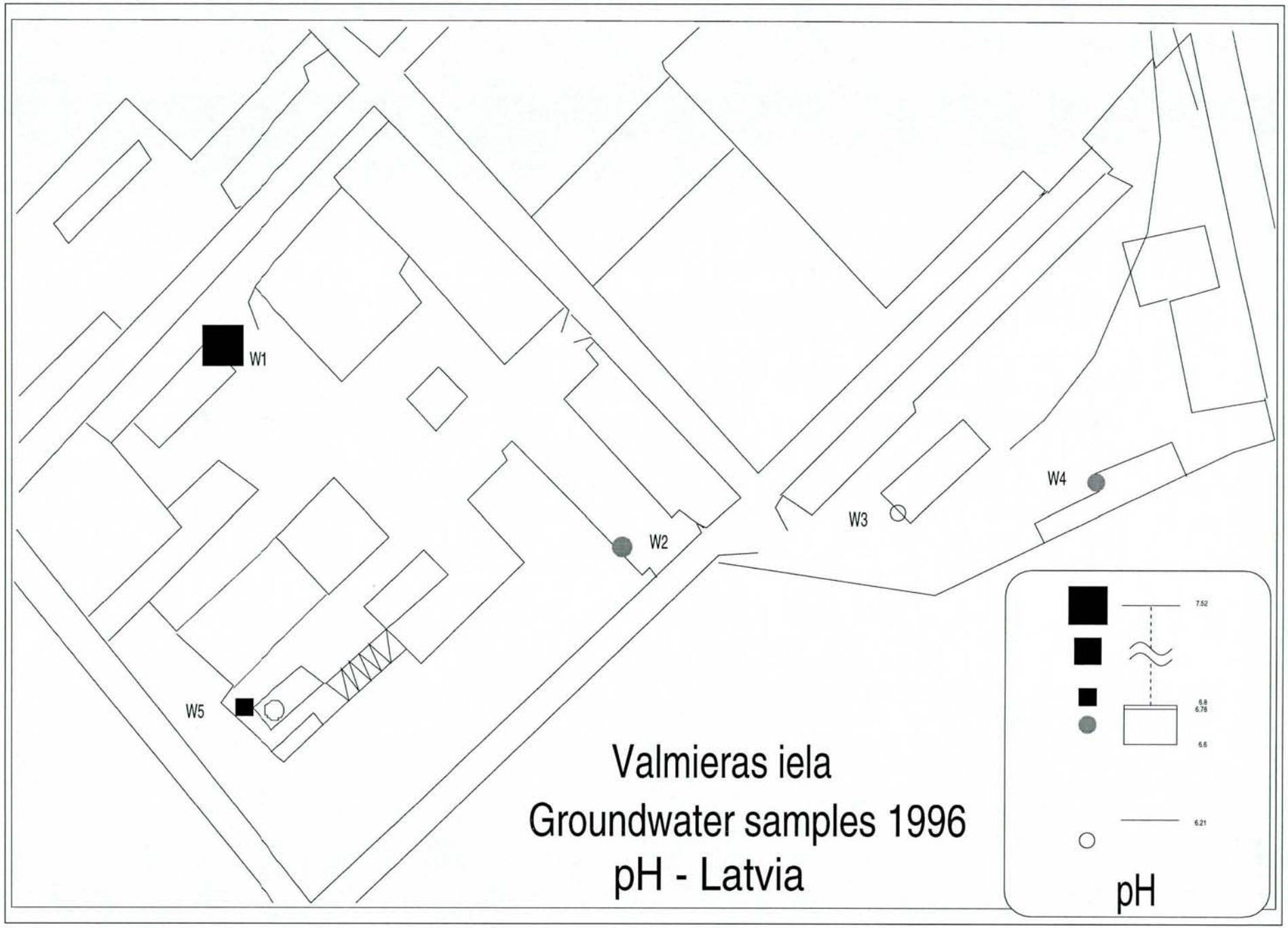

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
P (mg/L) by ICP - NGU
1.3759
1.3
0.9649
0.691
0.438
P97NGU

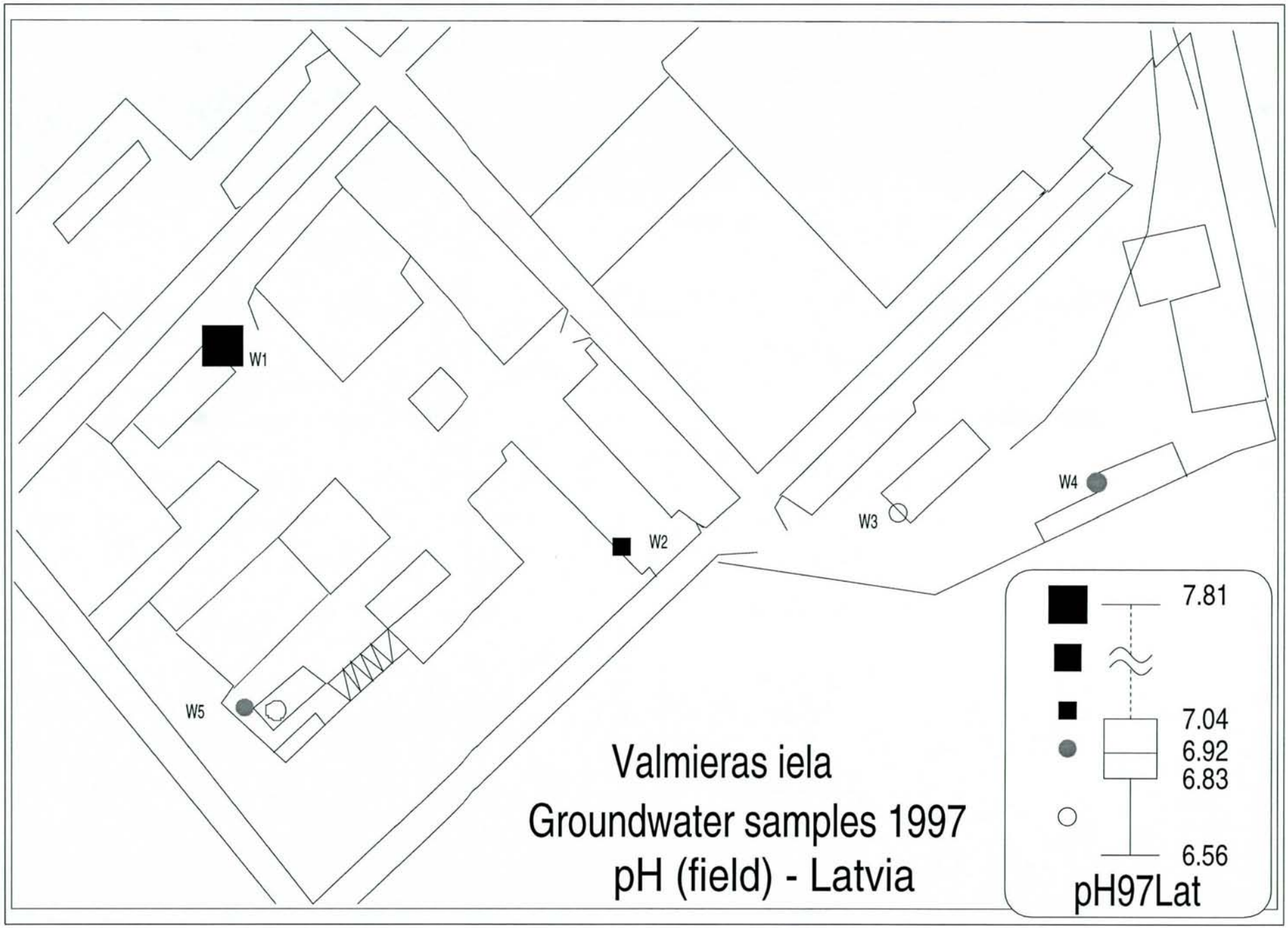

W1
W2
W3
W4
W5
Wells W3, W4 & W5 are all below detection limit (0.2 mg/L)
Valmieras iela
Groundwater samples 1997
PO4 (mg/L) by IC - NGU
3.29
1.07
0.1
PO497NGU

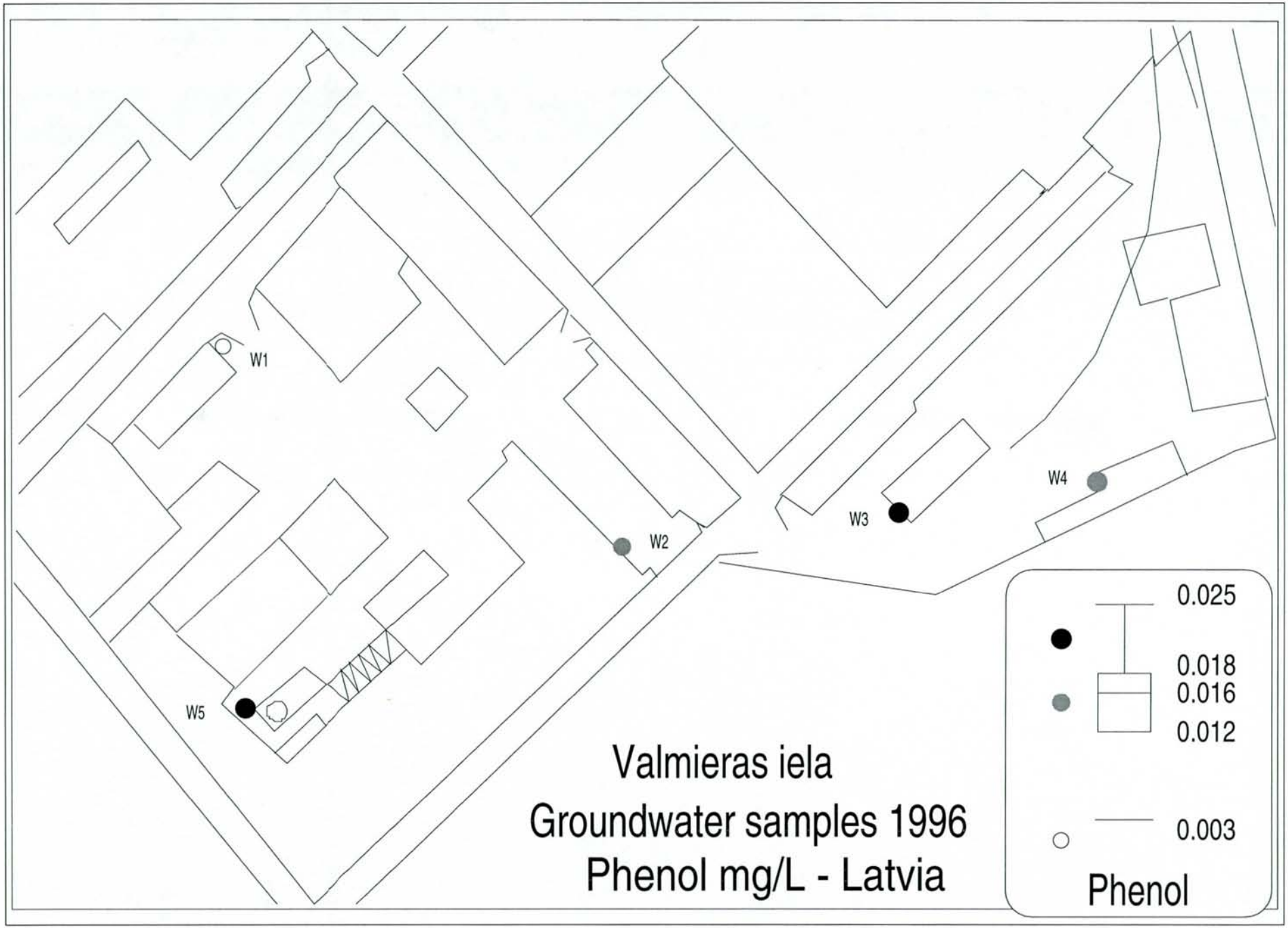

Detection limit = 0.2 ug/L
W1
W2
W3
W4
W5
2.44
0.71
0.1
PbAA
Valmieras iela
Groundwater samples 1996
Pb ug/L - NGU

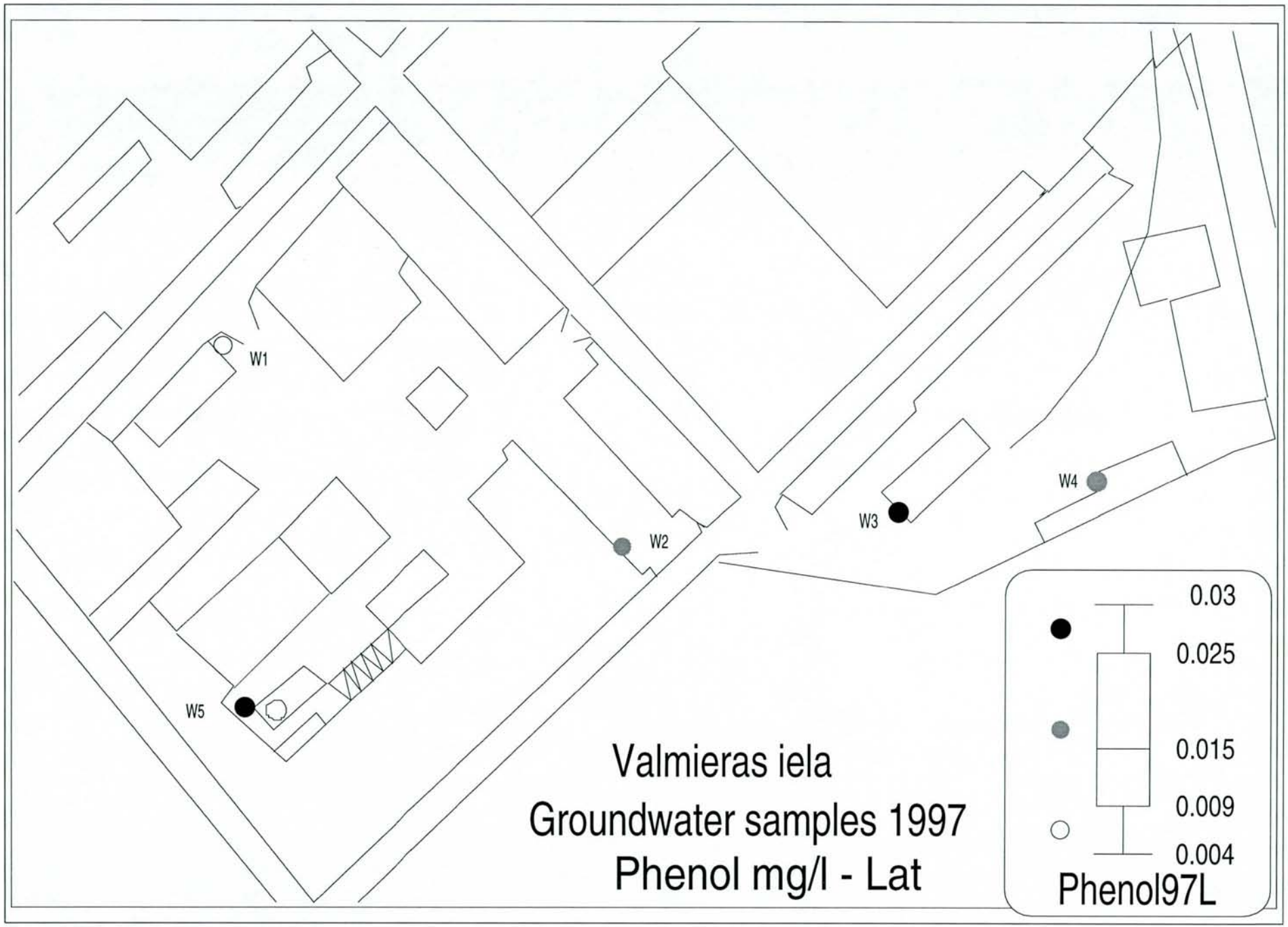

W1
W2
W3
W4
W5
Detection limit = 0.2 ug/L
Valmieras iela
Groundwater samples 1997
Pb (ug/L) by AA - NGU
0.93
0.46
0.44
0.28
0.2
PbAA97NGU

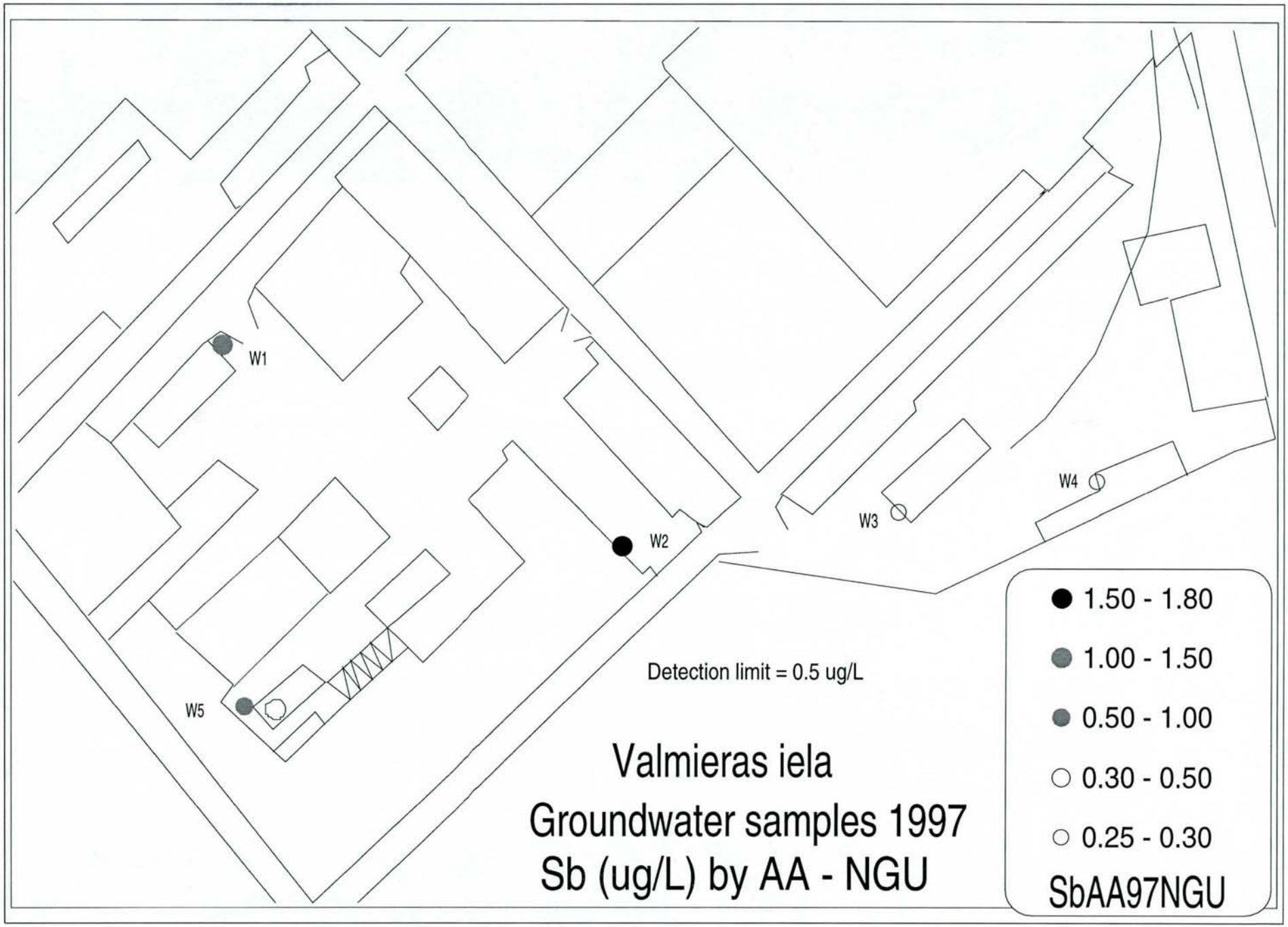

W1
W2
W3
W4
W5
0.75
Valmieras iela
Groundwater samples 1997
For all samples Pb < 1.5, Cr < 1.5, Hg < 0.05 ug/l Latvian analyses
Pb97Lv

