



Soil Science Society of Poland (Wrocław branch)
Czech Soil Science Society
Polish Humic Substances Society
Institute of Soil Science Plant Nutrition and Environmental Protection
Wrocław University of Environmental and Life Sciences

International Symposium and Field Workshop
**Black Earths - origin, transformations, classification
and ecosystem functions**
in relation to
Black Earth – Soil of the Year 2026 (Poland)



Field guide

Wrocław - Karczyce
September 2-4, 2026

Field Guide preparation

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Program

Wednesday, September 02, 2026

Arrival to Wrocław or directly to Karczyce (workshop venue)

13:00-14:00 Registration and lunch

14:00-16:00 Oral session 1

- C. Kabala "Black earth – concepts of origin, classification and challenges"
- M. Kozłowski "Elements of black earths' water regime in the western part of the Wielkopolska Lakeland"
- Ł. Uzarowicz, D. Murach, K. Feluch "Development of Bw horizon in black earths following groundwater table decrease"
- B. Strouhalová "Isotopic signatures of Neolithic soils and pit fills shed light on land use and waste management in the Linear Pottery culture"

16:00-16:20 Coffee break

16:20-17:20 Oral session 2

- M. Świtoniak "Diversity of black earths in Kuyavia region"
- B. Łabaz "Fertility status of Chernozems and Phaeozems under different moisture regimes in southwestern Poland"

17:20-18:45 Poster session

19.00-21.00 Dinner

Thursday, September 03, 2026

07:30-08:30 Breakfast

08:30-12:00 Field workshop 1: arable Black Earths

12:00-13:00 Lunch break (in the field)

13:00-17:00 Field workshop 2: arable Black Earths

18:00-19:00 Poster session (continued) and discussion meeting

19.00-22:00 Grill dinner

Friday, September 04, 2026

07:30-08:00 Breakfast

08:00-12:00 Field workshop 3: forest and fallow Black Earths

12:00-13:00 Closing remarks, lunch and departure

BRIEF ENVIRONMENTAL SETTING

Field sessions of the workshop will take place in SW Poland, on the Wrocław Plain, being a part of the Silesian Lowland, in the altitude range of 127 - 132 m ASL (Fig. 1 and 2).

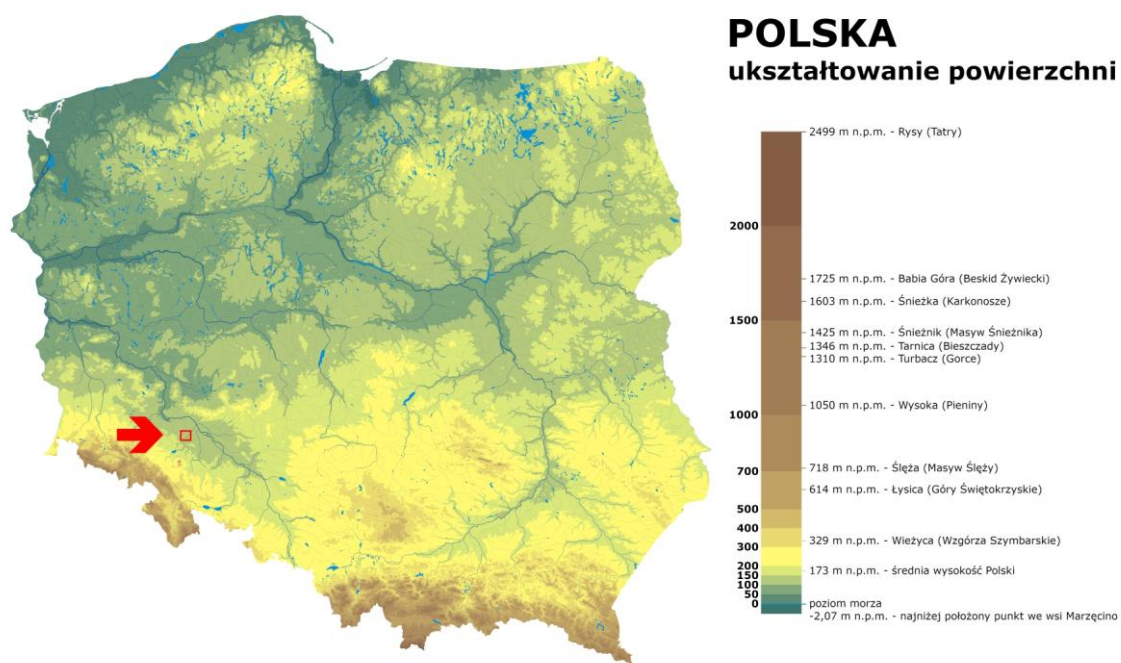


Fig. 1. Location of the workshop sites in SW Poland (Lower Silesia)

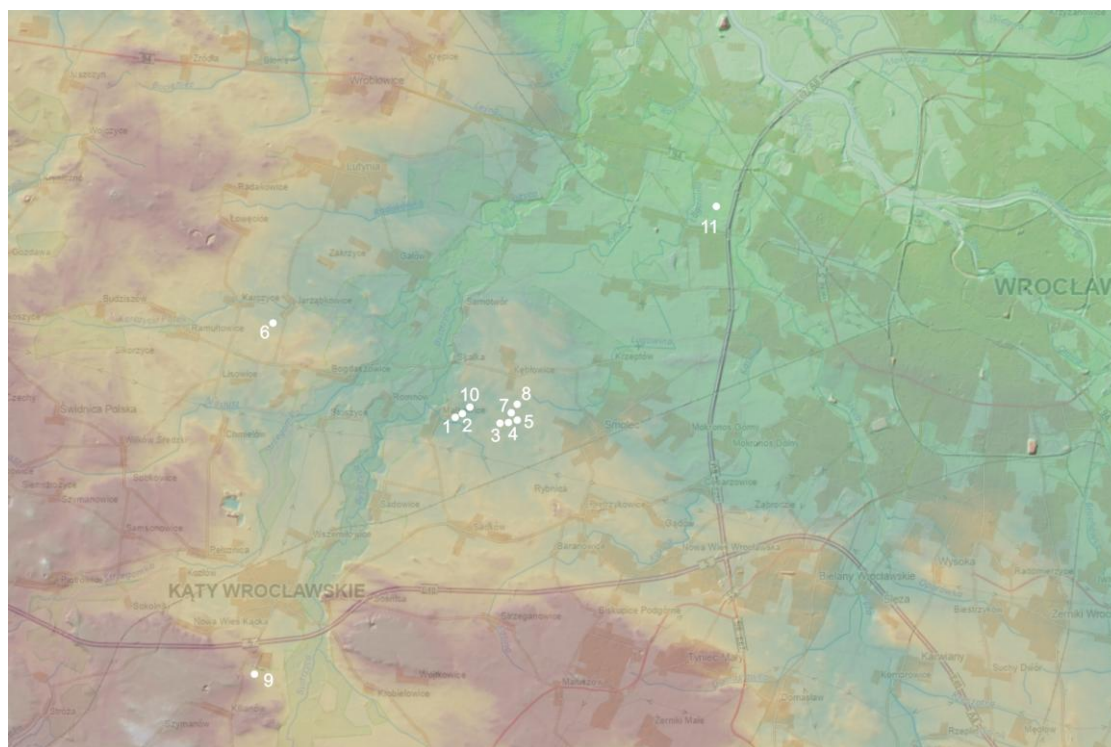


Fig. 2. Location of the soil profiles on a relief map (LIDAR) of the western part of the Wrocław Plain.

The Wrocław Plain is an old denudation surface covered with glacial tills and glaciofluvial sands of the Odra glaciation (Riss 1, Saale – Drenthe), locally covered with thin Vistulian (LGM) loess and loess-like sediments, all settled above thick Miocene clays. Locally, the Quaternary sediments are so thin that Miocene clays emerge within the soil profiles, sometimes even at soil surface.

Field sessions of the workshop are located at the north-western margins of a large black earth region, stretching ca 60 km south of Wrocław (Fig. 3). According to WRB, black soils of the region represent a variety of soils having mollic/chnernic horizons and stagnic/gleyic properties at various depth, thus classified as: Gleyic/Stagnic Phaeozems, Gleyic/Stagnic Chernozems, Mollic Gleysols, (Luvic) Mollic Stagnosols, and Mollic Planosols.