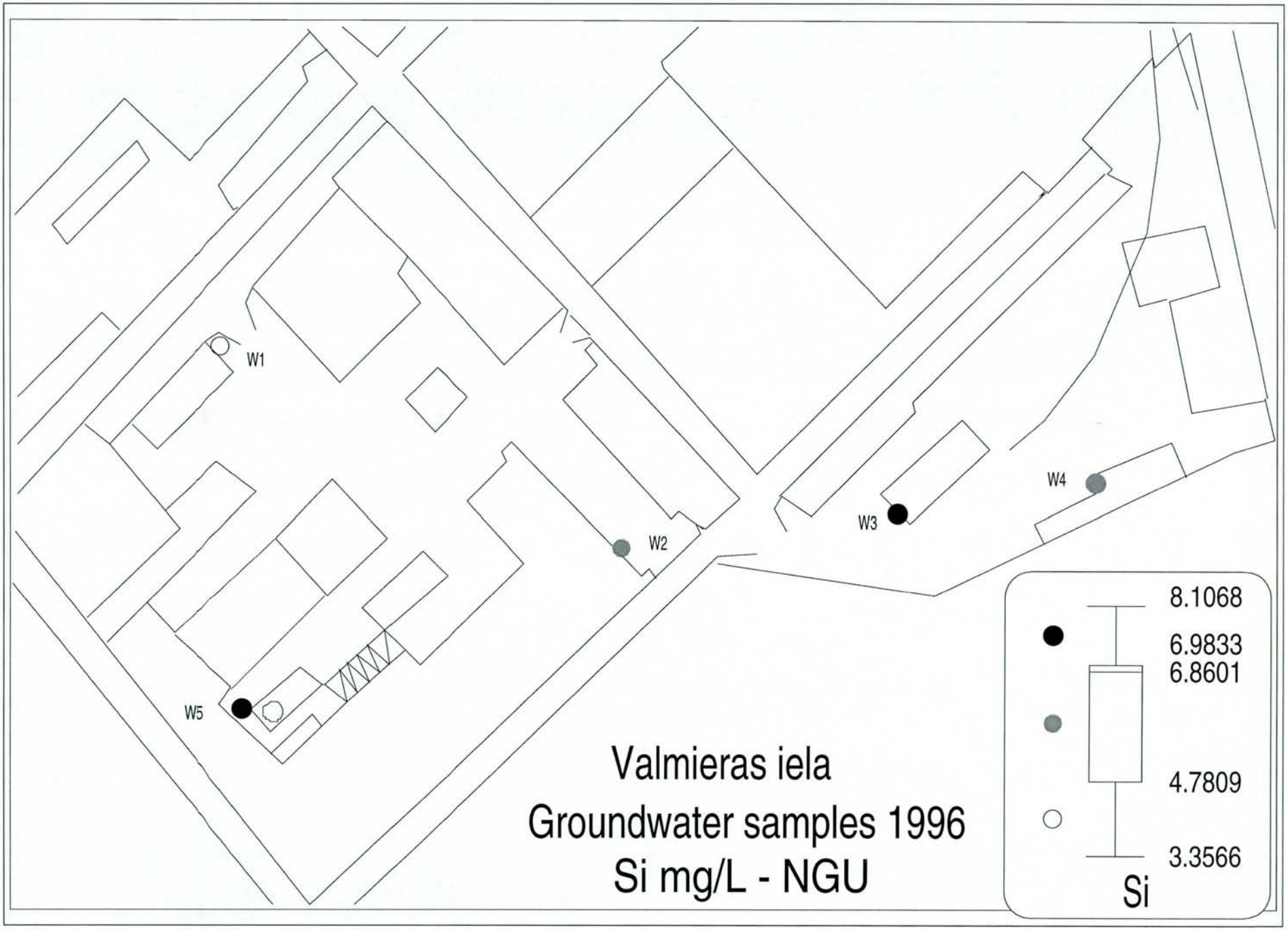

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
pH - Latvia
7.52
6.8
6.78
6.6
6.21
pH

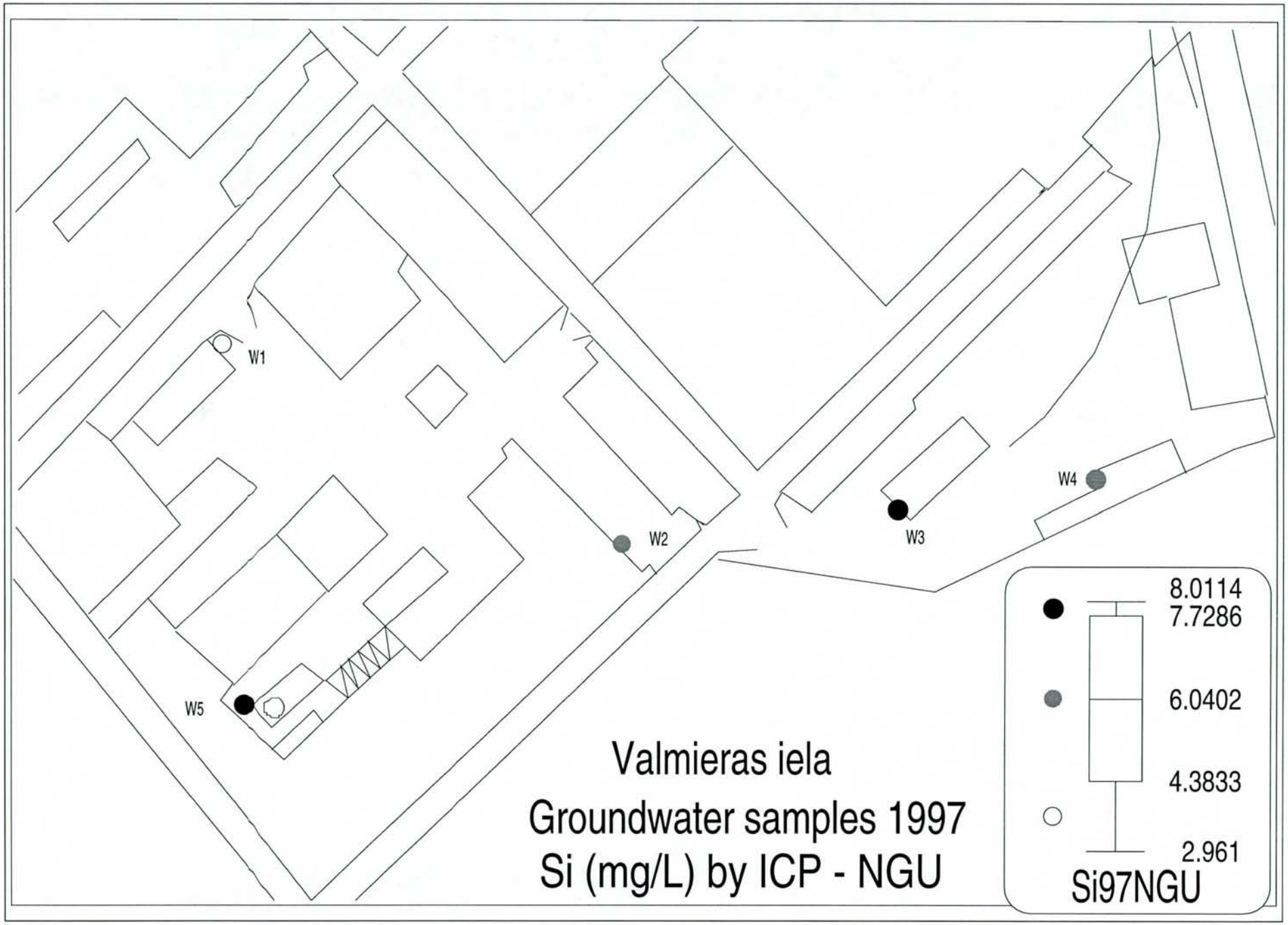

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
pH (field) - Latvia
7.81
7.04
6.92
6.83
6.56
pH97Lat

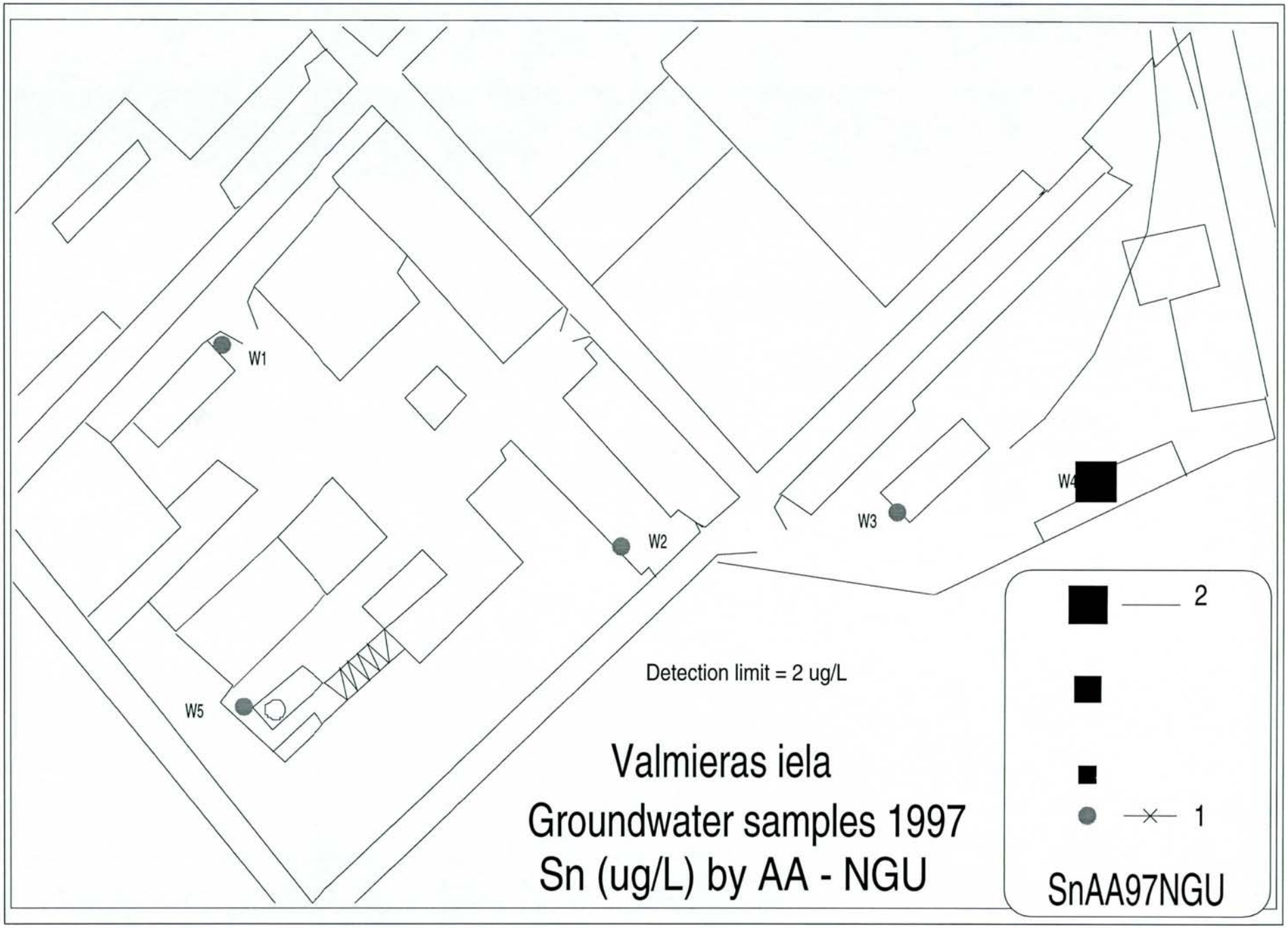

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Phenol mg/L - Latvia
0.025
0.018
0.016
0.012
0.003
Phenol

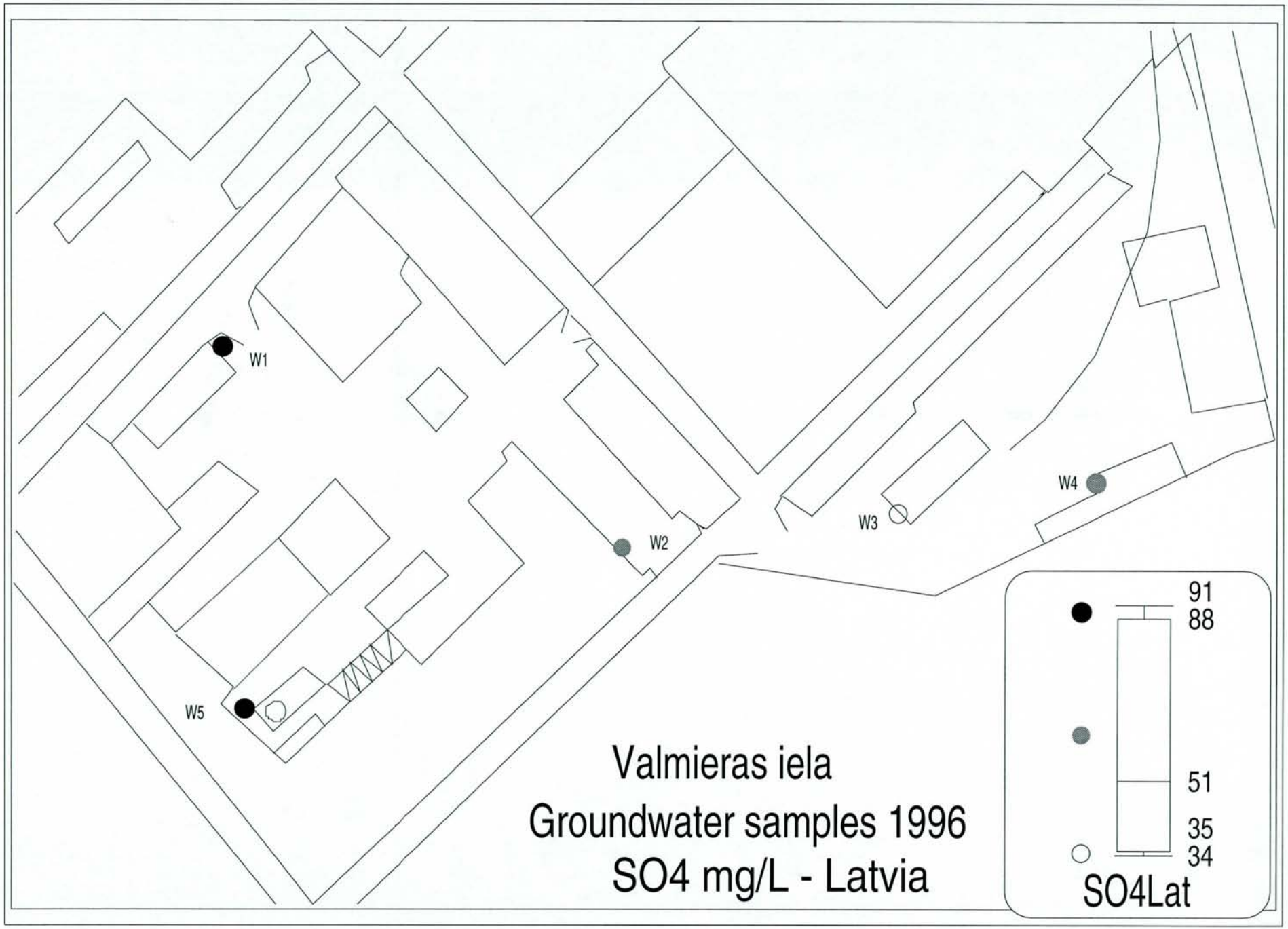

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Phenol mg/l - Lat
0.03
0.025
0.015
0.009
0.004
Phenol97L

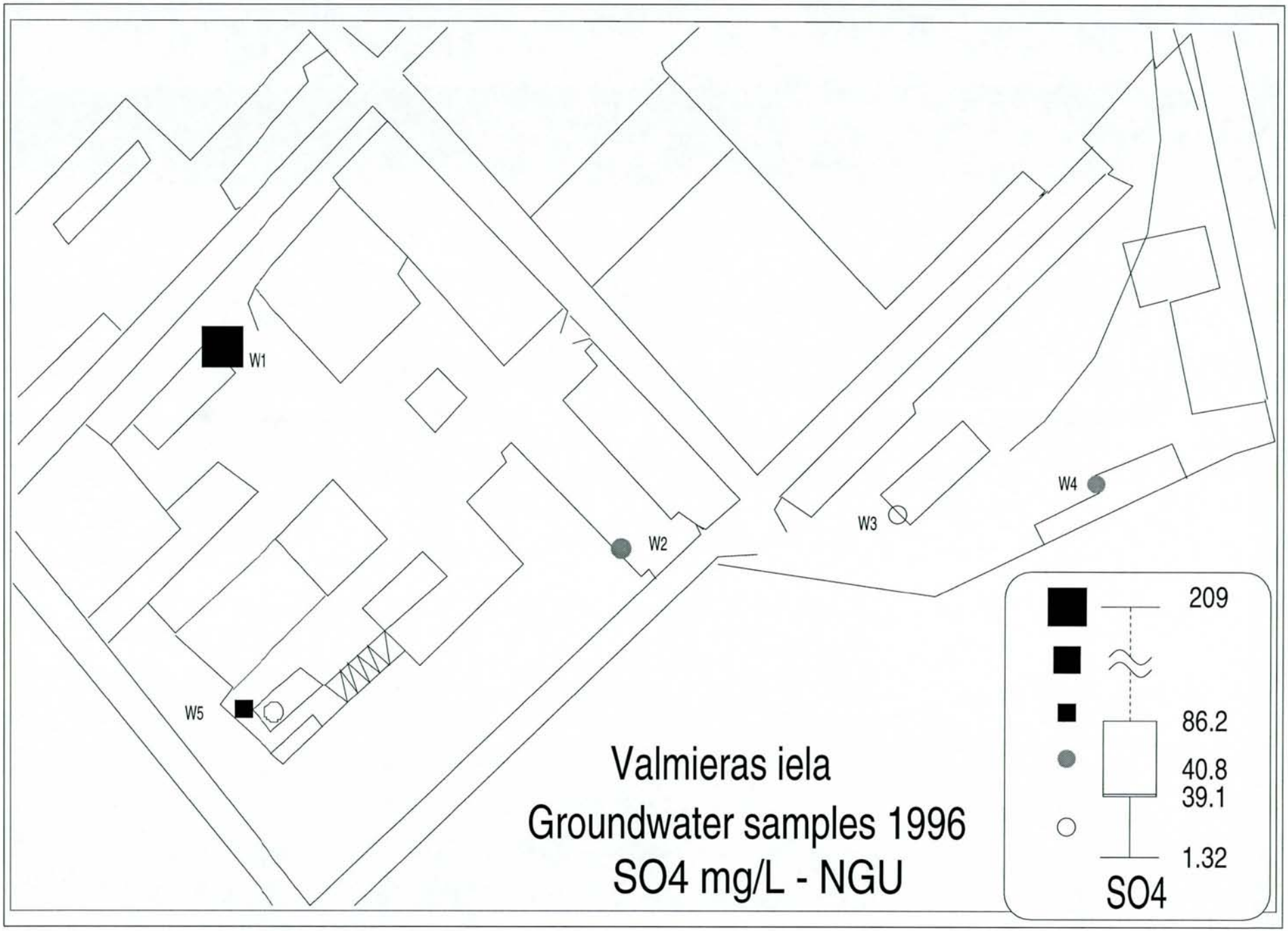

W1
W2
W3
W4
W5
Detection limit = 0.5 ug/L
Valmieras iela
Groundwater samples 1997
Sb (ug/L) by AA - NGU
1.50 - 1.80
1.00 - 1.50
0.50 - 1.00
0.30 - 0.50
0.25 - 0.30
SbAA97NGU

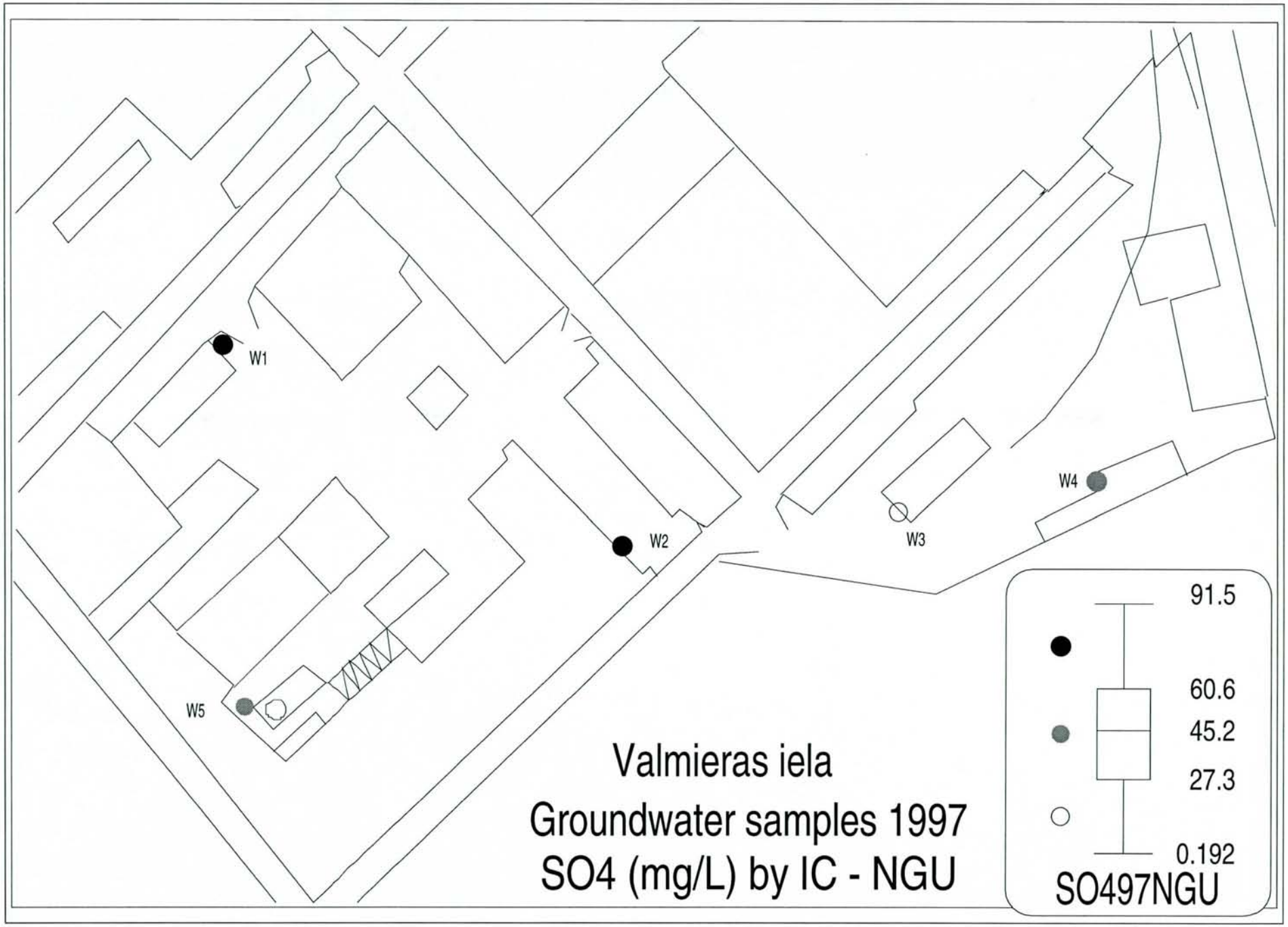

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Si mg/L - NGU
8.1068
6.9833
6.8601
4.7809
3.3566
Si