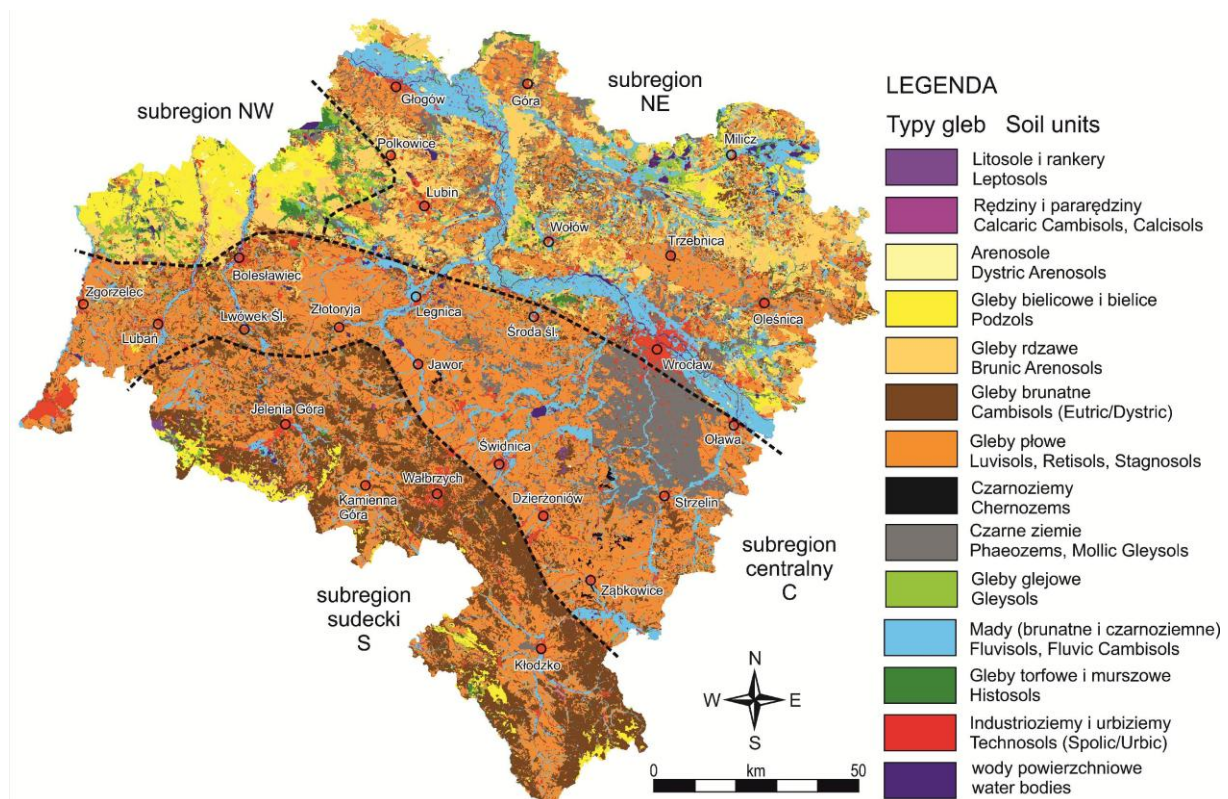


Fig. 3. Black earths (gray surface) on soil map of the Lower Silesia.

The Silesian Lowland is characterized by relatively (compared to other regions of Poland) high mean annual air temperatures of $>8.5^{\circ}\text{C}$ (recently $>9^{\circ}\text{C}$), moderate mean annual precipitation (around 550 mm) and slightly positive climatic water balance (Fig. 4-6).

Good soils, mild climate and plain landscape create beneficial environmental conditions for agriculture, and are reflected in high evaluation values, getting 70-80 credits on a scale of 4-100 credits (Fig. 7). As a result, the area is occupied and farmed permanently since the Neolithic period. Arable fields absolutely dominate the landscape, while forests persisted in the moist river valleys only.