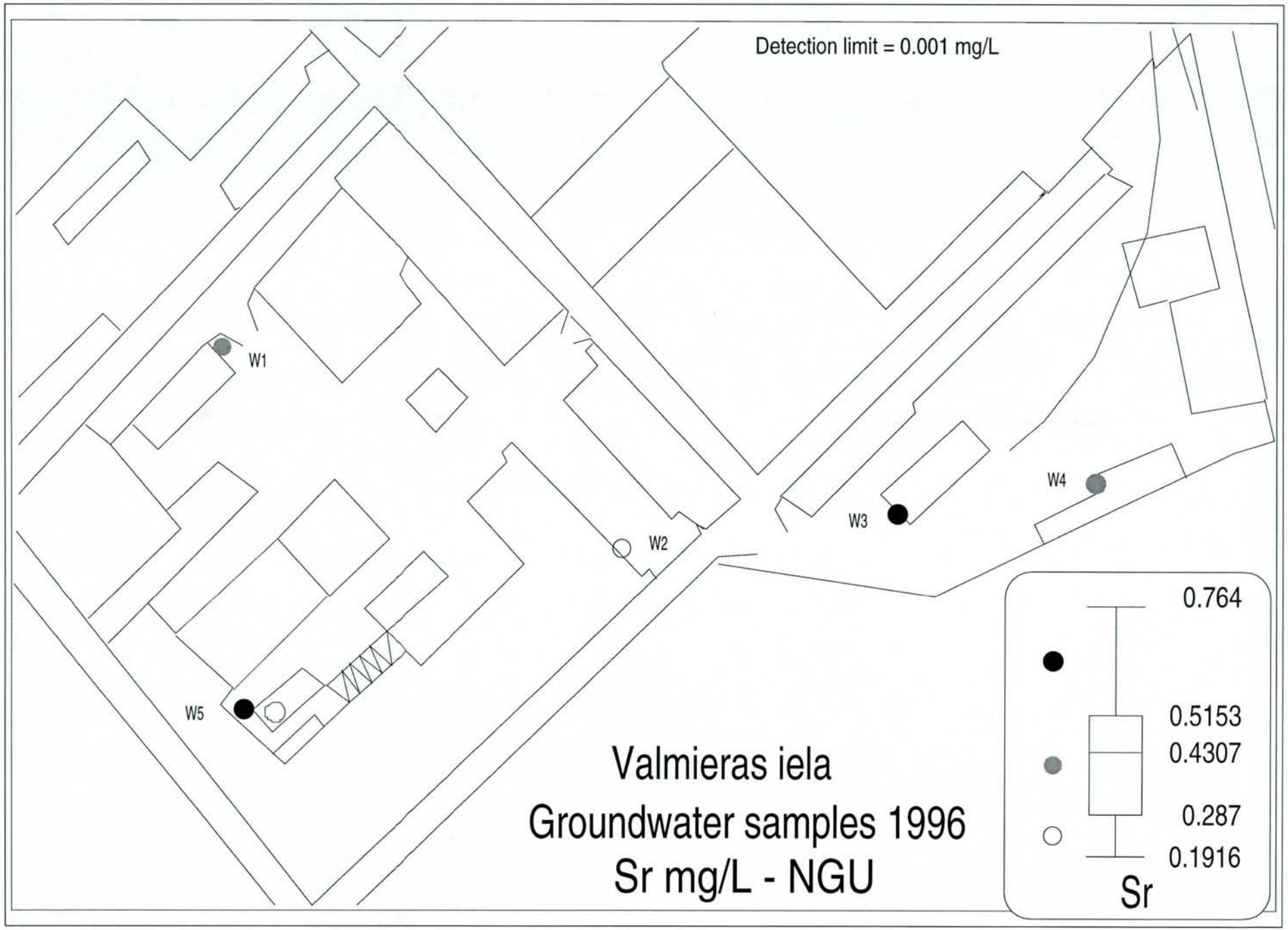

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Si (mg/L) by ICP - NGU
8.0114
7.7286
6.0402
4.3833
2.961
Si97NGU

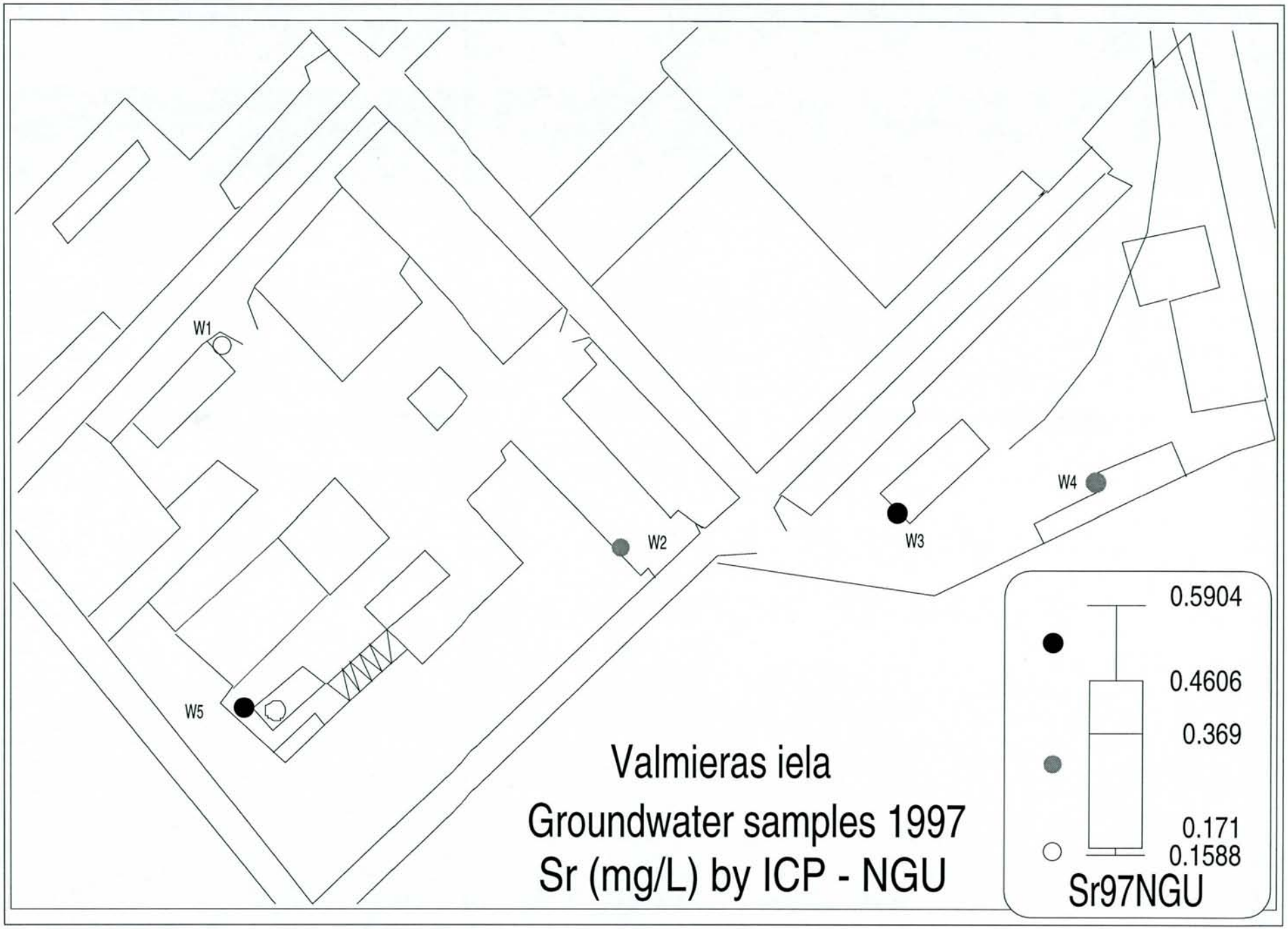

W1
W2
W3
W4
W5
Detection limit = 2 ug/L
Valmieras iela
Groundwater samples 1997
Sn (ug/L) by AA - NGU
2
1
SnAA97NGU

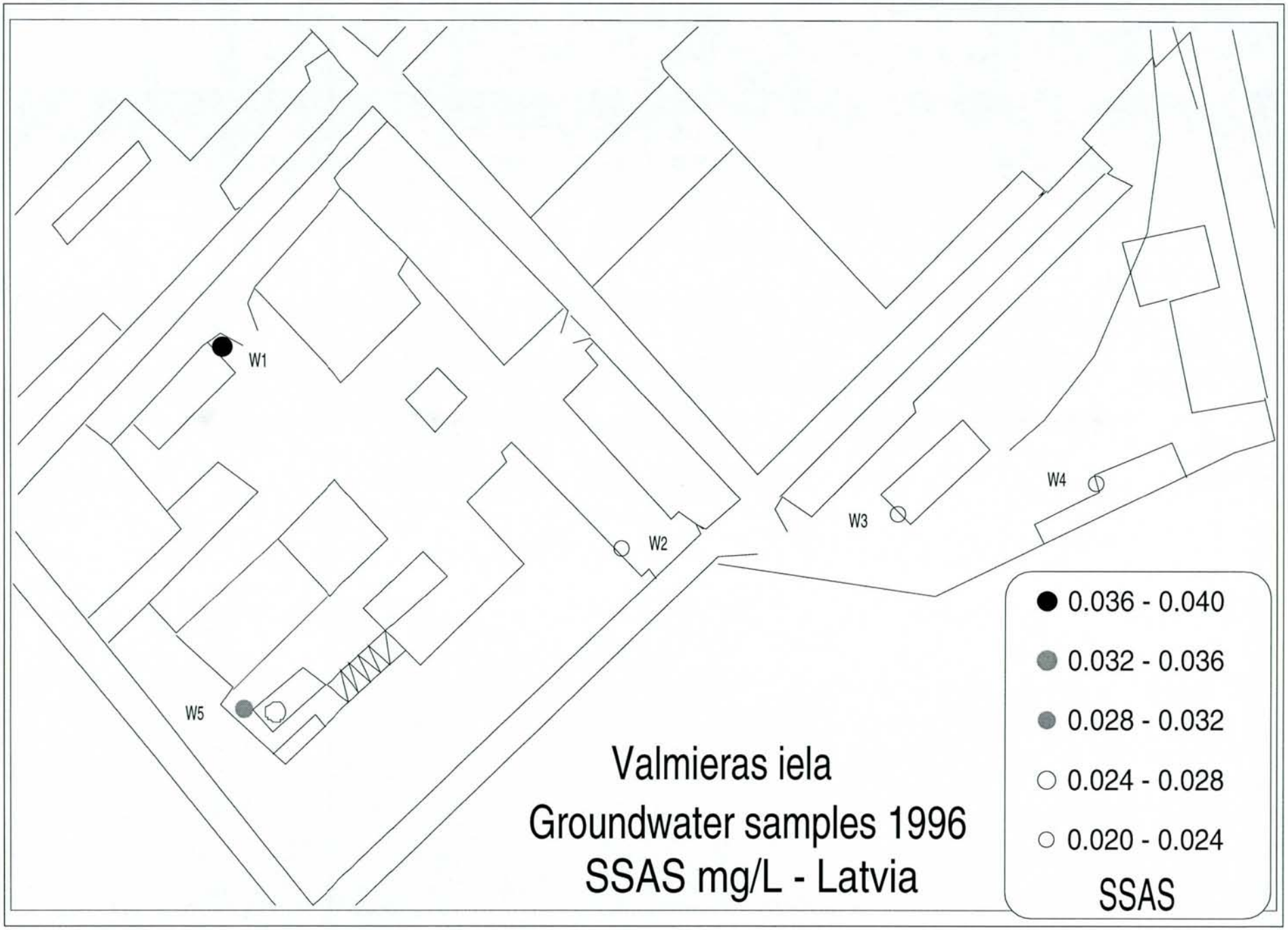

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
SO4 mg/L - Latvia
91
88
51
35
34
SO4Lat

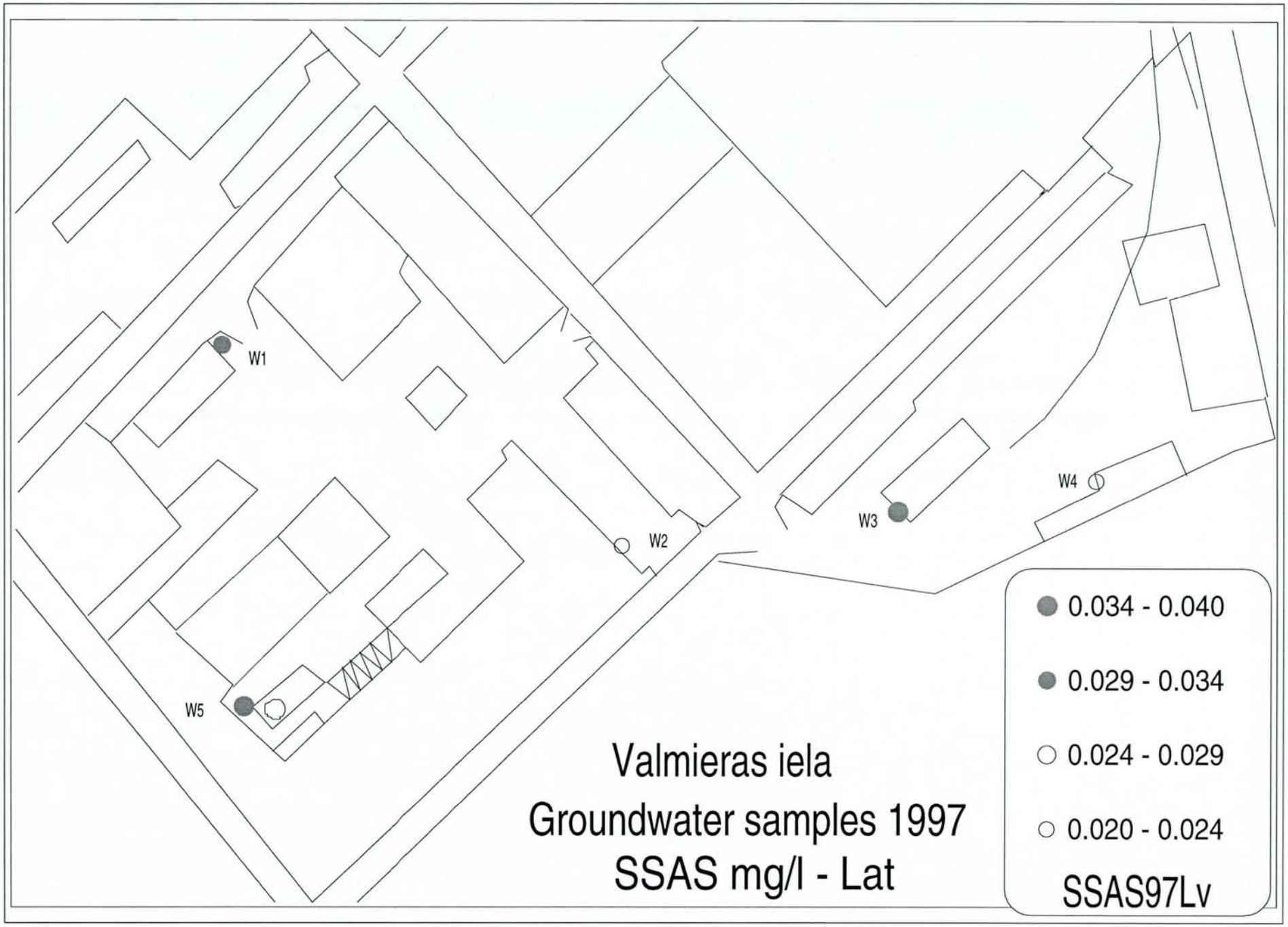

W1
W2
W3
W4
W5
209
86.2
40.8
39.1
1.32
SO4
Valmieras iela
Groundwater samples 1996
SO4 mg/L - NGU

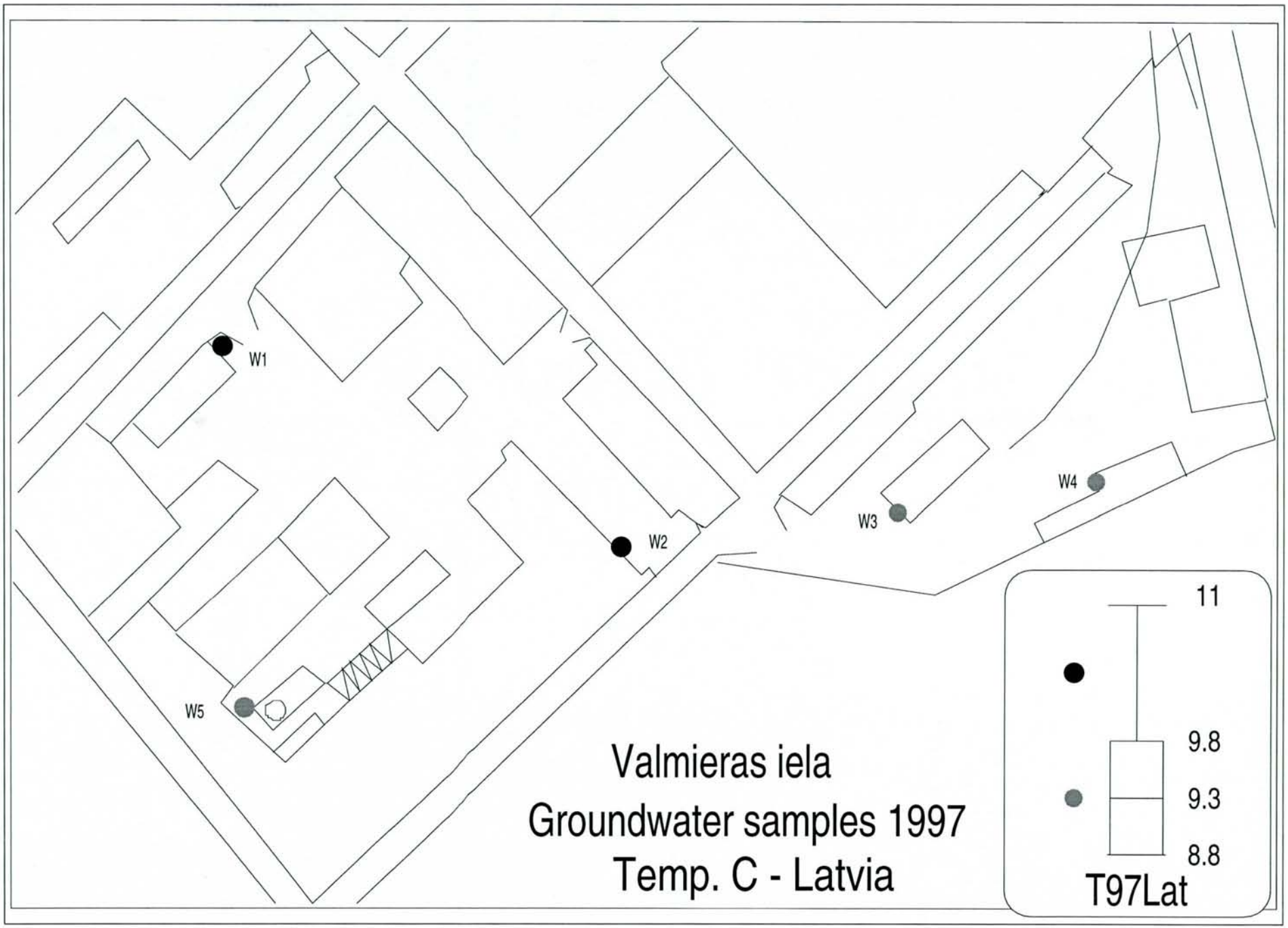

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
SO4 (mg/L) by IC - NGU
91.5
60.6
45.2
27.3
0.192
SO497NGU

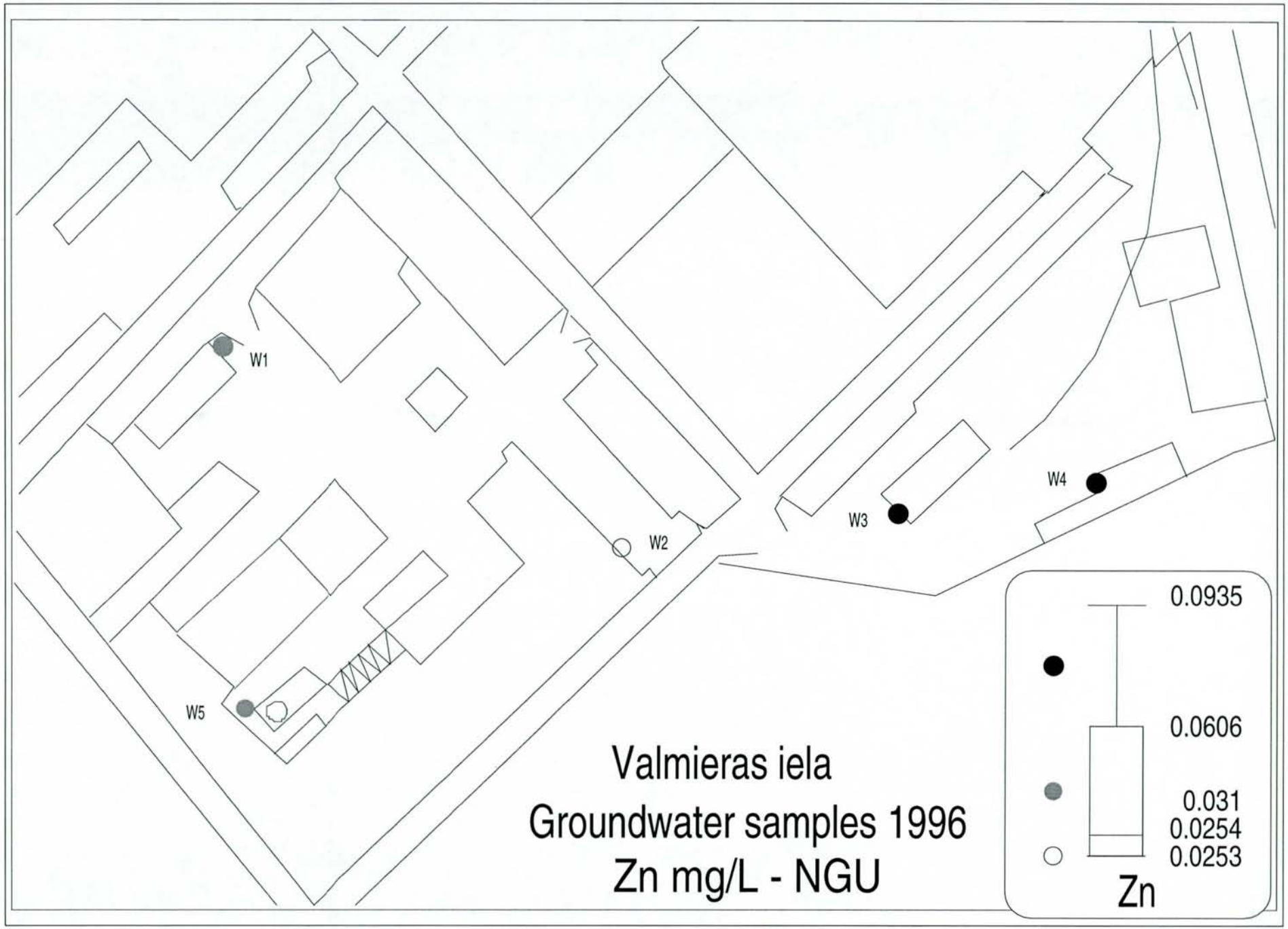

Detection limit = 0.001 mg/L
W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Sr mg/L - NGU
0.764
0.5153
0.4307
0.287
0.1916
Sr

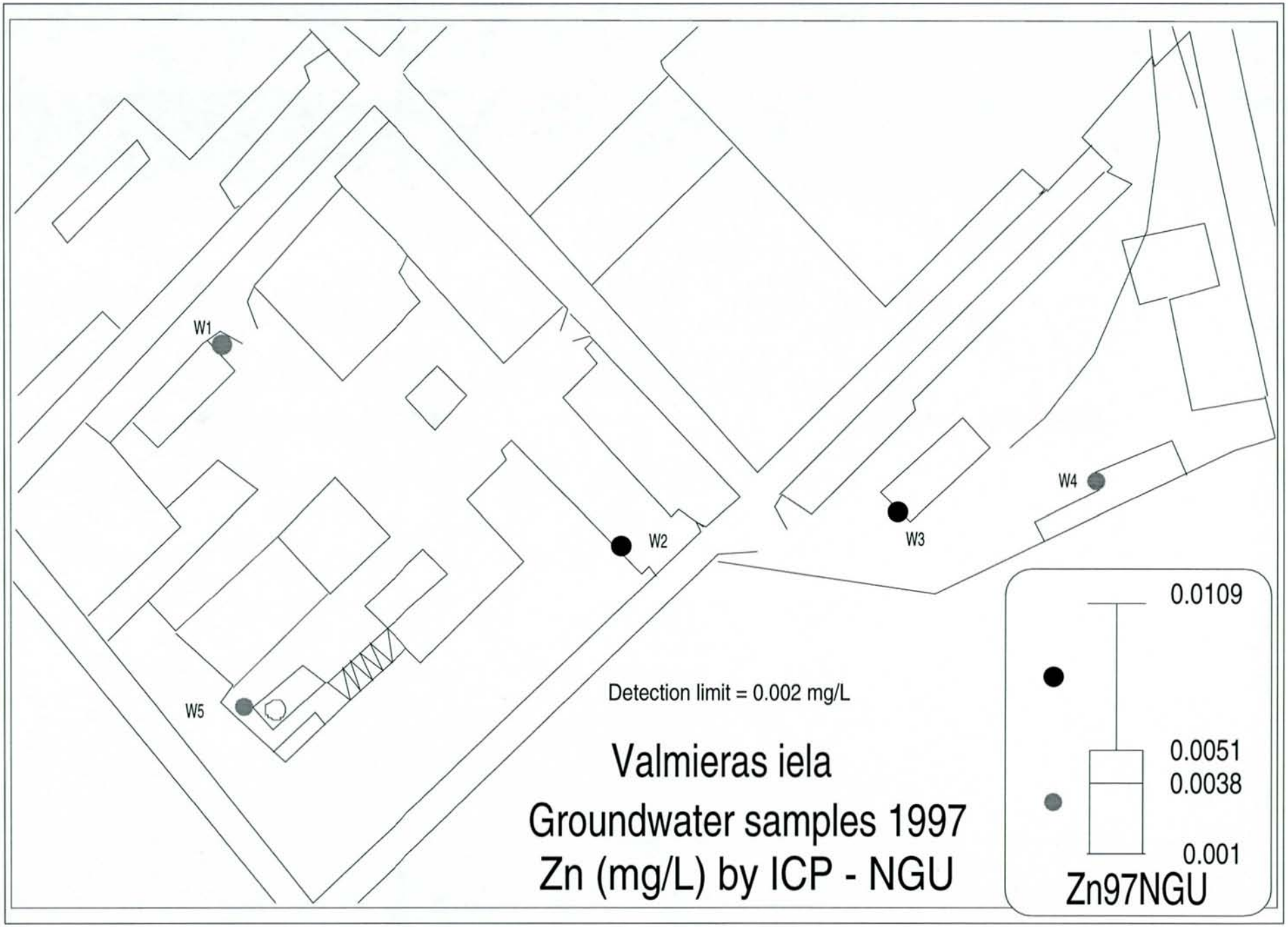

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Sr (mg/L) by ICP - NGU
0.5904
0.4606
0.369
0.171
0.1588
Sr97NGU

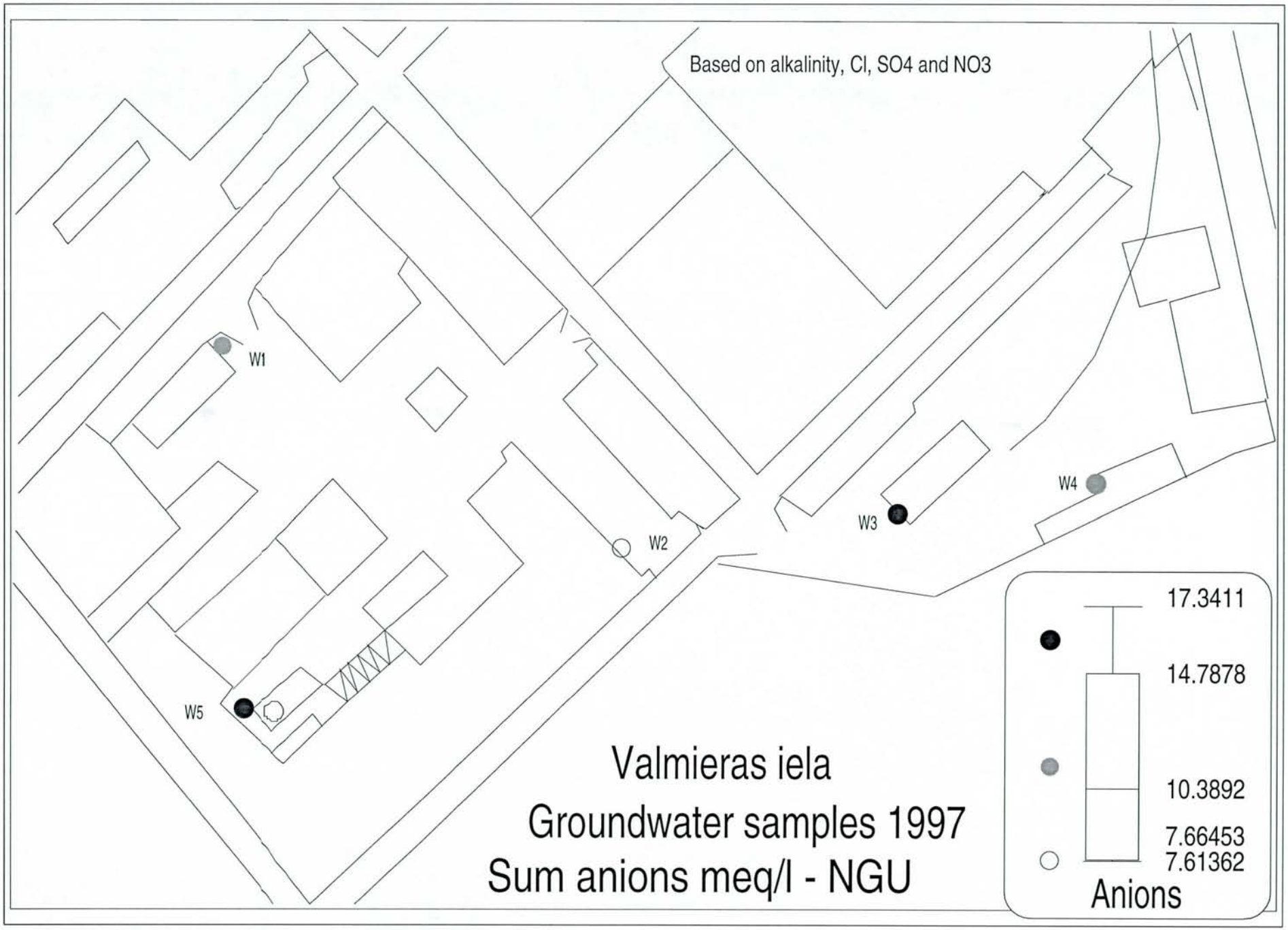

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
SSAS mg/L - Latvia
0.036 - 0.040
0.032 - 0.036
0.028 - 0.032
0.024 - 0.028
0.020 - 0.024
SSAS

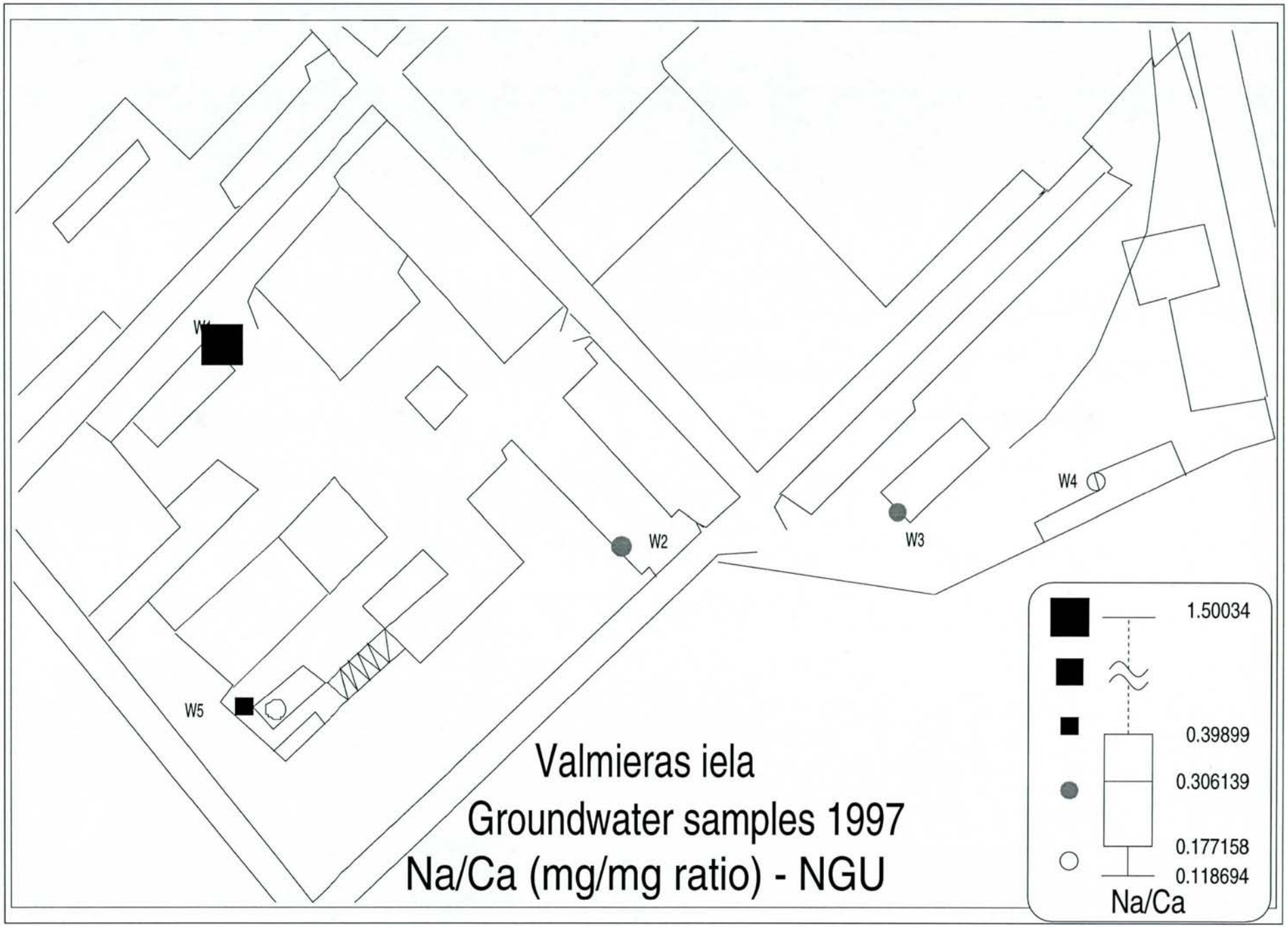

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
SSAS mg/l - Lat
0.034 - 0.040
0.029 - 0.034
0.024 - 0.029
0.020 - 0.024
SSAS97Lv

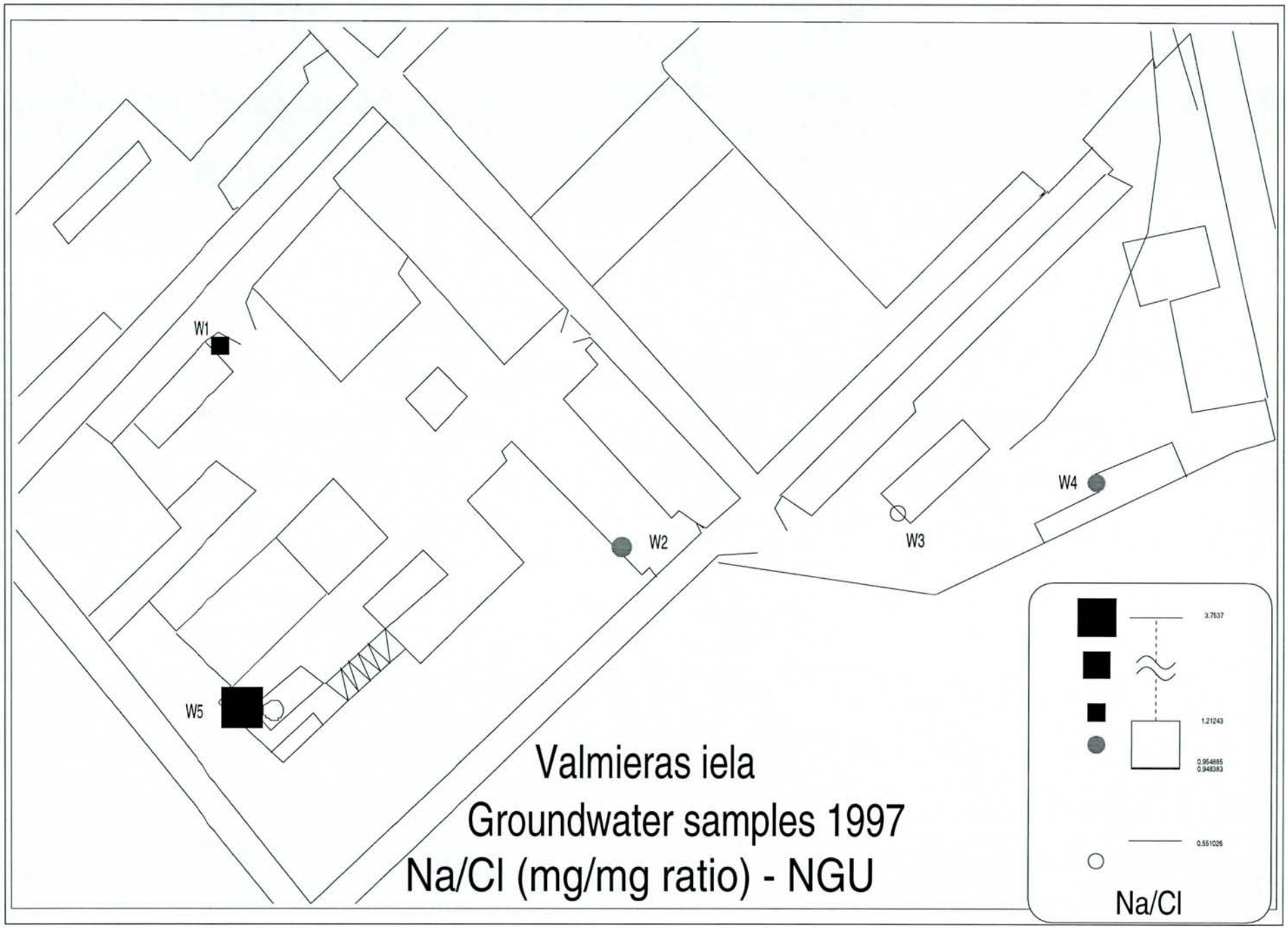

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Temp. C - Latvia
11
9.8
9.3
8.8
T97Lat

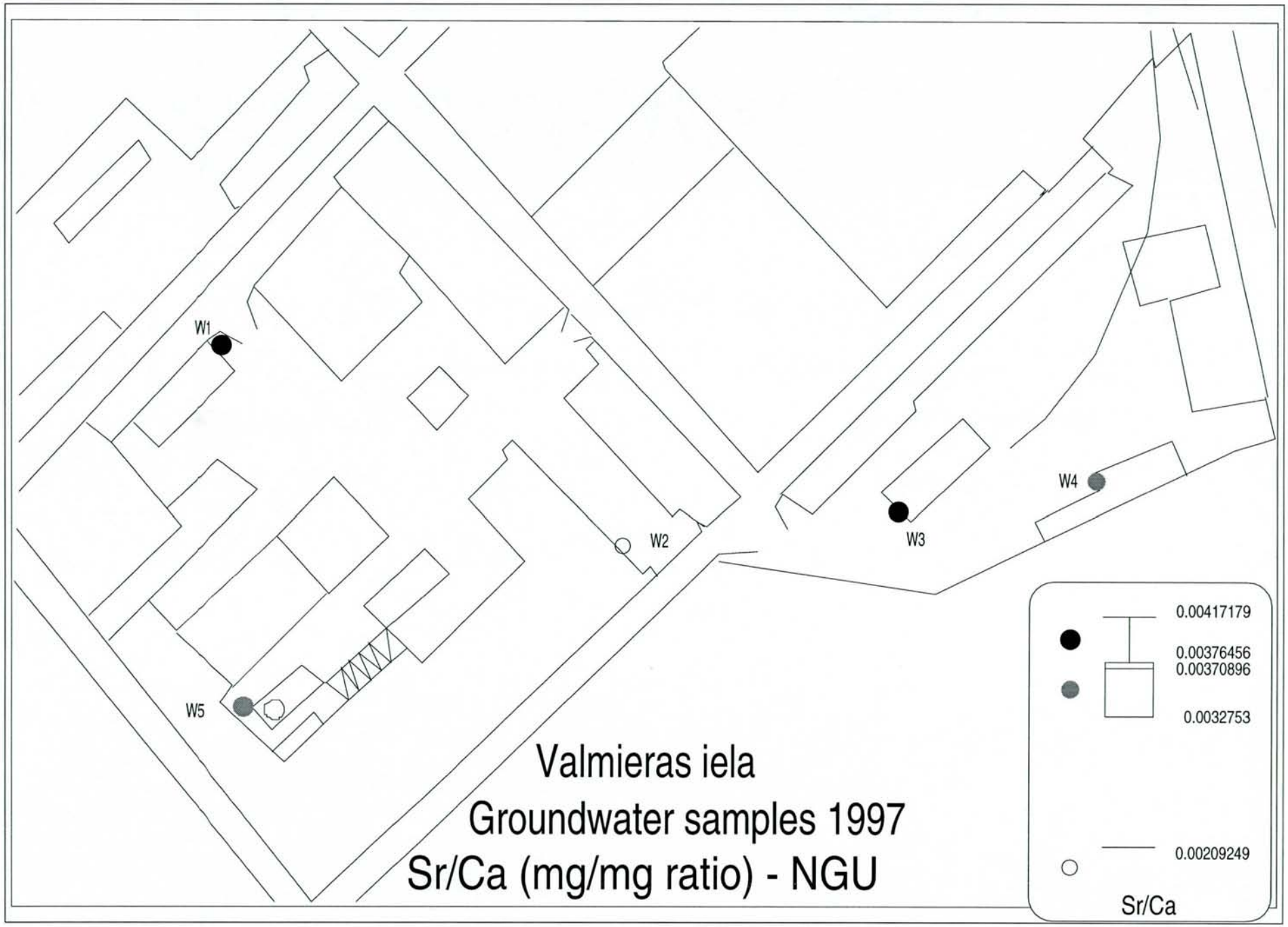

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1996
Zn mg/L - NGU
0.0935
0.0606
0.031
0.0254
0.0253
Zn