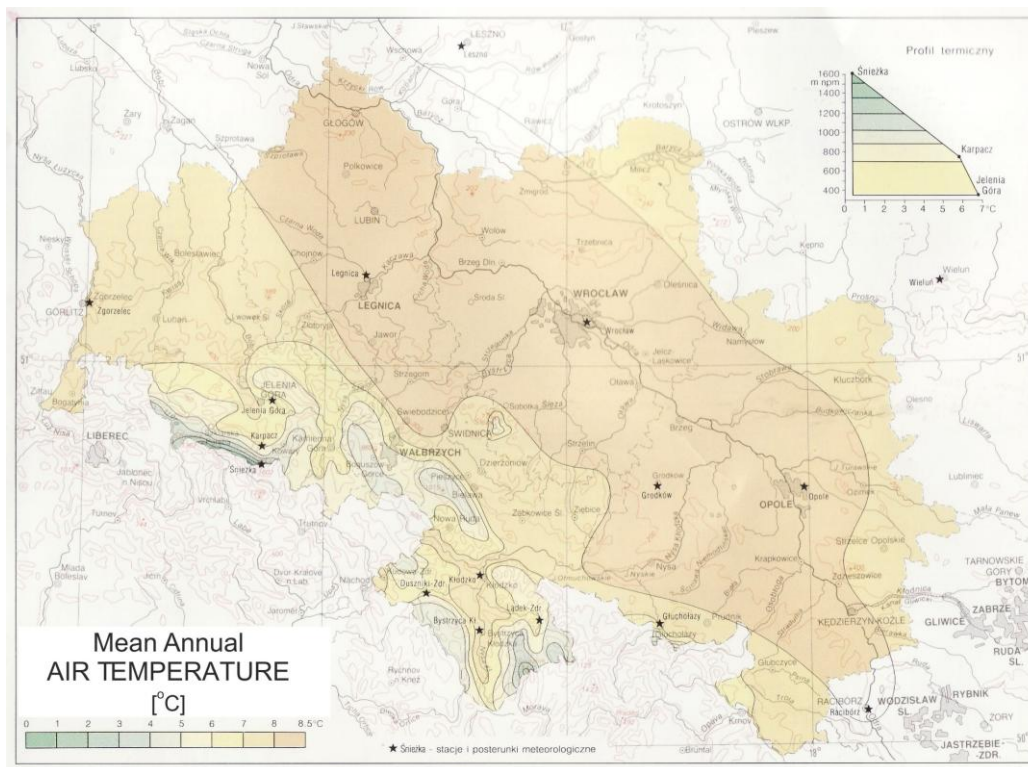


Fig. 4. Mean annual air temperatures (MAP) in the Lower Silesia

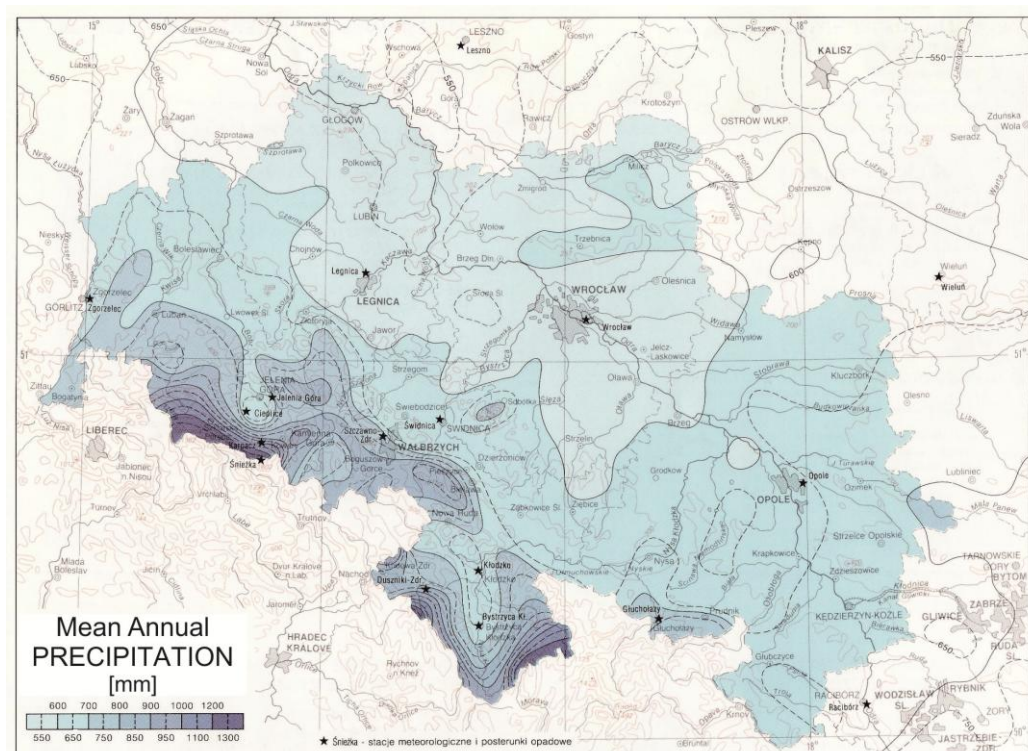


Fig. 5. Mean annual precipitation (MAP) in the Lower Silesia

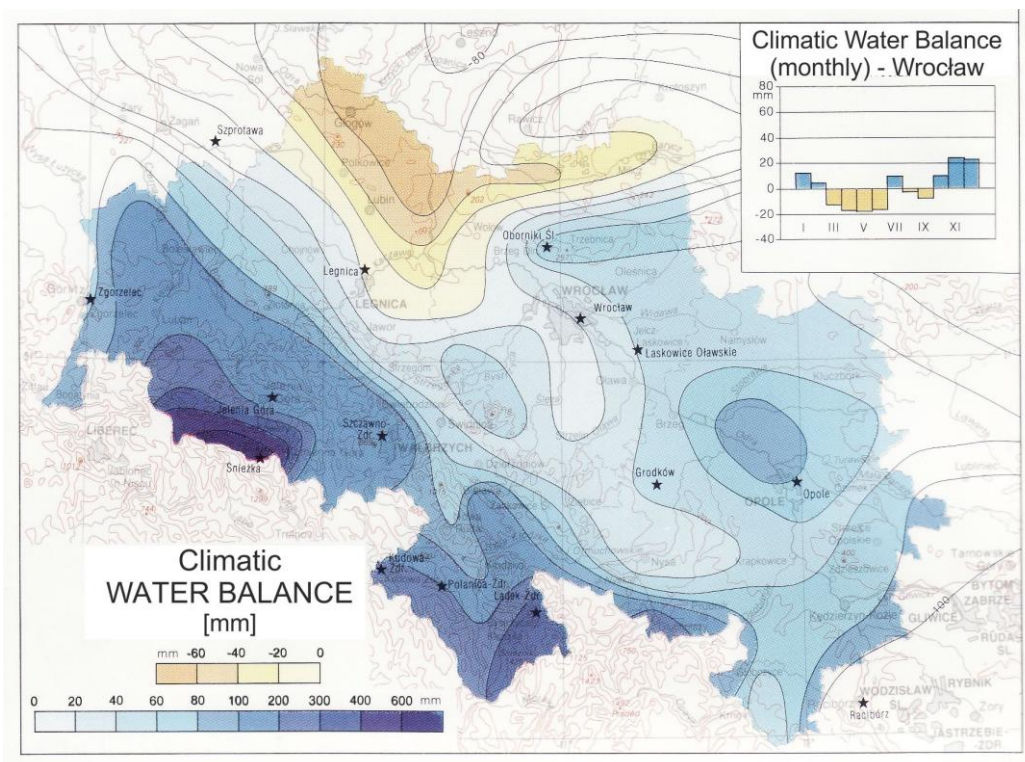


Fig. 6. Climatic water balance (precipitation minus evaporation) in the Lower Silesia

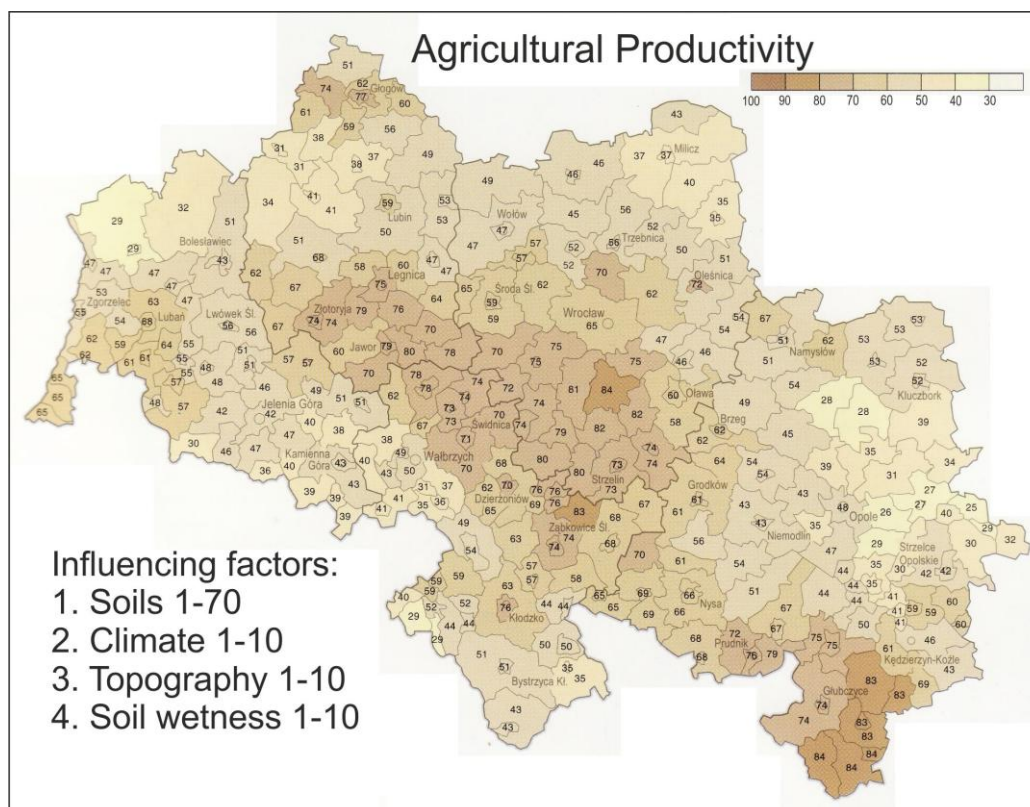


Fig. 7. Evaluation of potential productivity of agricultural space in the Lower Silesia (credit scale from 4 to 100)

The main part of the field sessions is located east of the Małkowice village and divided into two soil sequences (catenas): Małkowice West (profiles 1, 2, 10) and Małkowice East (profiles 4, 5, 7, 8) (Fig. 8). The archival maps, dated back to 1889 confirm the long history of the soil drainage in the Wrocław Plain (Fig. 9). The present-day network of ditches in the surrounding of Małkowice village already existed on these maps, that means the ditches have drained fields for at least 130 years.