W1
W2
W3
W4
W5
Detection limit = 0.002 mg/L
Valmieras iela
Groundwater samples 1997
Zn (mg/L) by ICP - NGU
0.0109
0.0051
0.0038
0.001
Zn97NGU


Based on alkalinity, Cl, SO4 and NO3
W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Sum anions meq/l - NGU
17.3411
14.7878
10.3892
7.66453
7.61362
Anions

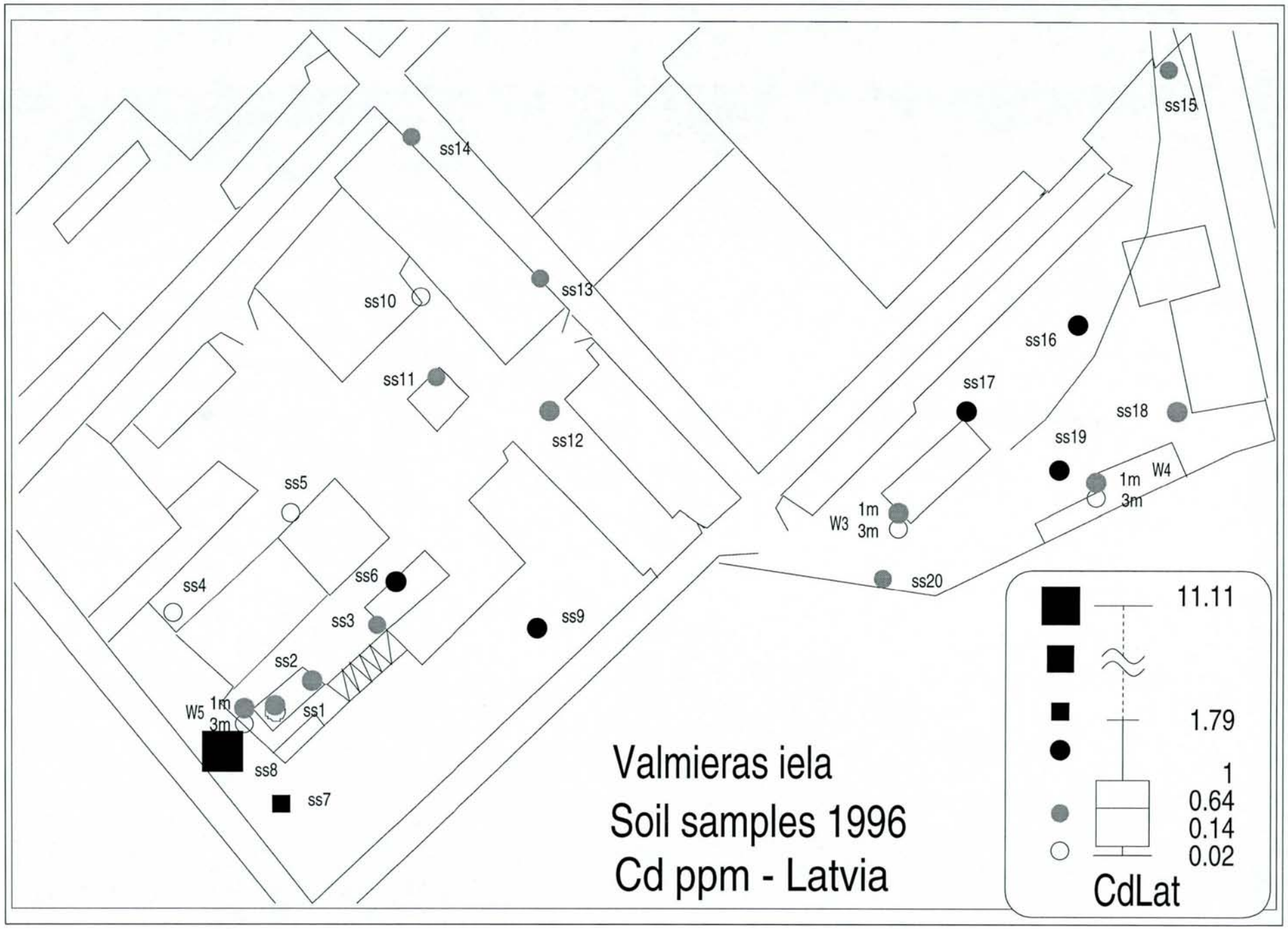

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Na/Ca (mg/mg ratio) - NGU
1.50034
0.39899
0.306139
0.177158
0.118694
Na/Ca

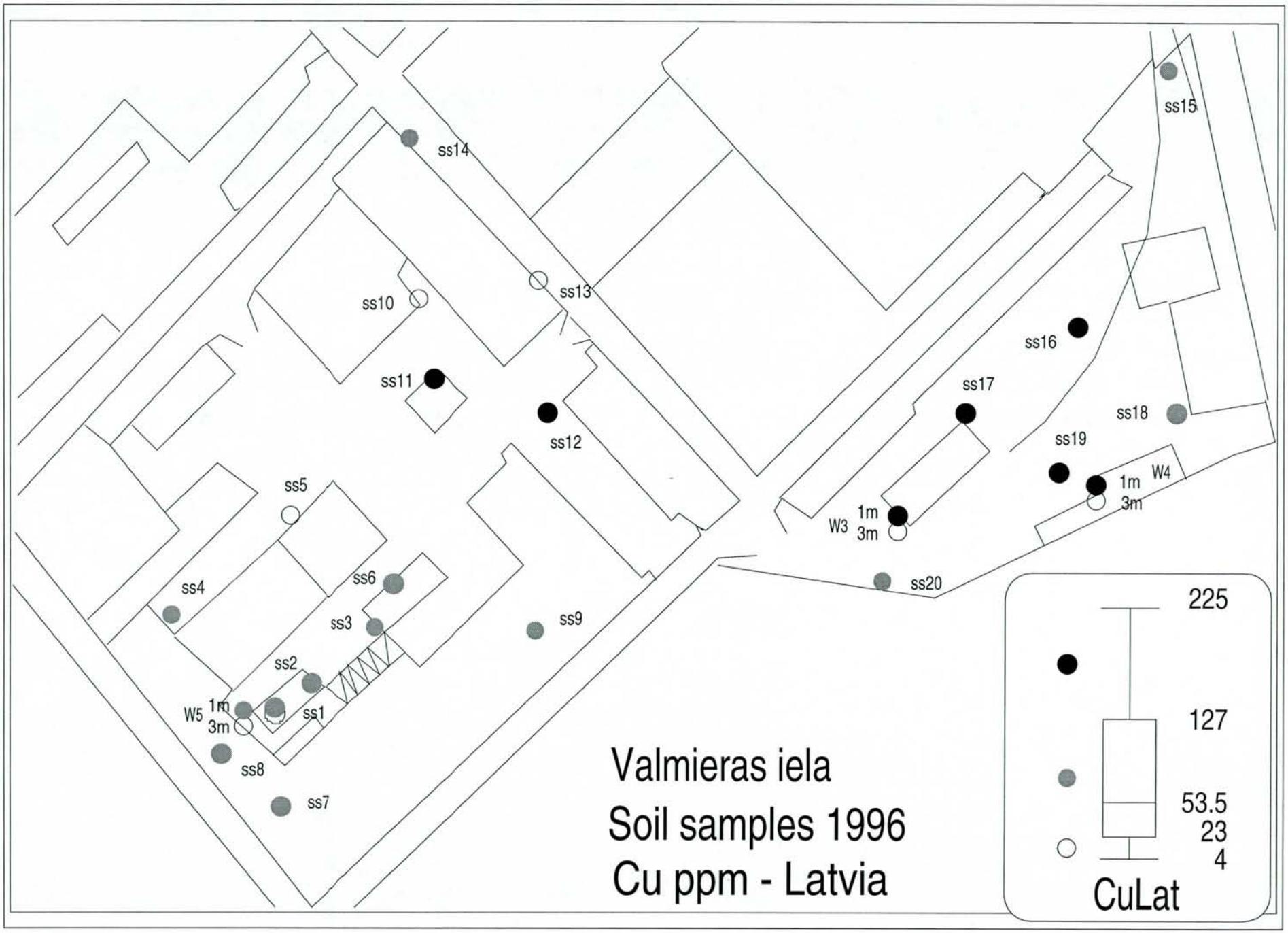

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Na/Cl (mg/mg ratio) - NGU
3.7537
1.21243
0.954885
0.948383
0.551026
Na/Cl

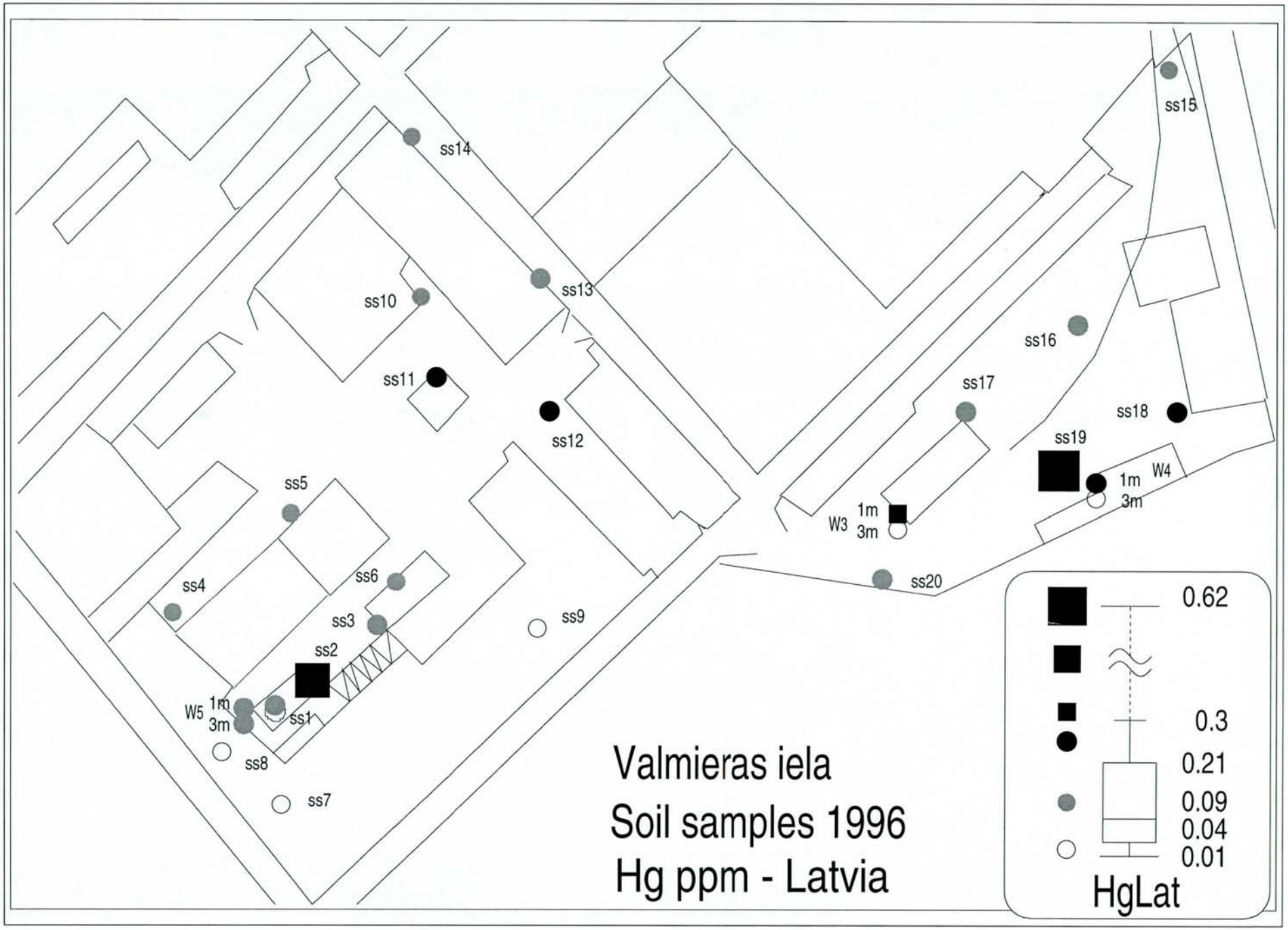

W1
W2
W3
W4
W5
Valmieras iela
Groundwater samples 1997
Sr/Ca (mg/mg ratio) - NGU
0.00417179
0.00376456
0.00370896
0.0032753
0.00209249
Sr/Ca

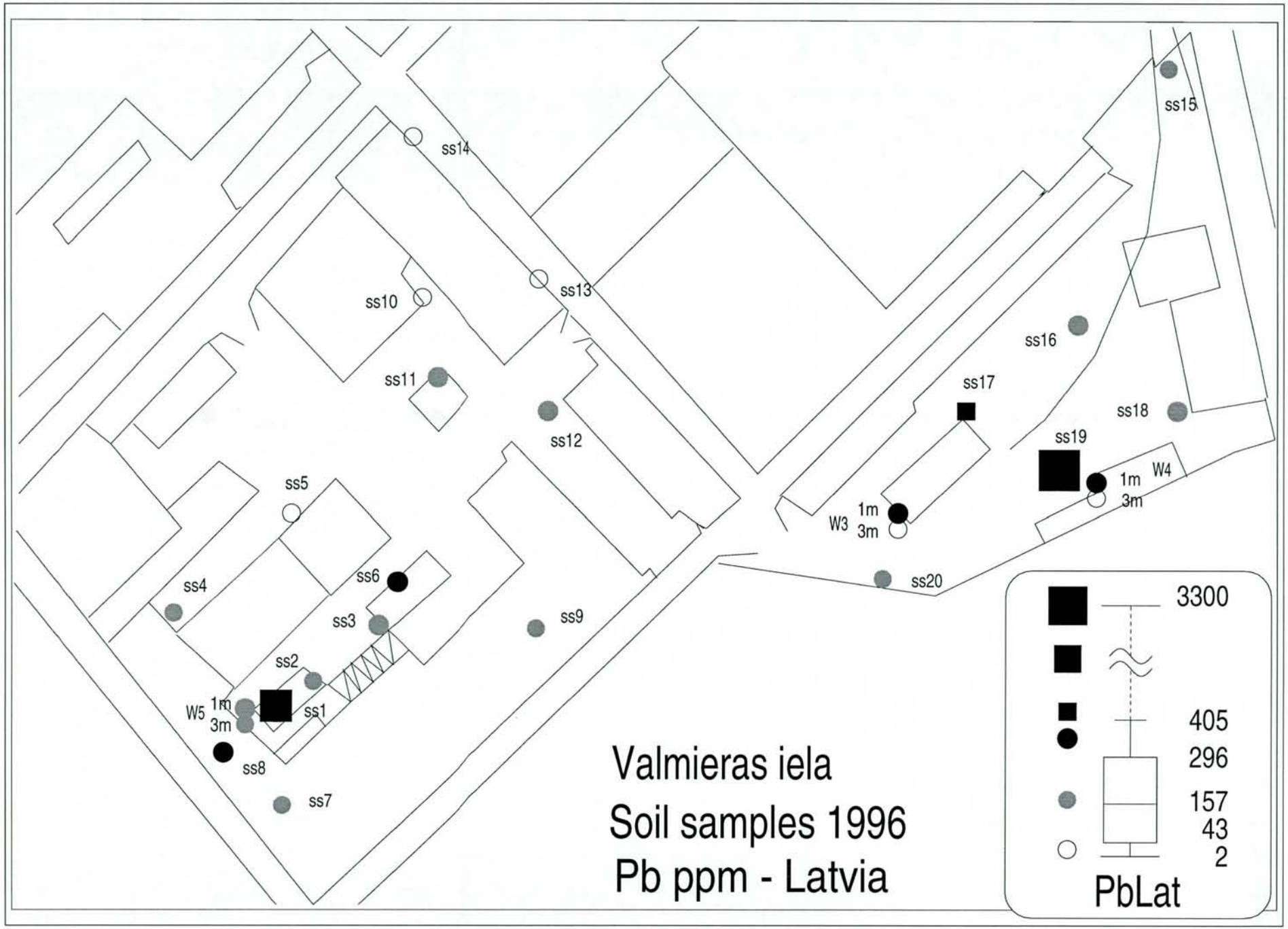
Appendix 7:

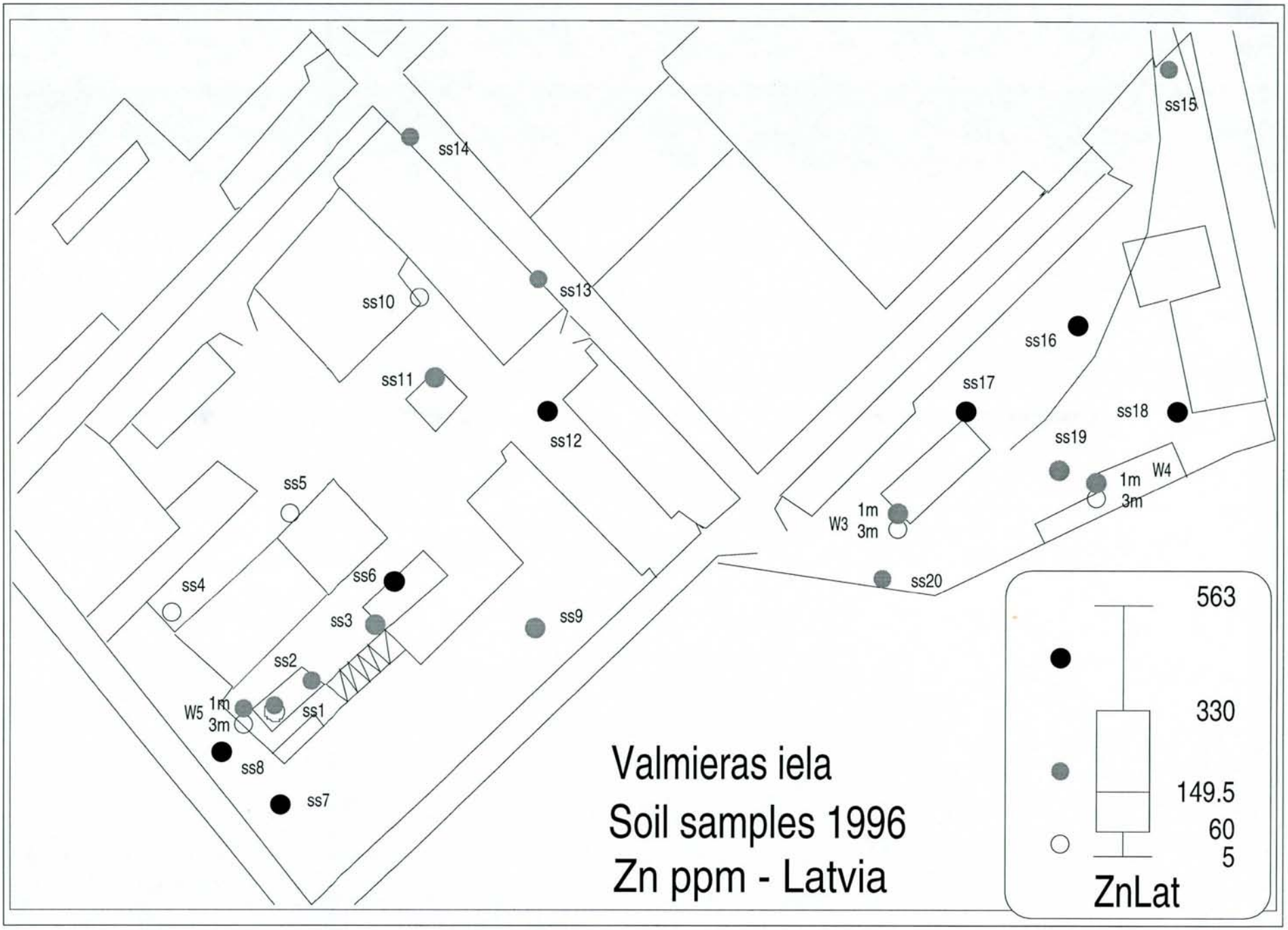
Maps of the Valmieras iela site showing concentrations of analysed parameters in soils.


ss14
ss15
ss13
ss10
ss16
ss11
ss17
ss18
ss12
ss19
ss5
W4
1m
3m
W3
1m
3m
ss4
ss6
ss20
ss3
ss9
ss2
W5
1m
3m
ss1
ss8
ss7
Valmieras iela
Soil samples 1996
Cd ppm - Latvia
11.11
1.79
1
0.64
0.14
0.02
CdLat


ss14
ss15
ss10
ss13
ss16
ss11
ss17
ss18
ss12
ss19
ss5
1m
W4
3m
W3
1m
3m
ss4
ss6
ss20
ss3
ss9
ss2
W5
1m
3m
ss1
ss8
ss7
Valmieras iela
Soil samples 1996
Cu ppm - Latvia
225
127
53.5
23
4
CuLat


ss14
ss15
ss13
ss10
ss16
ss11
ss17
ss18
ss12
ss19
1m
W4
3m
ss5
1m
W3
3m
ss4
ss6
ss20
ss3
ss9
ss2
W5
1m
3m
ss1
ss8
ss7
Valmieras iela
Soil samples 1996
Hg ppm - Latvia
0.62
0.3
0.21
0.09
0.04
0.01
HgLat


ss14
ss15
ss10
ss13
ss16
ss11
ss17
ss18
ss12
ss19
ss5
1m
W4
3m
1m
W3
3m
ss4
ss6
ss20
ss3
ss9
ss2
W5
1m
3m
ss1
ss8
ss7
Valmieras iela
Soil samples 1996
Pb ppm - Latvia
3300
405
296
157
43
2
PbLat

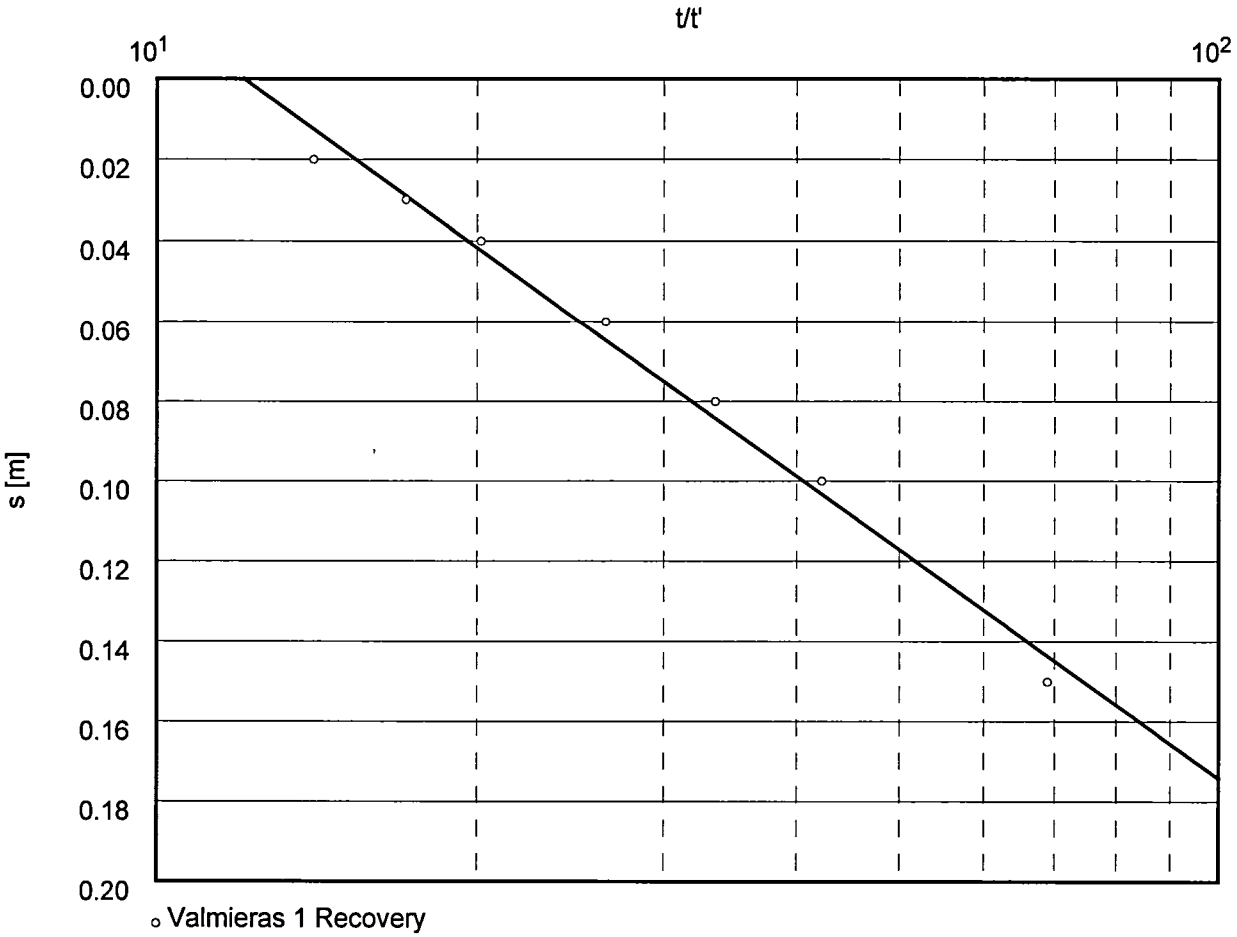

ss14
ss15
ss13
ss10
ss16
ss11
ss17
ss18
ss12
ss19
ss5
1m
W4
3m
1m
W3
3m
ss4
ss6
ss20
ss3
ss9
ss2
1m
W5
3m
ss1
ss8
ss7
Valmieras iela
Soil samples 1996
Zn ppm - Latvia
563
330
149.5
60
5
ZnLat

Appendix 8:

Results and interpretation of recovery tests performed at Valmieras iela

NGU Postboks 3006 Lade N 7002 TRONDHEIM Norway Tel: +47-73904011	Pumping test analysis Recovery method after THEIS & JACOB Confined aquifer	Page 1 Project: Valmieras iela Evaluated by: D. B.Date: 18.07.1997

Pumping Test No. Recovery	Test conducted on: 19.06.97
Valmieras 1	
Discharge 1.23 m³/d	
	Pumping test duration: 2516 s



Transmissivity [m²/s]: 1.37×10^{-5}

NGU
Postboks 3006 Lade
N 7002 TRONDHEIM Norway
Tel: +47-73904011

Pumping test analysis
Recovery method after
THEIS & JACOB
Confined aquifer

Project: Valmieras iela

Evaluated by: D. B. Date: 18.07.1997

Pumping Test No. Recovery

Test conducted on: 19.06.97

Valmieras 1

Valmieras 1 Recovery

Discharge 1.23 m³/d

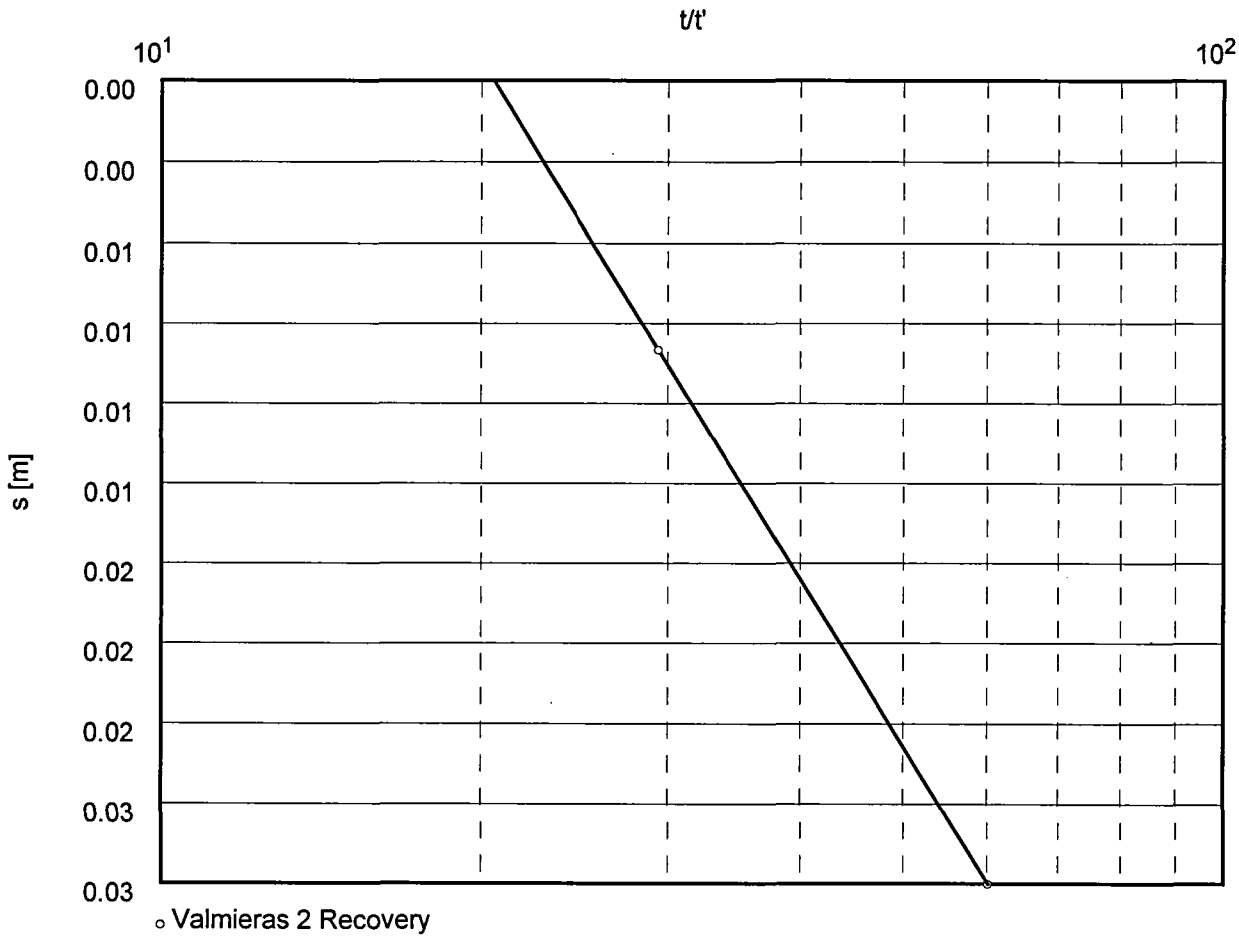
Static water level: 4.120 m below datum

Pumping test duration: 2516 s

	Time from end of pumping [s]	Water level [m]	Residual drawdown [m]	
1	37	4.270	0.150	
2	61	4.220	0.100	
3	77	4.200	0.080	
4	99	4.180	0.060	
5	131	4.160	0.040	
6	156	4.150	0.030	
7	193	4.140	0.020	

NGU Postboks 3006 Lade N 7002 TRONDHEIM Norway Tel: +47-73904011	Pumping test analysis Recovery method after THEIS & JACOB Confined aquifer	Page 1 Project: Valmieras iela Evaluated by: DB | Date: 18.07.1997

Pumping Test No. Recovery	Test conducted on: 19.06.97
Valmieras No. 2	
Discharge 1.73 m³/d	
	Pumping test duration: 2130 s



Transmissivity [m²/s]: 5.69×10^{-5}

NGU
Postboks 3006 Lade
N 7002 TRONDHEIM Norway
Tel: +47-73904011

Pumping test analysis
Recovery method after
THEIS & JACOB
Confined aquifer

Project: Valmieras iela

Evaluated by: DB | Date: 18.07.1997

Pumping Test No. Recovery | Test conducted on: 19.06.97

Valmieras No. 2 | Valmieras 2 Recovery

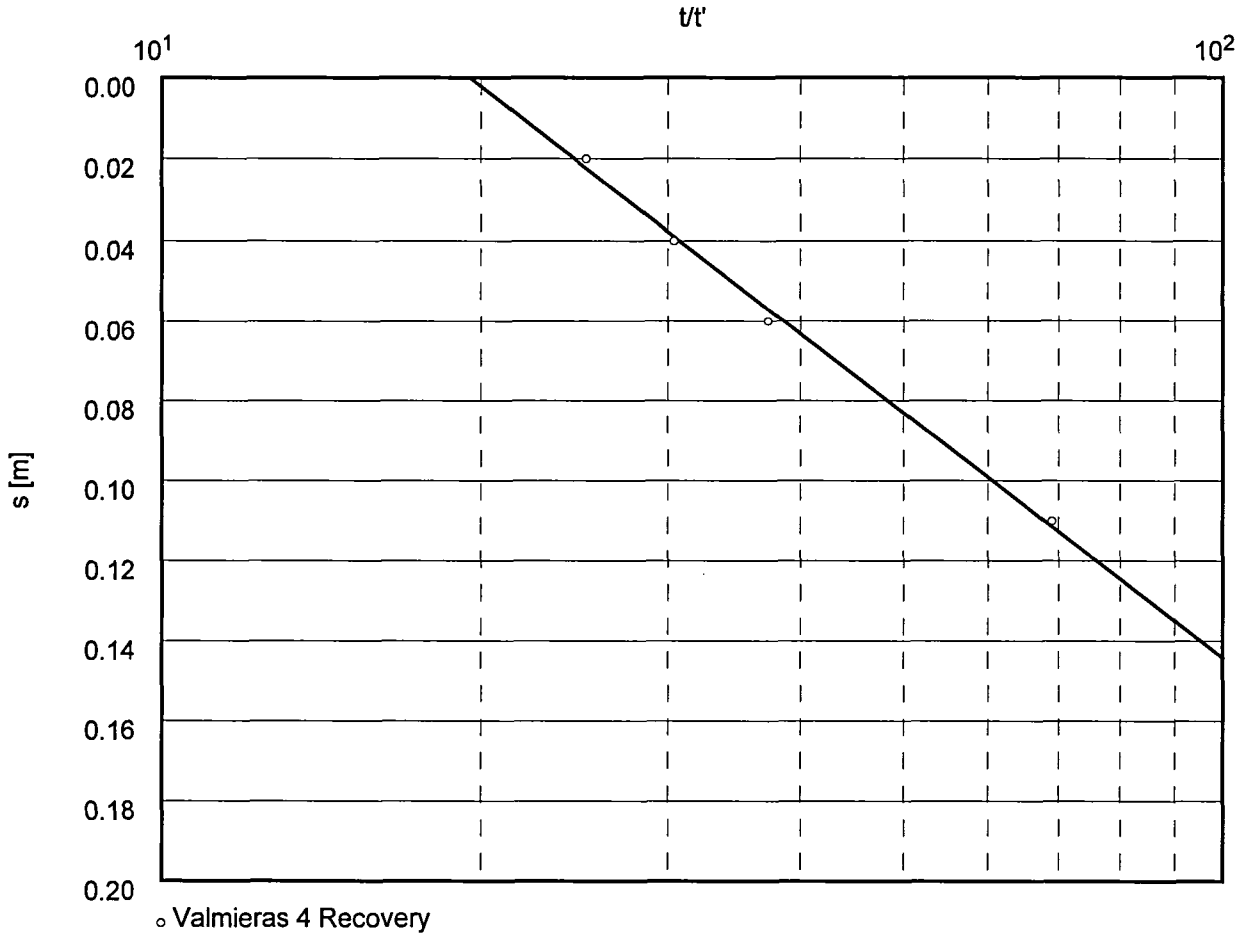
Discharge 1.73 m³/d

Static water level: 4.220 m below datum | Pumping test duration: 2130 s

	Time from end of pumping [s]	Water level [m]	Residual drawdown [m]	
1	36	4.250	0.030	
2	75	4.230	0.010	

NGU Postboks 3006 Lade N 7002 TRONDHEIM Norway Tel: +47-73904011	Pumping test analysis Recovery method after THEIS & JACOB Confined aquifer	Page 1 Project: Valmieras iela Evaluated by: DB | Date: 18.07.1997

Pumping Test No. Recovery	Test conducted on: 19.06.97
Valmieras No. 4	
Discharge 1.73 m³/d	
	Pumping test duration: 2176 s



Transmissivity [m²/s]: 1.80×10^{-5}

NGU
Postboks 3006 Lade
N 7002 TRONDHEIM Norway
Tel: +47-73904011

Pumping test analysis
Recovery method after
THEIS & JACOB
Confined aquifer

Project: Valmieras iela

Evaluated by: DB | Date: 18.07.1997

Pumping Test No. Recovery

Test conducted on: 19.06.97

Valmieras No. 4

Valmieras 4 Recovery

Discharge 1.73 m³/d

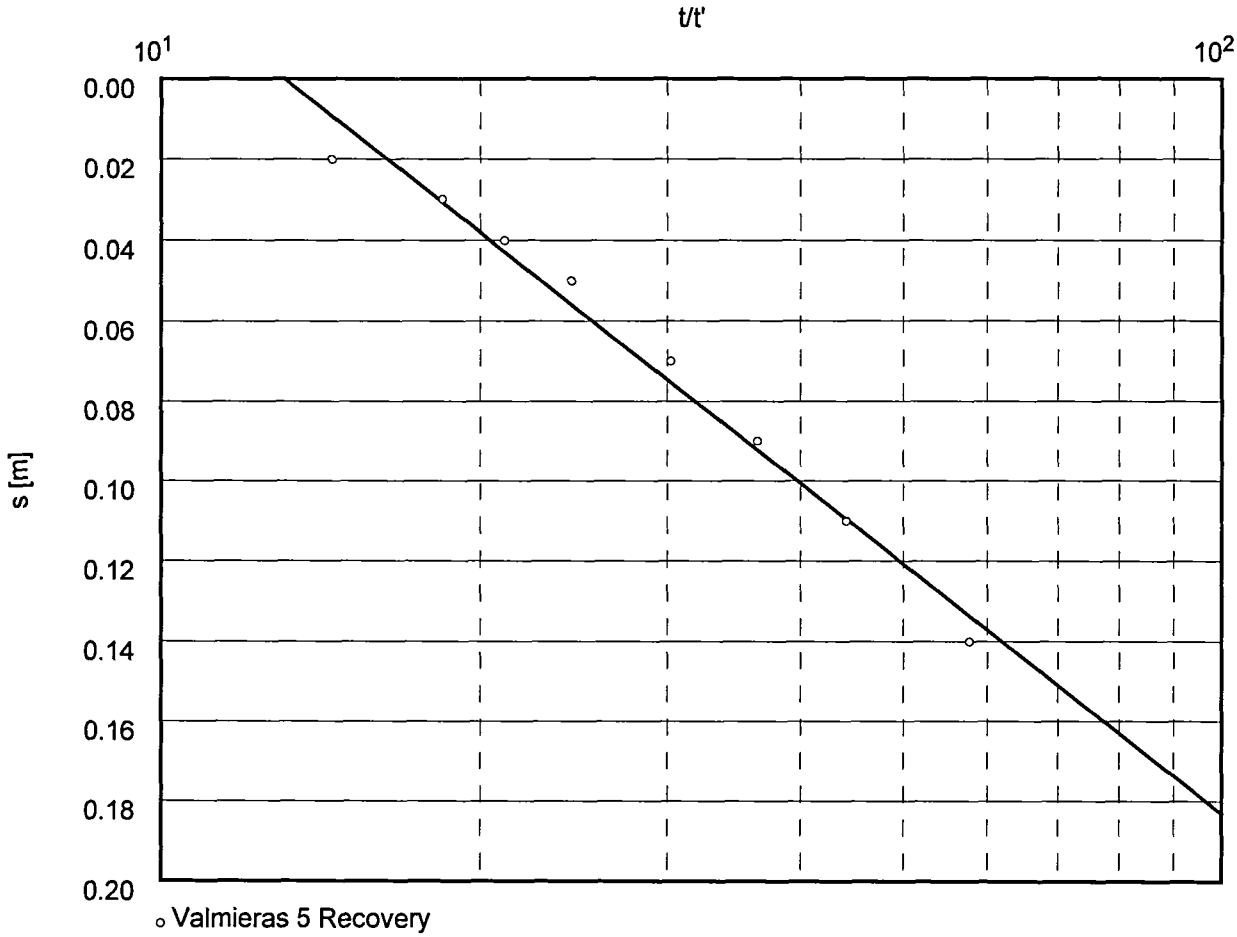
Static water level: 3.710 m below datum

Pumping test duration: 2176 s

	Time from end of pumping [s]	Water level [m]	Residual drawdown [m]	
1	32	3.820	0.110	
2	60	3.770	0.060	
3	74	3.750	0.040	
4	90	3.730	0.020	

NGU Postboks 3006 Lade N 7002 TRONDHEIM Norway Tel: +47-73904011	Pumping test analysis Recovery method after THEIS & JACOB Confined aquifer	Page 1 Project: Valmieras iela Evaluated by: DB | Date: 18.07.1997

Pumping Test No. Recovery	Test conducted on: 19.06.97
Valmieras no. 5	
Discharge 1.44 m³/d	
	Pumping test duration: 1987 s