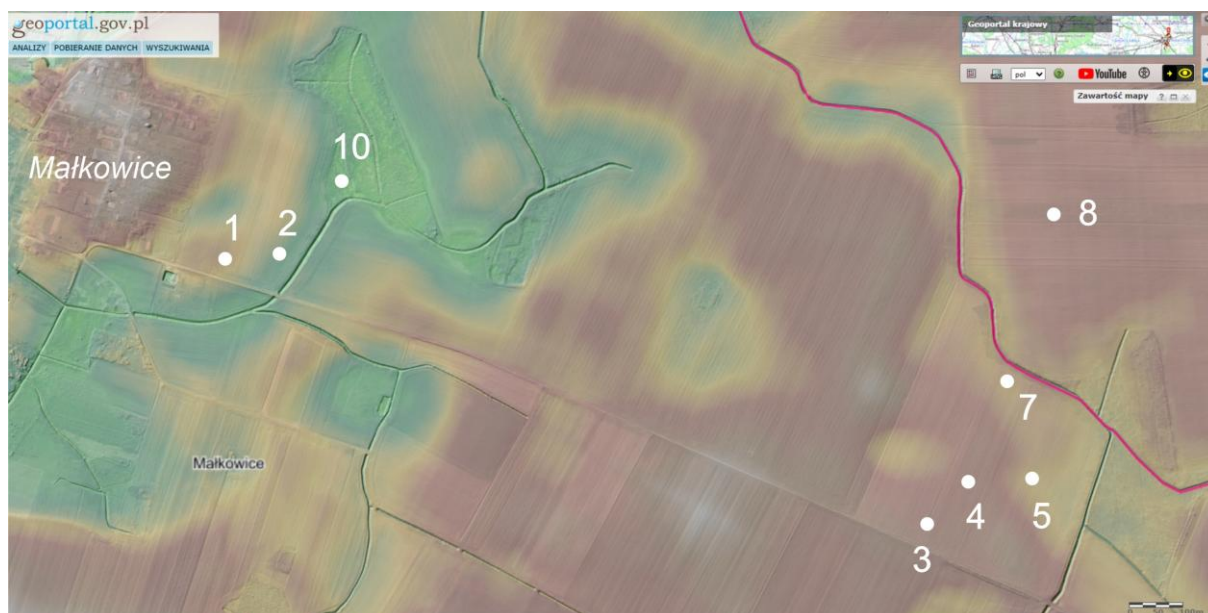


Fig. 8. Soil catenas in Małkowice: location of soil profiles on the LIDAR relief map.

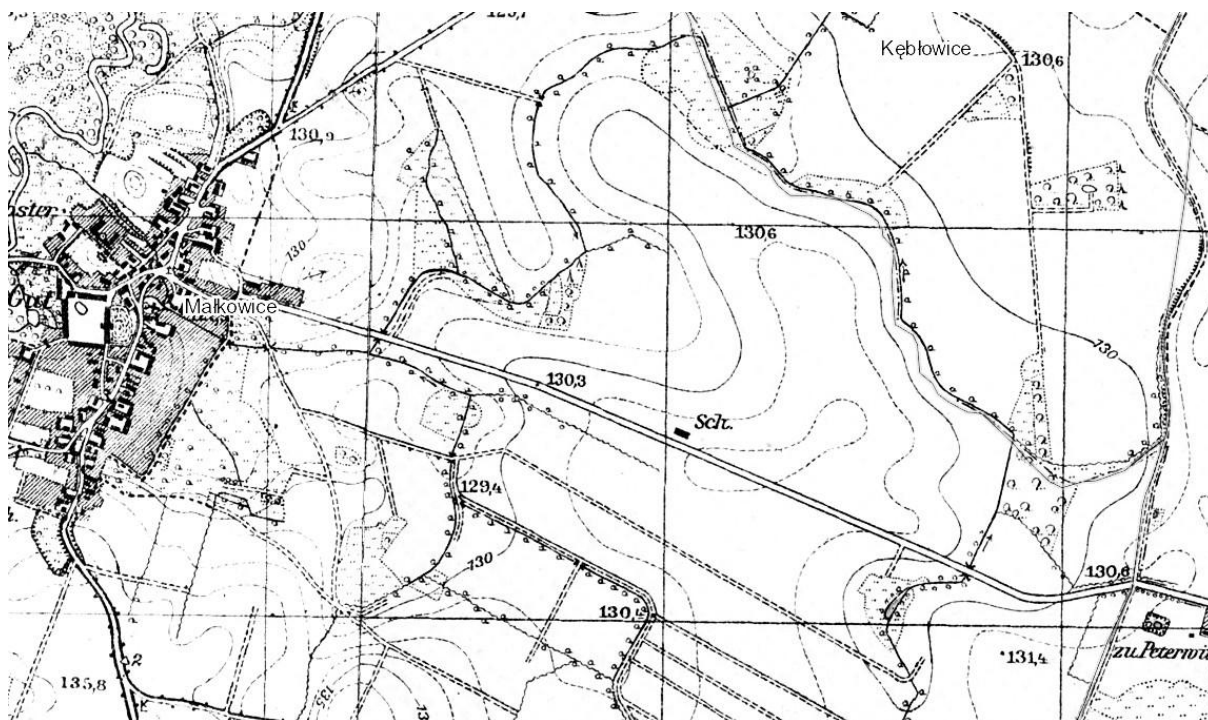


Figure 9. Archival topographic map (1889) of the fields of Małkowice village.

Fig. 10. Soil catena Małkowice West: location of soil profiles on the soil-agricultural map

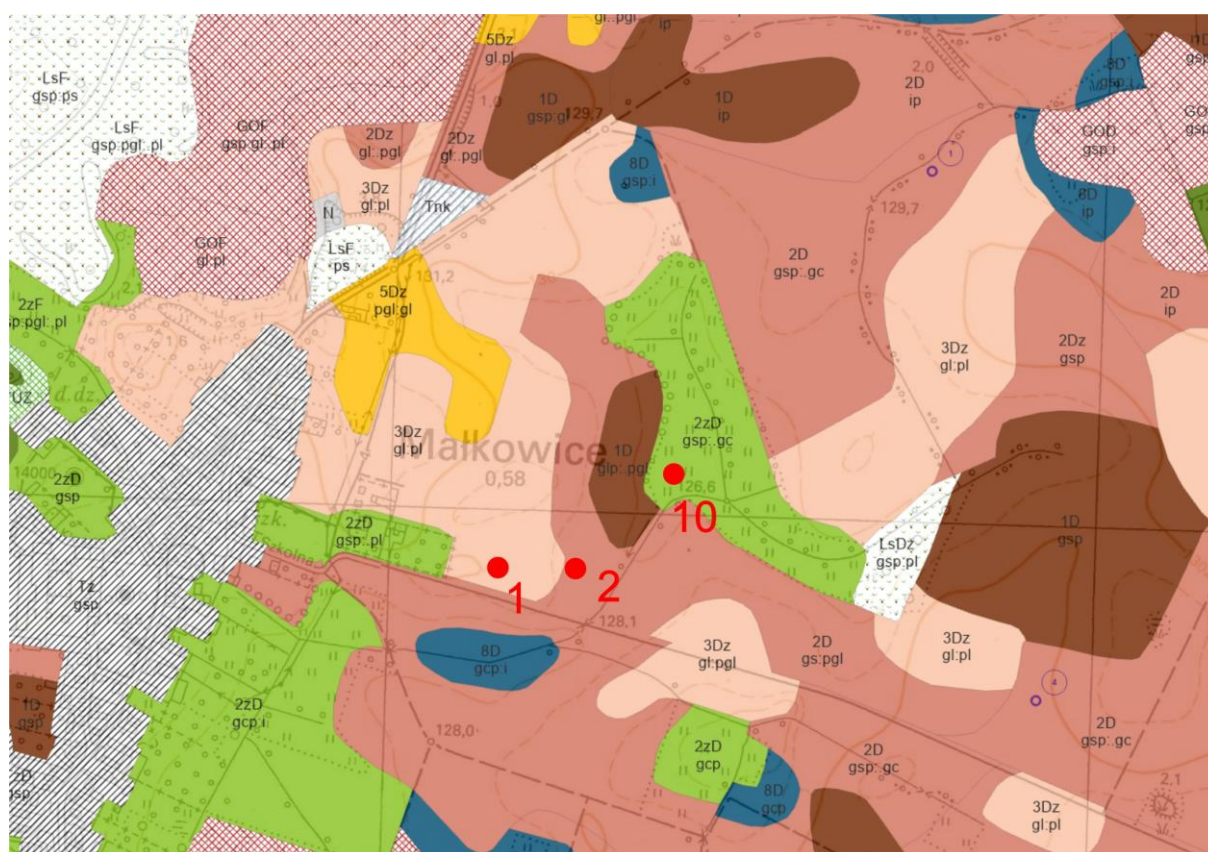
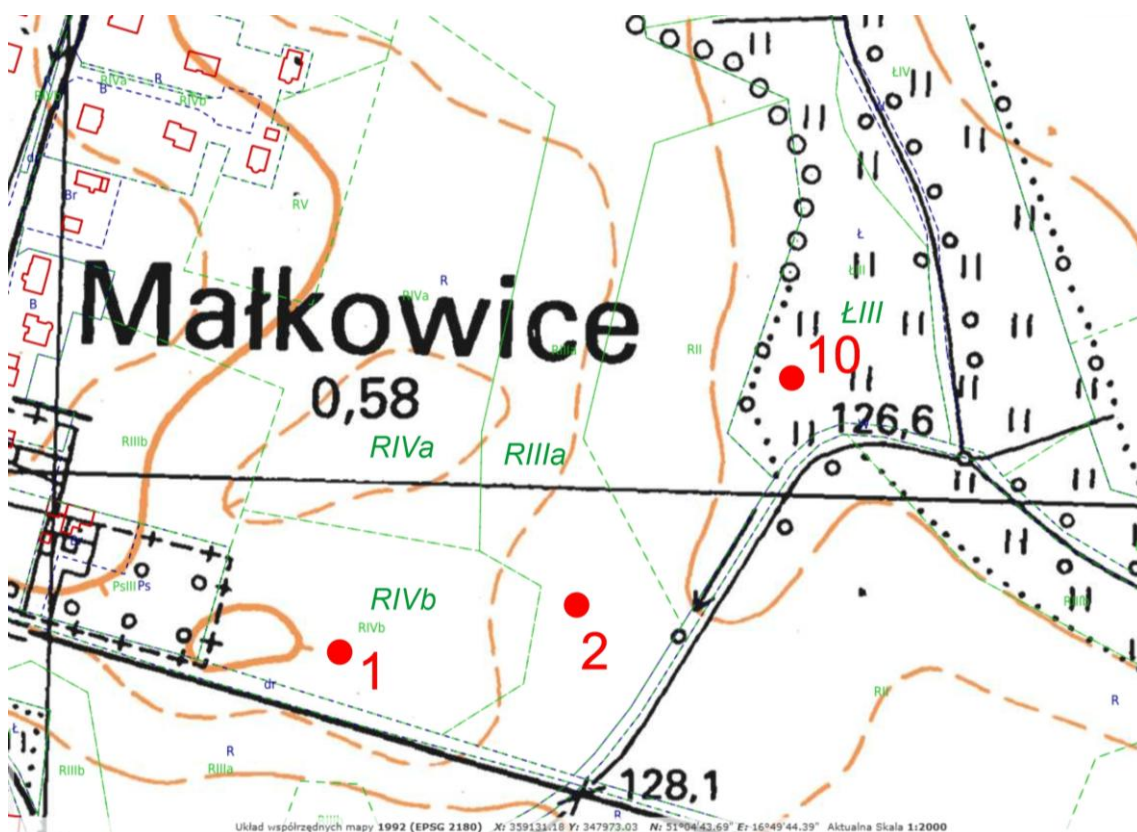


Fig. 11. Soil catena Małkowice West: location of soil profiles on the bonitation map



SOIL PROFILE 01

Localization: Małkowice, 10/5, Kąty Wrocławskie municipality, Wrocław county, Lower Silesia voivodshaft
Coordinates: 51°04'34.8" N, 16°49'46.5" E; PUWG: X 358856, Y 348006
Physiographical units: Silesian Lowland, Wrocław Plain
Altitude: 130 m above sea level
Landform: slightly undulating plain; soil profile located in a higher position on the field
Land use: arable field (2026: corn)
Parent materials: Pleistocene glacial tills and glaciofluvial sands on Miocene clays
Classification WRB2022: Luvic Stagnic Chernic Phaeozem (Epiloamic, Endogeoabruptic, Humic, Protocalcic, Protovertic)
Classification SGP6: Czarna ziemia iluwialna
Original agric. evaluation: class RIVb, complex 3Dz gl:pl



Soil profile 01 description

Horizon SGP	Ap1	Ap2	2BtCg1	2BtCg	3BCg	3BCikg
Horizon WRB	Ap1	Ap2	2BtCg1	2BtCg	3BCg	3BCikg
Depth, cm	0-28	28-47	47-70	70-82	82-105	105-140
Colour, moist	10YR 2/2	10YR 2-3/2	10YR 5/7	10YR 4/6	10YR 5/6	10YR 5/6
Boundary	gradual	clear irreg.	clear smooth	abrupt wavy	gradual	-
Structure	granular/blocky subangular medium	blocky subangular medium	platy/single grain	platy/ blocky subangular fine	blocky angular medium	blocky angular coarse
Consistence	very friable	friable	very friable	friable	firm	firm
Texture	L	L	LS	SL	SiC	SiC
Skeleton	<5%	<5%	0	10% remains of pavement	0	0
Carbonates	(+) lime	-	-	-	(+)	+ soft masses, fine concret.
Reductomorph. features	-	-	20% 10YR 5/4	-	20% 10YR 6/1	40% 5GY 6/1
Oximorphic features	-	-	-	20% 7.5YR 5/6	80%	60%
Redox accumulations	-	-	-	fine FM masses	very fine Mn masses	fine Mn masses
Clay accumul.	-	-	lamellae?	lamellae?	-	-
Slickensides	-	-	-	-	-	-
Earthworm channels/coasts	++	++	+	+	+	-
Other	-	-	-	ventifacts	-	-
Diagnostics	chernic	chernic	-	argic (lamellic)	stagnic	stagnic protocalcic

Analytical data for soil profile 01

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.02	0.02-0.005	0.005-0.002	<0.002	sand	silt	clay	
		%	%									%			
Ap1	0-28	<5	2.5	9.5	20	13	8	19	13	6	9	53	38	9	L
Ap2	-47	<5	2.5	9	21	11.5	10	19	11	6	10	54	36	10	L
2BtCg1	-70	0	11	21	32	13	6	6	4	1	6	83	11	6	LS
2BtCg2	-82	10	4	15	33	17	9	7	3	1	11	78	11	11	SL
3BCg	-105	0	0.3	0.4	1	0.3	2	4	27	15	50	4	46	50	SiC
3BCikg	-140	0	0.1	0.3	0.6	1	2	7	25	15	49	4	47	49	SiC

Explanation: L - loam (głina zwykła), LS - loamy sand (piasek gliniasty), SL – sandy loam (głina piaszczysta), SiC – silty clay (ił pyłasty)

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl
		g cm ⁻³	%			%		
Ap1	0-28	1.70	1.27	0.10	13	0.6	6.7	5.9
Ap2	-47	1.75	0.71	0.05	13	0	7.1	6.1
2BtCg1	-70	1.64	0.25	0.01	25	0	7.4	6.4
2BtCg2	-82	-	0.20	0.01	20	0	7.8	6.6
3BCg	-105	1.56	0.19	0.03	-	1	7.9	6.6
3BCikg	-140	-	0.17	0.01	-	6	8.3	6.8

Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pHw** – pH in distilled water (1:2.5 v/v), **pHkcl** – pH in 1 M KCl (1:2.5 v/v)

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Ap1	0-28	0.76	0	5.0	0.70	0.56	0.02	6.3	7.0	7.5	89	100	84
Ap2	-47	0.3	0	5.1	0.66	0.36	0.02	6.1	6.4	7.4	95	100	83
2BtCg1	-70	0.2	0	4.6	0.43	0.16	0.02	5.2	5.4	5.8	96	100	90
2BtCg2	-82	0.2	0	6.5	0.94	0.28	0.04	7.7	7.9	8.2	97	100	95
3BCg	-105	0	0	20.8	3.83	0.43	0.19	25.2	25.2	26.0	100	100	97
3BCikg	-140	0	0	35.4	4.32	0.40	0.22	40.3	40.3	28.0	100	100	100

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** - Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** - extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V=S*100/T$, **eBS** – effective base saturation $sBS=S*100/S+Al^{3+}$, **BS** – ‘real’ base saturation $BS=S*100/CEC$

SOIL PROFILE 02

Localization: Małkowice, 10/25, Kąty Wrocławskie municipality, Wrocław county, Lower Silesia voivodshaft
Coordinates: 51°04'35.1" N, 16°49'52.8" E; PUWG: X 358863, Y 348130
Physiographical units: Silesian Lowland, Wrocław Plain
Altitude: 128 m above sea level
Landform: slightly undulating plain; soil profile located in a lower position on the field, drained by ditch
Land use: arable field (2026: corn)
Parent materials: Pleistocene glacial tills and glaciofluvial sands on Miocene clays
Classification WRB2022: Cambic Stagnic Chernozem (Loamic, Humic, Pachic, Sombric, Geoabruptic*); Vertic or Protovertic should be discussed
* abrupt textural difference is too deep as for Planosols
Classification SGP6: Czarna ziemia zbrunatniała wertikowa
Original agric. evaluation: class RIIIa, complex 2D gs:pgl