Transmissivity [m²/s]: 1.47×10^{-5}

NGU
Postboks 3006 Lade
N 7002 TRONDHEIM Norway
Tel: +47-73904011

Pumping test analysis
Recovery method after
THEIS & JACOB
Confined aquifer

Project: Valmieras iela

Evaluated by: DB | Date: 18.07.1997

Pumping Test No. Recovery

Test conducted on: 19.06.97

Valmieras no. 5

Valmieras 5 Recovery

Discharge 1.44 m³/d

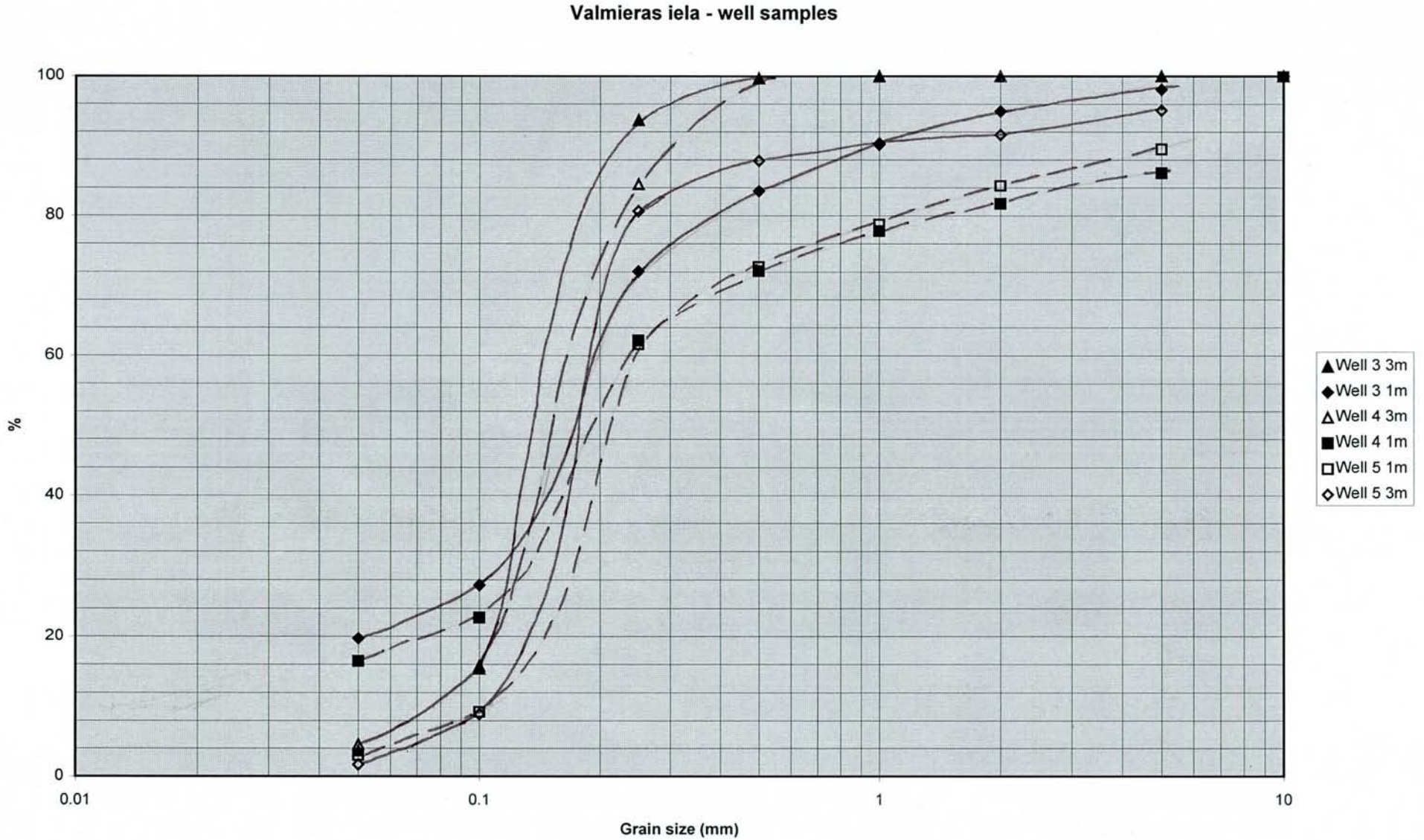
Static water level: 3.980 m below datum

Pumping test duration: 1987 s

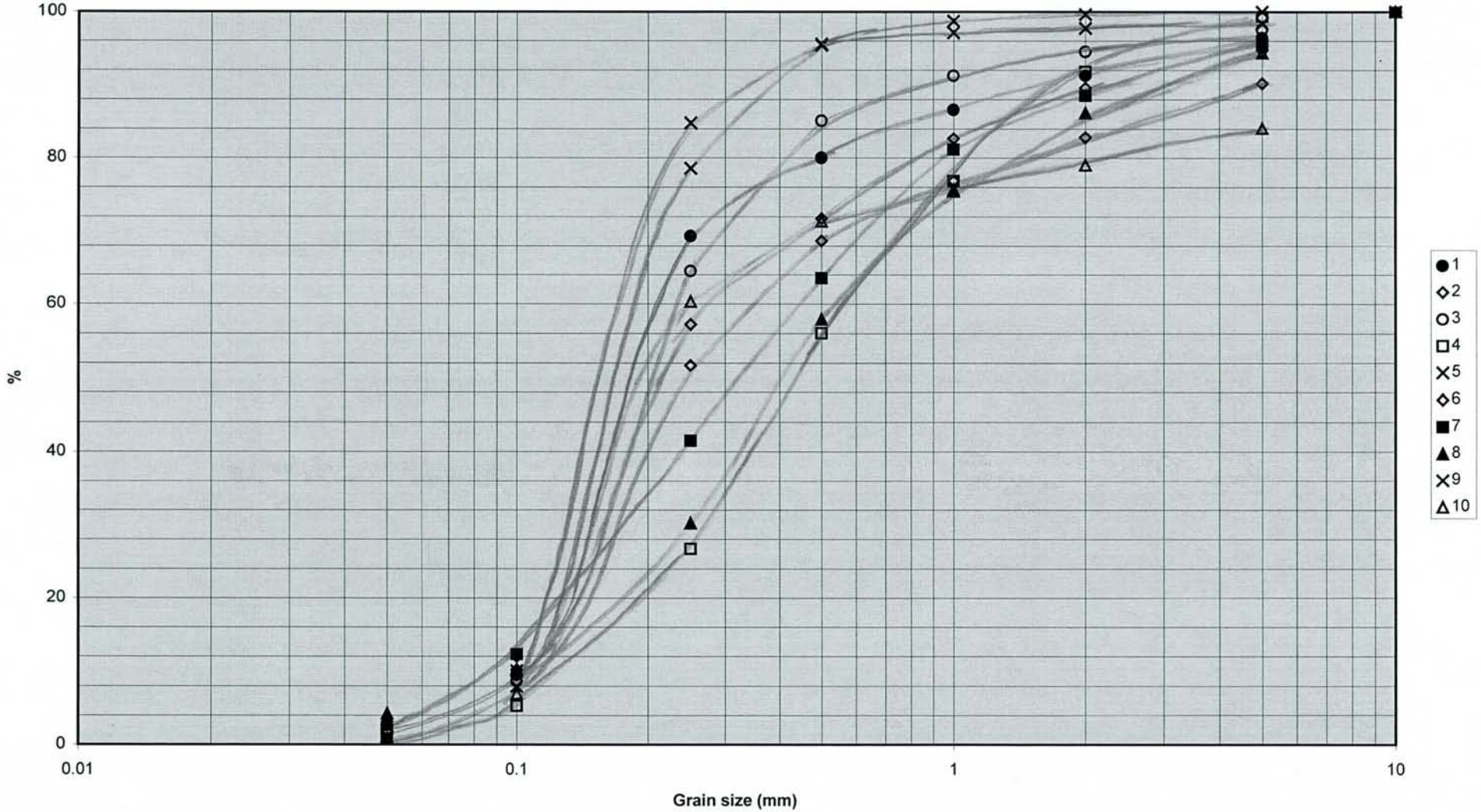
	Time from end of pumping [s]	Water level [m]	Residual drawdown [m]	
1	35	4.120	0.140	
2	46	4.090	0.110	
3	56	4.070	0.090	
4	68	4.050	0.070	
5	85	4.030	0.050	
6	99	4.020	0.040	
7	114	4.010	0.030	
8	147	4.000	0.020	

Appendix 9:

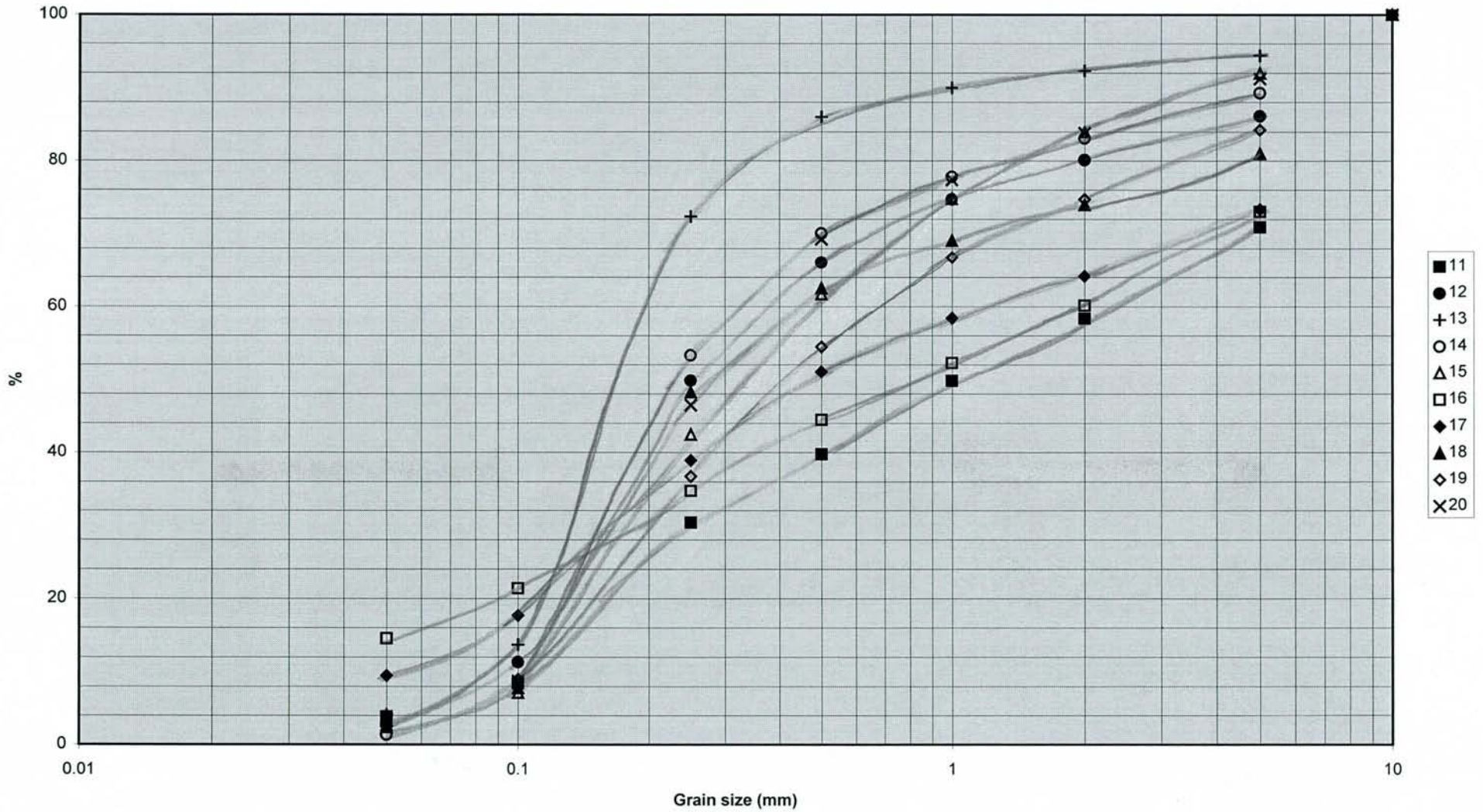
Drilling records and interpretation of grain-size analyses at Valmieras iela


Valmieras iela - well samples
100
80
60
40
20
0
%
0.01
0.1
1
10
Grain size (mm)
Well 3 3m
Well 3 1m
Well 4 3m
Well 4 1m
Well 5 1m
Well 5 3m

Valmieras iela Soil samples 1- 10



Valmieras iela Soil samples 11-20



011-96

NORGES GEOLOGISKE UNDERSØKELSE
SEDIMENTLABORATORIET

PRØVEJOURNAL

1996.0240

2699.00 / . . .
BELAST KONTO NR I DRIFTSREGNSKAP)

ANT. PRØVER I SERIEN: ___ SIDE: ___ ANT. SIDER I SERIEN: ___
ANFØRTE PRØVER SKAL: ANALYSERES: ___ FOREL. LAGRES ___ BRUK BLYANT!
(ANALYSE-OG LAGRINGSPRØVER MÅ IKKE BLANDES I SAMME SKJEMASERIE)

XIXIX KART NR. (M711) XIXIX KARTBLAD NAVN

KOMM. NR. DIALVIDI BIAINKIS INNLEVERT AV

PROBLEMSTILLING/SPES.KRAV TIL ANAL.METODE: ___

FYLLES UT AV INNSENDER

PRØVE MRK I FELT	UTM-KOORDINATER	DYP (cm)	AVSETNINGSTYPE	KASSE/ SEKK NR.
LvS1 = Viestura prospekt, Soil sample 31				
LvS2 = Valmieras, borehole 3 @ 5.5 m				
LvS3 = Valmieras, borehole 4 @ 3.1 m				

FYLLES NORMALT UT AV LABORATORIET MED MINDRE INNSENDERS PROBLEMSTILLING KREVER SPESIELLE ANALYSEMETODER.

	ANALYSER: SKAL UTFØRES: X ER UTFØRT: O	A	B	C									M	N
	JOURNAL NR. (for lab.)	TØRRSIKTING	VÅTSIKTING	HYDROMETER	PIPETTE	HUMUS-SLAM	OXALSYREV.	STORPRØVE					UTTAK GEOKJEMI	FRAKSJ. ___ PAKKES SEPARAT
1														
2														
3	960489		⊗											
4	960490		⊗											
5	960491		⊗											
6														
7														
8														
9														
10														
11														
12														
13														
14														
STEMPLINGS-HAL: 15														

NGU 158-07 79

FOR LAB: SIKTING: NORMAL SATS ___ SPESIELL SATS ___

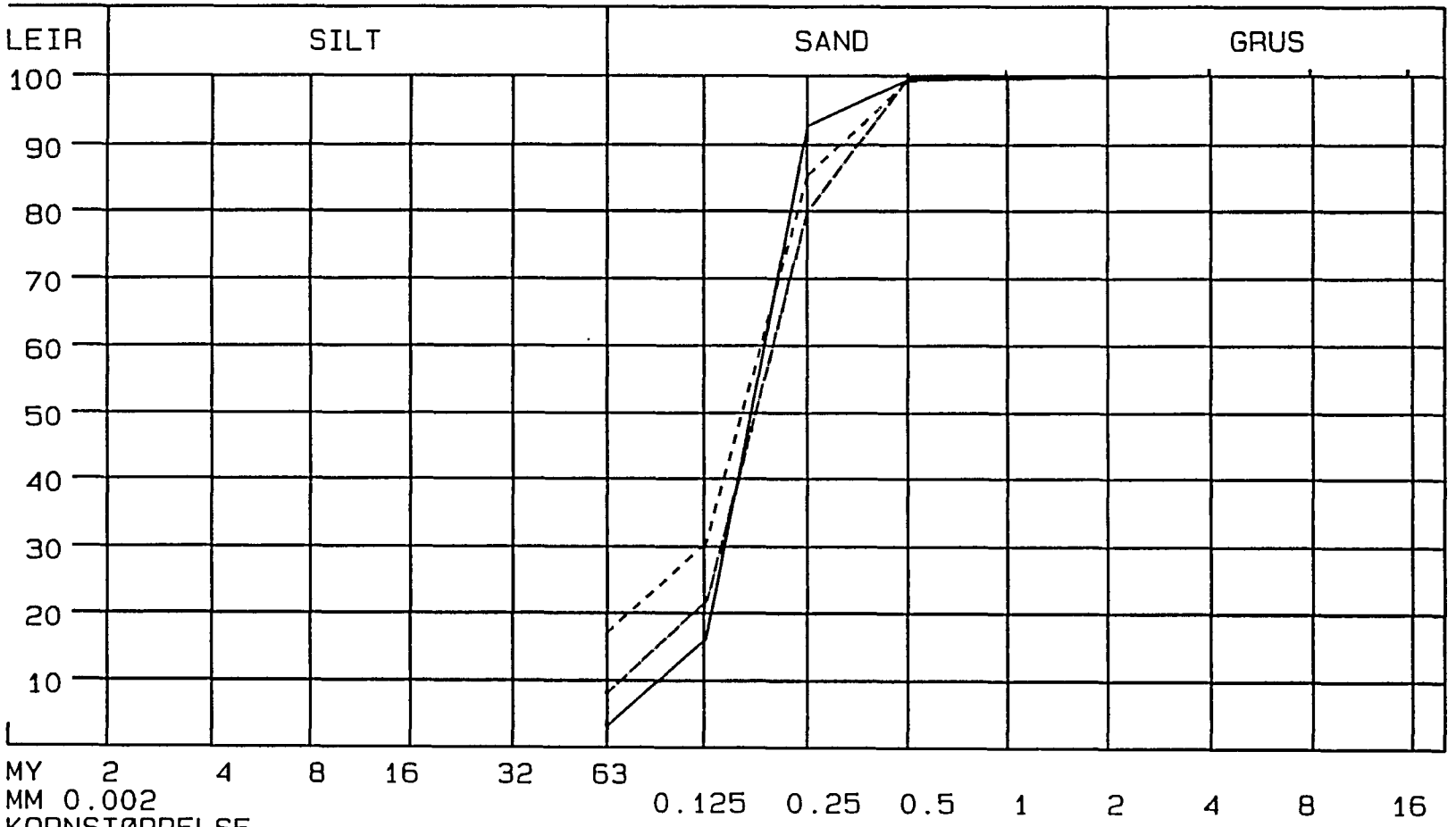
REGISTRERT: ___ DATO ___ SIGN

PUNCHET: 1/11-96 DATO A.N. SIGN

NORGES GEOLOGISKE UNDERSØKELSE
SEDIMENTLABORATORIET

KORNFORDELINGSKURVE

XXX XXX



		UTM X	UTM Y
————	960489	0	0
- - - - - - - - - - -	960490	0	0
————	960491	0	0

NGU
SEDIMENTLABORATORIET.

P R Ø V E J O U R N A L.

KARTBLADNR M711 : XXX
KARTBLADNAVN : XXX
KOMMUNENR :
INNLEVERT AV : David Banks

KONTONR DRIFTSREGNSKAP : 2699.00
SERIENUMMER : 011-96
SERIEINTERVALL : 960489-960491

UTM-KOORDINATER		DYP	AVSETNINGSTYPE	JOURNALNR	A	B	C	D	E	F	G	H	I	J	K	L	M	N
0	0	0		960489		B												
0	0	0		960490		B												
0	0	0		960491		B												
			ANTALL PRØVER :	3														

KORNFORDELINGSANALYSE

JOURNALNR:960489 STED: XXX KARTBLADNR: XXX KOORD: 0 0

DYP: 0 CM TYPE:

TOTALVEKT AV MAT.: 117.5 GR
19.00 MM: .0 GR, SOM ER .00 % AV TOTALVEKT

NETTOVEKT 117.5 GR
SVINN: .0 GR, SOM ER .00 % AV NETTOVEKT

BENYTTET VEKT: 117.5 GR

SIKTING

VEKT I GR.	KORNST. I MM	KORNST. I PHI	FREKV. %	KUMULATIV %
.0	16.0000	-4.00	.00	100.00
.0	8.0000	-3.00	.00	100.00
.0	4.0000	-2.00	.00	100.00
.2	2.0000	-1.00	.17	99.83
.2	1.0000	.00	.17	99.66
.3	.5000	1.00	.26	99.40
7.9	.2500	2.00	6.72	92.68
90.1	.1250	3.00	76.68	16.00
15.2	.0625	4.00	12.94	3.06
3.6	< .0625	> 4.00	3.06	.00

CALCULATED GRAIN-DIAMETERS FOR 9 CONSTANT ORDINATES:
MM : MD = .1700 5%: .0693 10%: .0906 16%: .1250 25%: .1356 75%: .2131 84%: .2311 90%: .2440 95%: .3175
PHI: MD = 2.56 5%: 3.85 10%: 3.46 16%: 3.00 25%: 2.88 75%: 2.23 84%: 2.11 90%: 2.03 95%: 1.66

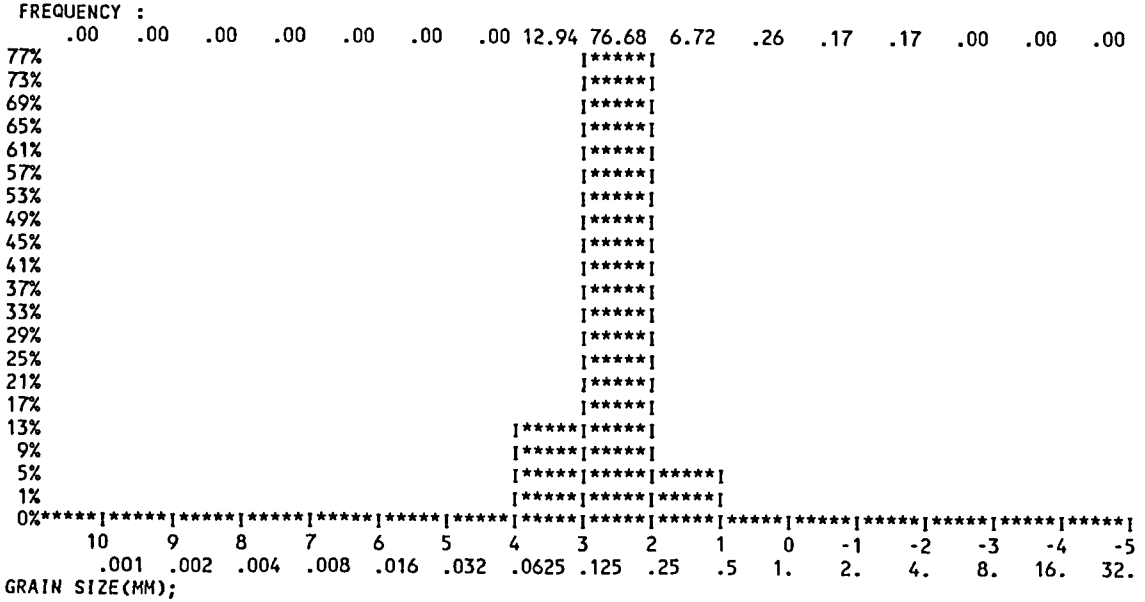
SEDIMENTOLOGICAL PARAMETERS:

TRASK 1932:		SO(SQRT Q75/25)= 1.25	SK(Q75,Q25,MD) = 1.00	KT(P75,25,90,10)= .25	
SELMER-OLSEN 1954:		SO(LOG Q75/Q25)= .20	SK(LOG SK(TRASK)) = .00		
INMAN 1952:	M(1/2(084+16))= 2.56	SO(1/2(084-16))= .44	SK(084,016,SO) = .00	KT(084,16,95,5) = 1.48	
			SK(095,05,MD,SO) = .44	M - MD = .00	
FOLK & WARD 1957:	MZ(016,50,84) = 2.56	SO(-16,84,5,95)= .55	SK(05,16,50,84,95)= .09	KG(05,95,25,75) = 1.38	
MOMENT :	MO = 2.61	SDO = .60	SKQ = .04	KTO = 5.98	

MAIN FRACTIONS % :

CLAY(<2MI): .00	SILT(2-62.5MI): .00		SAND(62.5MI-2MM): 96.77	GRAVEL(2-19.0MM): .17	
		PELITE(<62.5MI): 3.06			
CLAY(<4MI): .00	SILT(4-62.5MI): .00				