Soil profile 02 description

Horizon SGP	Ap	Apb	ABg	Bwg	Bkg	2Bikg
Horizon WRB	Ap	Apb	ABg	Bwg	Bkg	2Bikg
Depth, cm	0-32	32-50	50-60	60-70	70-95	95-150
Colour, moist	10YR 2/1	10YR 1/1	10YR 4/1	7.5YR 6/6	10YR 6/6	10YR 6/6
Boundary	clear smooth	gradual	gradual	irregular	abrupt/clear irregular	-
Structure	granular/blocky subangular medium	blocky angular medium	blocky subangular fine	blocky subangular fine	blocky angular fine/medium	blocky angular medium
Consistence	very friable	friable	very friable	friable	firm	very firm
Texture	SL	SL	SL	SL	SL	C
Skeleton	<5%	<5%	<5%	<5%	10% remains of pavement	0
Carbonates	-	-	-	-	(+)	++ fine concret.
Reductomorph. features	-	-	50% 10YR 5/4	30% 10YR 5/4	60% 10YR 5/4	25% 5GY 6/1
Oximorphic features	-	-	-	70%	40%	75%
Redox accumulations	-	-	fine FM masses	very fine Mn masses	very fine Mn masses	very fine Mn masses
Clay accumul.	-	-	-	-	-	-
Slickensides	-	-	-	-	-	++
Earthworm channels/coasts	++	++	++	+	+	+
Other	brick fragm.	-	-	-	-	vert. cracks
Diagnostics	chernic	chernic sombric	stagnic	stagnic	stagnic	stagnic (proto)vertic protocalcic

Analytical data for soil profile 02

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.02	0.02-0.005	0.005-0.002	<0.002	sand	silt	clay	
		%	%									%			
Ap	0-32	<5	3	10	19	10	11	21	12	6	8	53	39	8	SL
Apb	-50	<5	2	8	19	12	10	18	12	6	13	51	36	13	SL*
ABg	-60	<5	4	13	23	14	8	15	8	2	13	62	25	13	SL*
Bwg	-70	<5	2.7	9.8	20.2	12.3	9	19	11	3	13	54	33	13	SL*
Bkg	-95	10	2	10	19	13	8	19	12	3	14	52	34	14	SL*
2Bikg	-150	0	0.2	1.7	3.1	3	4	1	10	14	63	12	25	63	C*

Explanation: SL – sandy loam (głina piaszczysta), SL* - sandy loam (głina lekka), C* – clay (ił ciężki)

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl
		g cm ⁻³	%			%		
Ap	0-32	1.54	0.72	0.07	10	0	7.5	6.4
Apb	-50	1.65	1.31	0.12	11	0	7.2	6.4
ABg	-60	1.7	0.50	0.02	34	0	7.9	7.1
Bwg	-70	1.64	0.31	0.01	29	0	8.2	7.2
Bkg	-95	1.72	0.23	0.03		3.2	8.2	7.3
2Bikg	-150	1.52	0.37	0.05		8.1	8.3	7.3

Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pHw** – pH in distilled water (1:2.5 v/v), **pHkcl** – pH in 1 M KCl (1:2.5 v/v)

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Ap	0-32	0.3	0	10.5	0.87	0.17	0.03	11.5	11.8	13.3	97	100	87
Apb	-50	0.24	0	11.3	1.23	0.64	0.04	13.2	13.4	13.9	98	100	95
ABg	-60	0	0	10.6	0.68	0.13	0.03	11.4	11.4	11.9	100	100	96
Bwg	-70	0	0	11.3	0.71	0.10	0.03	12.1	12.1	12.3	100	100	99
Bkg	-95	0	0	21.9	1.23	0.15	0.06	23.4	23.4	13.5	100	100	100
2Bikg	-150	0	0	38.3	7.24	0.39	0.22	46.1	46.1	27.3	100	100	100

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** - Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** - extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V=S*100/T$, **eBS** – effective base saturation $sBS=S*100/S+Al^{3+}$, **BS** – ‘real’ base saturation $BS=S*100/CEC$

SOIL PROFILE 10

Localization:	Małkowice, 10/19, Kąty Wrocławskie municipality, Wrocław county, Lower Silesia voivodshaft
Coordinates:	51°04'39.4" N, 16°49'57.9" E; PUWG: X 358990, Y 348232
Physiographical units:	Silesian Lowland, Wrocław Plain
Altitude:	127 m above sea level
Landform:	slightly undulating plain; soil profile located in a shallow concave basin drained by deep ditches; water stagnates on the surface in spring and after heavy rains
Land use:	in the past: meadow; presently: fallow; mainly sedges (<i>Carex</i> spp.), poplar (<i>Populus</i> spp.)
Parent materials:	Pleistocene glacial tills and glaciofluvial sands on Miocene clays
Classification WRB2022:	Eutric Chernic Stagnosol (Epiloamic, Katoclayic, Epiraptic, Humic, Protocalcic, Protovertic)
Classification SGP6:	Czarna ziemia typowa
Original agric. evaluation:	class ŁIII, complex 2zD gsp:gz



Soil profile 10 description

Horizon SGP	Ap	Apg	2ABkgg	3Bkg	3Bikg
Horizon WRB	Ap	Apg	2ABkr	3Bkg	3Bikg
Depth, cm	0-22	22-31	31-35	35-60	60-90
Colour, moist	10YR 3/1	2.5Y 2-3/1	2.5Y 3/1	10YR 6/6	10YR 6/6
Boundary	gradual	gradual	irregular	gradual	-
Structure	blocky subangular fine-medium	blocky subangular fine-medium	blocky subangular fine	blocky angular medium	blocky angular/wedge medium
Consistence	friable	friable	friable	firm	firm
Texture	SiL	L	L	C	C
Skeleton	<5%	<5%	10	0	0
Carbonates	+ (lime?)	+	+	+	+
Reductomorph. features	-	-	50% 2.5Y 7/1	25% 10G 7/1	40% 10GY 7/1
Oximorphic features	-	-	-	75%	60%
Redox accumulations	-	-	-	very fine FM masses	very fine FM masses
Clay accumul.	-	-	-	coatings	-
Slickensides	-	-	-	+	++
Earthworm channels/coasts	+	+	+	-	-
Other	-	-	-	-	-
Diagnostics	chernic	chernic	stagnic (+gleyic?)*	stagnic	stagnic protocalcic protovertic

* Note criterion 5 of the stagnic properties (WRB 2022).

Analytical data for soil profile 10

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.02	0.02-0.005	0.005-0.002	< 0.002	sand	silt	clay	
		%	%									%			
Ap	0-22	<5	2.5	5	11.5	9	8	28	18	7	11	36	53	11	SiL*
Apg	-31	<5	2	5.5	11	9.5	8	20	20	5	19	36	45	19	L
2ABkgg	-35	10	2.5	5	10	9.5	7	13	17	10	26	34	40	26	L
3Bkg	-60	0	0	1	2	2	3	2	15	19	56	8	36	56	C
3Bikg	-90	0	0	1	1	2	2	1	14	23	56	6	38	56	C

Explanation: SiL* – silt loam (pył gliniasty), L - loam (glina zwykła), C – clay (ił zwykły)

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl
		g cm ⁻³	%			%		
Ap	0-22	-	3.04	0.32	9	1.3	7.3	7.0
Apg	-31	-	1.67	0.13	13	4.5	8.2	7.5
2ABkgg	-35	-	1.01	0.07	-	10.3	8.3	7.5
3Bkg	-60	-	0.62	0.08	-	10.1	8.2	7.3
3Bikg	-90	-	0.42	0.06	-	5.7	8.3	7.5

Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pHw** – pH in distilled water (1:2.5 v/v), **pHkcl** – pH in 1 M KCl (1:2.5 v/v)

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Ap	0-22	0.1	0	27.2	3.82	0.62	0.34	32.0	32.1	21.8	100	100	100
Apg	-31	0	0	40.3	2.79	0.22	0.20	43.5	43.5	17.9	100	100	100
2ABkgg	-35	0	0	51.7	3.67	0.24	0.23	55.8	55.8	16.4	100	100	100
3Bkg	-60	0	0	49.8	7.11	0.43	0.39	57.8	57.8	31.0	100	100	100
3Bikg	-90	0	0	41.3	7.44	0.47	0.38	49.6	49.6	35.3	100	100	100

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** - Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** - extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V=S*100/T$, **eBS** – effective base saturation $sBS=S*100/S+Al^{3+}$, **BS** – ‘real’ base saturation $BS=S*100/CEC$

SOIL PROFILE 03

Localization:	Małkowice, 11/6, Kąty Wrocławskie municipality, Wrocław county, Lower Silesia voivodshaft
Coordinates:	51°04'19.5" N, 16°50'59.7" E; PUWG: X 358343, Y 349415
Physiographical units:	Silesian Lowland, Wrocław Plain
Altitude:	131.5 m above sea level
Landform:	soil profile located in a higher position on the field
Land use:	arable field (2026: wheat)
Parent materials:	Pleistocene glacial tills and glaciofluvial sands on Miocene clays
Classification WRB2022:	Eutric Chernic Planosol (Epiloamic, Endoclayic, Aric, Raptic, Protocalcic, Protovertic, Brunic)
Classification SGP6:	Czarna ziemia typowa
Original agric. evaluation:	class RIVb, complex 3D gl:pl



Soil profile 03 description

Horizon SGP	Ap1	Ap2	2Bvg	2Bkcg	2Bikg
Horizon WRB	Ap1	Ap2	2Bwg	2Bkcg	2Bikg
Depth, cm	0-12	12-40	40-60	60-85	85-150
Colour, moist	10YR 2/2	10YR 2-3/2	10YR 5/8	10YR 6/6	10YR 6/6
Boundary	gradual	abrupt smooth	clear wavy	gradual	-
Structure	blocky subangular fine/medium	blocky subangular/angular fine	blocky subangular fine	blocky angular medium	blocky angular/wedge medium
Consistence	friable	friable	loose/very friable	firm	very firm
Texture	SL	SL	LS	C	C
Skeleton	0	0	10% remain of pavement	0	0
Carbonates	-	-	-	++ fine concret.	+ dispersed
Reductomorph. features	-	-	-	15% 5GY 6/1	25% 5GY 6/1
Oximorphic features	-	-	20% 10YR 6/6	85%	75%
Redox accumulations	-	-	fine Fe masses	very fine Mn masses	very fine Mn masses
Clay accumul.	-	-	-	-	-
Slickensides	-	-	-	-	++
Earthworm channels/coasts	++	++	++	+	-
Other	-	-	-	-	-
Diagnostics	chernic	chernic	(brunic)	stagnic protocalcic	stagnic (proto)vertic

Analytical data for soil profile 03

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.02	0.02-0.005	0.005-0.002	< 0.002	sand	silt	clay	
		%	%									%			
Ap1	0-12	0	3	9	13	12	12	16	14	6	15	49	36	15	SL*
Ap2	-40	0	4	11.3	20.3	12.4	8	12	14	4	14	56	30	14	SL*
2Bvg	-60	10	13	21	28	18	3	3	2	3	9	83	8	9	LS
3Bkcg	-85	0	0.6	1.4	1	1	2	2	23	15	54	6	40	54	C
3Bkig	-150	0	0.5	0.5	1	1	1	2	15	18	61	4	35	61	C*

Explanation: SL* – sandy loam (glina lekka), LS – loamy sand (piasek gliniasty), C – clay (ił zwykły), C* – clay (ił ciężki)

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl
		g cm ⁻³	%			%		
Ap1	0-12	1.52	1.45	0.12	12	0	6.0	5.0
Ap2	-40	1.60	1.33	0.10	13	0	6.2	5.1
2Bvg	-60	1.55	0.41	0.02	24	0	6.9	5.8
3Bkcg	-85	1.54	0.30	0.04	-	5.7	8.0	6.9
3Bkig	-150	1.59	0.26	0.03	-	4.2	8.1	7.1

Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pHw** – pH in distilled water (1:2.5 v/v), **pHkcl** – pH in 1 M KCl (1:2.5 v/v)

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Ap1	0-12	2.14	0	8.5	1.28	0.83	0.05	10.7	12.8	16.5	83	100	65
Ap2	-40	1.92	0	7.9	0.97	0.38	0.04	9.3	11.3	13.2	83	100	71
2Bvg	-60	0.05	0	4.0	1.51	0.29	0.03	5.8	5.9	6.0	99	100	97
3Bkcg	-85	0	0	31.9	6.77	0.30	0.14	39.1	39.1	25.0	100	100	100
3Bkig	-150	0	0	29.4	10.6	0.44	0.23	40.7	40.7	29.3	100	100	100

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** – Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** – extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V=S*100/T$, **eBS** – effective base saturation $sBS=S*100/S+Al^{3+}$, **BS** – ‘real’ base saturation $BS=S*100/CEC$

SOIL PROFILE 04

Localization:	Małkowice, 11/6, Kąty Wrocławskie municipality, Wrocław county, Lower Silesia voivodshaft
Coordinates:	51°04'23.3" N, 16°51'00.3" E; PUWG: X 358457, Y 349441
Physiographical units:	Silesian Lowland, Wrocław Plain
Altitude:	131 m above sea level
Landform:	soil profile located in a higher position on the field
Land use:	arable field (2026: wheat)
Parent materials:	Pleistocene glacial tills and glaciofluvial sands on Miocene clays
Classification WRB2022:	Stagnic Chernic Phaeozem (Loamic, Aric, Raptic, Relictiturbic)
Classification SGP6:	Czarna ziemia typowa
Original agric. evaluation:	class RIIIa, complex 2D gsp



Soil profile 04 description

Horizon SGP	Ap1	Ap2	ABwg	2BCg	2BCg@	2BCgg@	3BCg
Horizon WRB	Ap1	Ap2	ABwg	2BCg	2BCg@	2BC(l)@p	3BCg
Depth, cm	0-13	13-35	35-50	50-65	65-90	90-120	120-150
Colour, moist	10YR 3/1	10YR 3/2	10YR 4/3	10YR 5/3	10YR 6/2	10YR 7/1	10YR 6/1
Boundary	abrupt smooth	clear vawy	gradual	clear vawy	clear irreg.	clear vawy	-
Structure	granular/ blocky subangular fine	granular/ blocky angular fine	blocky subangular fine	blocky subangular fine	blocky subangular /single grain	single grain	blocky angular/ platy
Consistence	friable	friable	very friable	very friable	very friable /loose	loose	firm
Texture	L	L	L	SL+S	SL+S	S	SL+L
Skeleton	<5%	<5%	10%	10%	30% remains of pavement	0	0
Carbonates	-	-	-	-	-	-	-
Reductomorph. features	-	-	-	40%	50%	90%	50%
Oximorphic features	-	-	20% 10YR 4/6	30% 10YR 6/3	50% 10YR 5/8	10% 10YR 5/8	50% 10YR 6/8
Redox accumulations	-	-	-	fine FM masses	very fine Mn masses	-	very fine Mn masses
Clay accumul.	-	-	-	-	-	-	-
Slickensides	-	-	-	-	-	-	-
Earthworm channels/coasts	++	++	+	+	+	+	-
Other	-	-	-	-	relict cryoturbation		
Diagnostics	chernic	chernic	stagnic	stagnic	stagnic	gleyic?*	stagnic

* Note criterion 5 of the stagnic properties (WRB 2022).