960489


FREQUENCY :
.00 .00 .00 .00 .00 .00 .00 12.94 76.68 6.72 .26 .17 .17 .00 .00 .00
77%
73%
69%
65%
61%
57%
53%
49%
45%
41%
37%
33%
29%
25%
21%
17%
13%
9%
5%
1%
0%
10 9 8 7 6 5 4 3 2 1 0 -1 -2 -3 -4 -5
.001 .002 .004 .008 .016 .032 .0625 .125 .25 .5 1. 2. 4. 8. 16. 32.
GRAIN SIZE(MM);

KORNFORDELINGSANALYSE

JOURNALNR:960490 STED: XXX KARTBLADNR: XXX KOORD: 0 0

DYP: 0 CM TYPE:

TOTALVEKT AV MAT.: 110.5 GR
19.00 MM: .0 GR, SOM ER .00 % AV TOTALVEKT

NETTOVEKT 110.5 GR
SVINN: .0 GR, SOM ER .00 % AV NETTOVEKT

BENYTTET VEKT: 110.5 GR

SIKTING

VEKT I GR.	KORNST. I MM	KORNST. I PHI	FREKV. %	KUMULATIV %
.0	16.0000	-4.00	.00	100.00
.0	8.0000	-3.00	.00	100.00
.0	4.0000	-2.00	.00	100.00
.0	2.0000	-1.00	.00	100.00
.1	1.0000	.00	.09	99.91
.8	.5000	1.00	.72	99.19
15.4	.2500	2.00	13.94	85.25
60.5	.1250	3.00	54.75	30.50
15.0	.0625	4.00	13.57	16.92
18.7	< .0625	> 4.00	16.92	-.00

CALCULATED GRAIN-DIAMETERS FOR 9 CONSTANT ORDINATES:
MM : MD = .1600 5%: .0340 10%: .0439 16%: .0596 25%: .0944 75%: .2196 84%: .2461 90%: .3166 95%: .4060
PHI: MD = 2.64 5%: 4.88 10%: 4.51 16%: 4.07 25%: 3.40 75%: 2.19 84%: 2.02 90%: 1.66 95%: 1.30

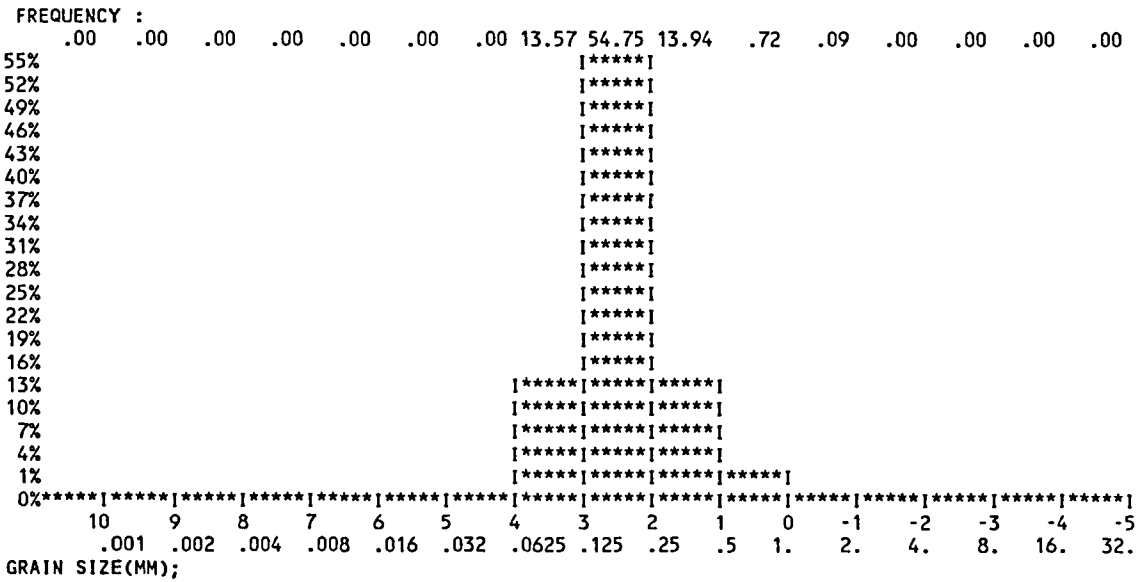
SEDIMENTOLOGICAL PARAMETERS:

TRASK 1932:		SO(SQRT Q75/25)= 1.53	SK(Q75,Q25,MD) = .81	KT(P75,25,90,10)= .23	
SELMER-OLSEN 1954:		SO(LOG Q75/Q25)= .37	SK(LOG SK(TRASK)) = -.05		
INMAN 1952:	M(1/2(084+16))= 3.05	SO(1/2(084-16))= 1.02	SK(084,016,SO) = .39	KT(084,16,95,5) = .75	
			SK(095,05,MD,SO) = .44	M - MD = .40	
FOLK & WARD 1957:	MZ(016,50,84) = 2.91	SO(-16,84,5,95)= 1.05	SK(05,16,50,84,95)= .32	KG(05,95,25,75) = 1.20	
MOMENT :	MO = 2.82	SDO = .94	SKO = .23	KTO = 10.42	

MAIN FRACTIONS % :

CLAY(<2MI): .00	SILT(2-62.5MI): .00		SAND(62.5MI-2MM): 83.08	GRAVEL(2-19.0MM): .00	
		PELITE(<62.5MI): 16.92			
CLAY(<4MI): .00	SILT(4-62.5MI): .00				

960490


FREQUENCY :
.00 .00 .00 .00 .00 .00 .00 13.57 54.75 13.94 .72 .09 .00 .00 .00 .00
55%
52%
49%
46%
43%
40%
37%
34%
31%
28%
25%
22%
19%
16%
13%
10%
7%
4%
1%
0%
10 9 8 7 6 5 4 3 2 1 0 -1 -2 -3 -4 -5
.001 .002 .004 .008 .016 .032 .0625 .125 .25 .5 1. 2. 4. 8. 16. 32.
GRAIN SIZE(MM);

KORNFORDELINGSANALYSE

JOURNALNR:960491 STED: XXX KARTBLADNR: XXX KOORD: 0 0

DYP: 0 CM TYPE:

TOTALVEKT AV MAT.: 99.4 GR
19.00 MM: .0 GR, SOM ER .00 % AV TOTALVEKT

NETTOVEKT 99.4 GR
SVINN: .0 GR, SOM ER .00 % AV NETTOVEKT

BENYTTET VEKT: 99.4 GR

SIKTING

VEKT I GR.	KORNST. I MM	KORNST. I PHI	FREKV. %	KUMULATIV %
.0	16.0000	-4.00	.00	100.00
.0	8.0000	-3.00	.00	100.00
.0	4.0000	-2.00	.00	100.00
.0	2.0000	-1.00	.00	100.00
.1	1.0000	.00	.10	99.90
.4	.5000	1.00	.40	99.50
19.3	.2500	2.00	19.42	80.08
58.1	.1250	3.00	58.45	21.63
13.7	.0625	4.00	13.78	7.85
7.8	< .0625	> 4.00	7.85	-.00

CALCULATED GRAIN-DIAMETERS FOR 9 CONSTANT ORDINATES:
MM : MD = .1750 5%: .0542 10%: .0696 16%: .0942 25%: .1301 75%: .2354 84%: .2875 90%: .3562 95%: .4258
PHI: MD = 2.51 5%: 4.21 10%: 3.84 16%: 3.41 25%: 2.94 75%: 2.09 84%: 1.80 90%: 1.49 95%: 1.23

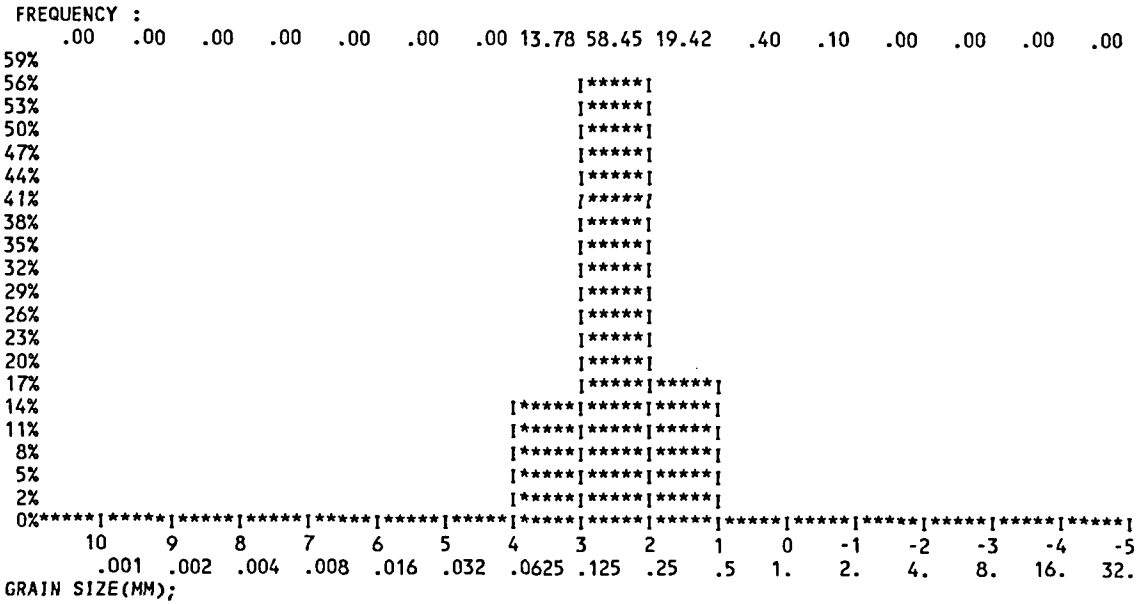
SEDIMENTOLOGICAL PARAMETERS:

TRASK	1932:			SO(SQRT Q75/25)=	1.35	SK(Q75,Q25,MD) =	1.00	KT(P75,25,90,10)=	.18
SELMER-OLSEN	1954:			SO(LOG Q75/Q25)=	.26	SK(LOG SK(TRASK)) =	.00		
INMAN	1952:	M(1/2(084+16))=	2.60	SO(1/2(084-16))=	.81	SK(084,016,SO) =	.11	KT(084,16,95,5) =	.85
						SK(095,05,MD,SO) =	.25	M - MD =	.09
FOLK & WARD	1957:	MZ(016,50,84) =	2.57	SO(-16,84,5,95)=	.85	SK(05,16,50,84,95)=	.12	KG(05,95,25,75) =	1.43
MOMENT	:	M0 =	2.59	SD0 =	.81	SK0 =	.31	KT0 =	.47

MAIN FRACTIONS % :

CLAY(<2MI):	.00	SILT(2-62.5MI):	.00			SAND(62.5MI-2MM):	92.15	GRAVEL(2-19.0MM):	.00
				PELITE(<62.5MI):	7.85				
CLAY(<4MI):	.00	SILT(4-62.5MI):	.00						

960491


FREQUENCY :
.00 .00 .00 .00 .00 .00 .00 13.78 58.45 19.42 .40 .10 .00 .00 .00 .00
59%
56%
53%
50%
47%
44%
41%
38%
35%
32%
29%
26%
23%
20%
17%
14%
11%
8%
5%
2%
0%
10 9 8 7 6 5 4 3 2 1 0 -1 -2 -3 -4 -5
.001 .002 .004 .008 .016 .032 .0625 .125 .25 .5 1. 2. 4. 8. 16. 32.
GRAIN SIZE(MM);

SOILSAMPLING in Valmieras iela

Locality	colour	grainsize	smell	remarks
1	grey-black	fine	no	bricks and roots
2	brown-black	fine	no	marbleised, pebbles
3	golden brown	medium	no	concrete, stone, roots
4	brown - black	sand - gravel	no	marbleised, stone, roots
5	light - brown	fine	no	pebbles
6	black - brown	sand - gravel	no	roots, pebbles, concrete
7	dark - brown	sand - gravel	heavy oil	stone, roots, painting, glass
7A	black	silt	strong - heavy oil	point pollution in washinghall
8	grey - brown	sand - gravel	diesel	pebbles
9	black - grey	sand - gravel	heavy oil	pebbles
10	light - brown	medium sand	no	pebbles
11	black	gravely sand	solvents	organic, pebbles, from fuelstorage area
12	black - brown	medium sand	no	roots and pebbles
13	grey - black	medium sand	no	pebbles
14	grey - black	medium sand	no	roots, pebbles, asphalt
15	grey - black	medium sand	no	pebbles, roots
16	grey - black	sand - gravel	no	pebbles and sorted sand
17	black	sand - gravel	lubrication oil	stone, glass, oily after drain out of the oil
18	grey - black	sand - gravel	old oil	iron, concrete, glass, pebbles
19	grey - black	sand - gravel	old oil	asphalt, pebbles, nail
20	grey - brown	sand - gravel	no	roots, pebbles, asphalt

Latvia Sediment Samples

LvS1 = Viestura prospekt, Soil sample 31
LvS2 = Valmieras, borehole 3 @ 5.5 m
LvS3 = Valmieras, borehole 4 @ 3.1 m

All analytical results refer to < 2 mm fraction

The suffix R (e.g. LvS1R) refers to a portion of the sample where soluble hydrocarbons (e.g. diesel) have been removed by rinsing with toluene. The results for TC and TOC for toluene-rinsed samples should give «refractory» (non-toluene-soluble) contents.

BOREHOLES - VALMIERAS STREET

Logs during drilling 1/10/96 - D. Banks

Borehole 1

Sample depth m bgl	*Description*
1 m	Medium-grained dirty brown sand with many stones. Fragments of brick, glass and concrete
2 m	Fine-medium grained golden brown homogeneous sand
3 m	Fine-medium grained golden brown homogeneous sand
4 m	Slightly coarser and darker fine-medium grained golden brown homogeneous sand
5 m - 7 m	Fine-medium grained golden brown homogeneous sand. Slight oily smell at c. 5 - 6 m and oil film observed in samples from 5 - 7 m.
7 - 10 m	Assumed fine-medium grained golden brown homogeneous sand
c. 10 m	Dark, reddish brown very compact silt

Water level = c. 4.5 m

Tubewell installed of u-PVC, ISO 3633, 75 mm diameter. 2 m lengths are welded using a PVC adhesive (Casco rørlim) based on tetrahydrofuran (60-100%) and cyclohexanone (5-10 %). The slotted section comprises spirally arranged 2 cm diameter circular holes covered by a fine wire- and tape-bound plastic mesh.

The well-top is protected by a c. 1 m length of steel casing. The annulus around the PVC pipe was backfilled with clean sand from a nearby pile and with sand from the hole. The uppermost annulus (around the steel pipe) is cemented in.

The slotted section was emplaced at c. 3.8 - 5.8 m below ground level (bgl).

Borehole 2

Sample depth m bgl	*Description*
1 m	Fine-medium grained golden brown homogeneous sand
2 m	Fine-medium grained golden brown homogeneous sand
3 m	Fine-medium grained golden brown homogeneous sand
4 m	Fine-medium grained golden brown homogeneous sand
5 m	Fine-medium grained golden brown homogeneous sand
6 m	Fine-medium grained golden brown homogeneous sand
6 - 7.5 m	Fine-medium grained golden brown homogeneous sand
7.5 m	Dark grey / black, coarse, poorly sorted sand with pebbles of dolomite (littoral deposit ?)

Water at c. 4.5 m. No oily smell in any of the samples.

Tubewell installed of u-PVC, ISO 3633, 75 mm diameter. 2 m lengths are welded using a PVC adhesive (Casco rørlim) based on tetrahydrofuran (60-100%) and cyclohexanone (5-10 %). The slotted section comprises spirally arranged 2 cm diameter circular holes covered by a fine wire- and tape-bound plastic mesh.

The well-top is protected by a c. 1 m length of steel casing. The annulus around the PVC pipe was backfilled with sand from the hole. The uppermost annulus (around the steel pipe) is cemented in.

The slotted section was emplaced at c. 3.8 - 5.8 m below ground level (bgl) or 4 - 6 m below PVC well top.

2/10/96

Borehole 3

Sample depth m bgl	*Description*
1 m	brown sandy organic soil with stones and anthropogenic fragments (incl. lead cable)
1.9 m	as 1 m but lighter brown and with distinct oily smell
2 m	as 1.9 m but blacker and with slight oily smell
2.4 m	Into fine-medium light brown sand, slight oil smell
2.7 m	as 2.4 m, slight oily smell
2.9 m	Fine-medium light brown-grey sand. No clear oil smell.
3.0 m	As 2.9 m but slight oil smell and becoming more grey.
3.3 m	As 3.0 m.
3.5 m	As 3.0 m but grey and strong oil smell.
3.7 m - 3.8 m	Dark grey- black fine-medium sand. Very strong oil smell. Oil film on contact with water
3.8 - 4.7 m	Samples not recovered
4.7 - 5.5 m	Dark grey, homogeneous fine-medium sand. Strong oil smell.
6.0 - 7.0 m	As 4.7 - 5.5 m but with oil smell reducing with depth.
7.0 m	Transition to greyish brown fine-medium sand with only a slight oil smell
7.0 - 8.0 m	Becoming clean golden-brown fine-medium sand without oil smell

Tubewell installed of u-PVC, ISO 3633, 75 mm diameter. 2 m lengths are welded using a PVC adhesive (Casco rørlim) based on tetrahydrofuran (60-100%) and cyclohexanone (5-10 %). The slotted section comprises spirally arranged 2 cm diameter circular holes covered by a fine wire- and tape-bound plastic mesh.

The well-top is protected by a c. 1 m length of steel casing. The annulus around the PVC pipe was backfilled with sand from the hole. The uppermost annulus (around the steel pipe) is cemented in.

The slotted section was emplaced at c. 3.8 - 5.8 m below ground level (bgl) or 4 - 6 m below PVC well top.

Borehole 4

Sample depth m bgl	*Description*
0 - 0.2 m	Asphalt + soil
0.2 - 0.3 m	Concrete floor
0.3 - 0.5 m	Brown organic soil
0.6 - 1.7 m	Black sandy soil with brick fragments and much oil.
1.7 - 2.7 m	Pale brown, fine-medium sand with large brick fragments and a little oil smell
2.8 - 3.1 m	Natural, fine-medium grained, medium brown sand. No oil smell
3.1 - 3.9 m	Samples not recovered
3.9 - 4.0 m	Pale brown, becoming brown-grey fine-medium sand. Slight oil smell at 4.0 m
4.5 - 5.0 m	Greyish-brown fine-medium sand. Very slight oil smell
5.0 - 6.0 m	Greyish-brown fine-medium sand. No oil smell
6.0 m	Thin layer of dark grey to black fine-medium sand. No oil smell.
6.0 - 6.5 m	Slightly greyish brown fine-medium sand. No oil smell
6.5 - 7.0 m	Golden brown fine-medium sand - becoming fine sand with layers of silt. No oil smell.

Groundwater level at c. 4.5 m.

Tubewell installed of u-PVC, ISO 3633, 75 mm diameter. 2 m lengths are welded using a PVC adhesive (Casco rørlim) based on tetrahydrofuran (60-100%) and cyclohexanone (5-10 %). The slotted section comprises spirally arranged 2 cm diameter circular holes covered by a fine wire- and tape-bound plastic mesh.

The well-top is protected by a c. 1 m length of steel casing. The annulus around the PVC pipe was backfilled with sand from the hole. The uppermost annulus (around the steel pipe) is cemented in.

The slotted section was emplaced at c. 4.1 - 6.1 m below ground level (bgl) or 4 - 6 m below PVC well top. PVC well top is at c. 0.1 m bgl.

A significant amount of clean water was used during drilling. May require significant clearance pumping for valid sampling.

Borehole 5

Sample depth m bgl	*Description*
0 - 0.2 m	Concrete
0.2 - 1.6 m	Mixture of sandy organic soil and anthropogenic fragments (no oil smell)
1.6 - 2.0 m	Ditto, possibly a very slight oily smell
c. 2.5 m	Into golden brown fine-medium sand. No clear oily smell.
3.5 m	Golden brown fine-medium sand. Slight oily smell.
3.7 m	Golden brown fine-medium sand. Slight oily smell.
3.7 - 6.7 m	Light brown fine medium sand. Slight oily smell

Water level = c. 4 m bgl

Tubewell installed of u-PVC, ISO 3633, 75 mm diameter. 2 m lengths are welded using a PVC adhesive (Casco rørlim) based on tetrahydrofuran (60-100%) and cyclohexanone (5-10 %). The slotted section comprises spirally arranged 2 cm diameter circular holes covered by a fine wire- and tape-bound plastic mesh.

The well-top is protected by a c. 1 m length of steel casing. The annulus around the PVC pipe was backfilled with sand from the hole. The uppermost annulus (around the steel pipe) is cemented in.

The slotted section was emplaced at c. 3.2 - 5.2 m below ground level (bgl) or 4 - 6 m below PVC well top.

A significant amount of clean water was used during drilling. May require significant clearance pumping for valid sampling.

STREAM AT SCRUNDA **28.09.96**

Field measurements

pH = 8.2 ± 0.2 (NGU)
T = 11.5 °C (NGU)
Eh = 174 mV (stable)

Brown (Fe) precipitate on filter for filtered water sample.

VIESTURA PROSPECT 2

BORE 14

RWL = 3.47 m below steel well top
No free oil phase
Start pumping 11.23
Finish pumping 12.23

pH = 6.14 (LGU), [6.34 (NGU)] ± 0.2
EC = 558 µS/cm
T = 9.5 °C (LGU), [9.8 °C (NGU)]
CO2 > 100 mg /l

CEMETRY 1 Well (SE cemetry)

pH = 7.96 (NGU) [would be 7.76 according to LGU]
T = 8.7 °C (NGU)

CEMETRY 2 Well (NW cemetry)

pH = 7.54 (NGU) [would be 7.34 according to LGU]
T = 8.8 °C (NGU)