Analytical data for soil profile 04

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.02	0.02-0.005	0.005-0.002	<0.002	sand	silt	clay	
		%	%									%			
Ap1	0-13	<5	1	7.5	17.5	7	12	22	15	5	13	45	42	13	L
Ap2	-35	<5	1	5.5	19	7.5	12	20	16	6	13	45	42	13	L
ABwg	-50	10	1	7	15	5	12	23	13	5	19	40	41	19	L
2BCg	-65	10	1.3	9	35	12.7	6	15	5	1	15	64	21	15	SL*
2BCg@	-90	30	2.3	15	36	15.7	7	7	3	1	13	76	11	13	SL
2BCgg@	-120	0	5	20	58	14	1	0	0	1	1	98	1	1	S*
3BCg	-150	0	2	9	21	18	16	9	8	2	15	66	19	15	SL

Explanation: L – loam (glina zwykła), SL – sandy loam (glina piaszczysta), SL* – sandy loam (glina lekka), S* – sand (piasek luźny)

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl
		g cm ⁻³	%			%		
Ap1	0-13	1.54	1.29	0.12	11	0	6.0	5.1
Ap2	-35	1.60	1.08	0.10	11	0	5.9	5.0
ABwg	-50	1.67	0.51	0.05	10	0	6.5	5.3
2BCg	-65	1.63	0.30	0.02	-	0	6.8	5.5
2BCg@	-90	-	0.24	0.01	-	0	7.2	5.8
2BCgg@	-120	1.7	0.06	0.01	-	0	7.2	5.9
3BCg	-150	-	0.09	0.01	-	0	7.3	6.1

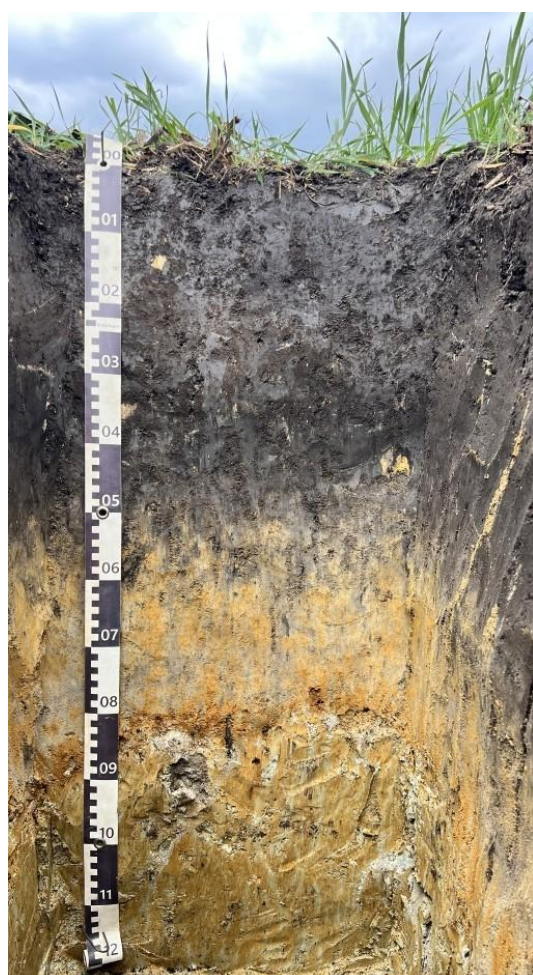
Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pHw** – pH in distilled water (1:2.5 v/v), **pHkcl** – pH in 1 M KCl (1:2.5 v/v)

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Ap1	0-13	2.22	0	6.22	0.72	0.82	0.03	7.8	10.0	13.2	78	100	59
Ap2	-35	2.58	0	6.42	0.59	0.37	0.03	7.4	10.0	12.5	74	100	59
ABwg	-50	0.66	0	6.64	0.88	0.25	0.04	7.8	8.5	13.4	92	100	58
2BCg	-65	0.22	0	5.17	0.74	0.19	0.03	6.1	6.4	9.0	97	100	68
2BCg@	-90	0.05	0	4.72	0.49	0.14	0.02	5.4	5.4	6.5	99	100	83
2BCgg@	-120	0.05	0	0.83	0.28	0.08	0.01	1.2	1.3	1.6	96	100	75
3BCg	-150	0	0	6.07	1.05	0.18	0.04	7.3	7.3	8.1	100	100	90

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** – Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** – extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V=S*100/T$, **eBS** – effective base saturation $sBS=S*100/S+Al^{3+}$, **BS** – ‘real’ base saturation $BS=S*100/CEC$

SOIL PROFILE 05

Localization:	Małkowice, 11/6, Kąty Wrocławskie municipality, Wrocław county, Lower Silesia voivodshaft
Coordinates:	51°04'22" N, 16°51'06" E; PUWG: X 358417, Y 349543
Physiographical units:	Silesian Lowland, Wrocław Plain
Altitude:	129 m above sea level
Landform:	soil profile located in an intermediate position on the field
Land use:	arable field (2026: wheat)
Parent materials:	Pleistocene loess-like sediments and glacial tills on Miocene clays
Classification WRB2022:	Haplic Chernozem (Anosiltic, Humic, Pachic, Stagnic, Endogeoabruptic, Protovertic)
Classification SGP6:	Czarna ziemia typowa
Original agric. evaluation:	class RII, complex 1D gsp



Soil profile 05 description

Horizon SGP	Ap1	Ap2	Ap3(b)	ABkg	2Bkg	3Bikcg	3Bikg
Horizon WRB	Ap1	Ap2	Ap3(b)	ABkg	2Bkg	3Bikcg	3Bikg
Depth, cm	0-18	18-35	35-50	50-60	65-85	90-100	100-150
Colour, moist	10YR 1-2/1	10YR 2/2	10YR 2/1	10YR 5/2	10YR 5/6	10YR 6/6	10YR 6/6
Boundary	clear smooth	clear wavy	gradual	gradual	clear wavy	gradual	-
Structure	granular/ blocky subangular fine	blocky subangular fine	blocky angular medium	blocky subangular fine	blocky subangular fine	blocky angular/ wedge	blocky angular/ wedge
Consistence	very friable	friable	friable	very friable	very friable	firm	firm
Texture	SiL	SiL	SiL	SiL	SL	C	C
Skeleton	<5%	<5%	<5%	0	5 remains of pavement	15% remains of pavement	0
Carbonates	-	-	-	+	+	++ soft masses fine nodulae pendants	++
Reductomorph. features	-	-	-	30% 10YR 6/2	40% 10YR 6/2	40% 10YR 6/1	40% 10YR 6/1
Oximorphic features	-	-	-	-	60%	60%	60%
Redox accumulations	-	-	-	-	fine FM masses	fine Mn masses	fine Mn masses
Clay accumul.	-	-	-	-	-	-	-
Slickensides	-	-	-	-	-	++	++
Earthworm channels/coasts	++	++	+	+	+	-	-
Other	-	-	-	-	FM nodulae above transition to 3Bikcg	-	-
Diagnostics	chernic	chernic	chernic	stagnic	stagnic	stagnic protovertic protocalcic	stagnic protovertic calcic?

Analytical data for soil profile 05

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.02	0.02-0.005	0.005-0.002	<0.002	sand	silt	clay	
		%	%									%			
Ap1	0-18	<5	1	4	10	6	9	27	18	10	15	30	55	15	SiL*
Ap2	-35	<5	1	4	10	6	8	25	20	9	17	29	54	17	SiL*
Ap(b)3	-50	<5	0.5	2.5	7	4	12	29	18	6	21	26	53	21	SiL*
ABkg	-60	0	0.3	2.5	7.2	5	11	32	18	6	18	26	56	18	SiL*
2BCkg	-85	0	1	6	25	12	10	22	10	3	11	54	35	11	SL*
3BCikcg	-100	15	1.3	2.5	5	2.2	3	2	22	14	48	14	38	48	C
3BCikg	-150	0	0.5	1	1.5	1	2	4	23	13	54	6	40	54	C

Explanation: SiL* – silt loam (pył ilasty), SL* – sandy loam (glina lekka), C – clay (ił zwykły)

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl
		g cm ⁻³	%			%		
Ap1	0-18	1.62	2.16	0.16	13	0	7.5	6.8
Ap2	-35	1.65	2.03	0.14	15	0	7.7	7.0
Ap(b)3	-50	-	1.67	0.10	18	4	7.9	7.0
ABkg	-60	-	0.75	0.09	11	2	8.0	7.2
2BCkg	-85	1.65	0.26	0.02	-	3	8.1	7.4
3BCikcg	-100	-	0.32	0.04	-	5	8.3	7.5
3BCikg	-150	1.62	0.20	0.03	-	17	8.3	7.5

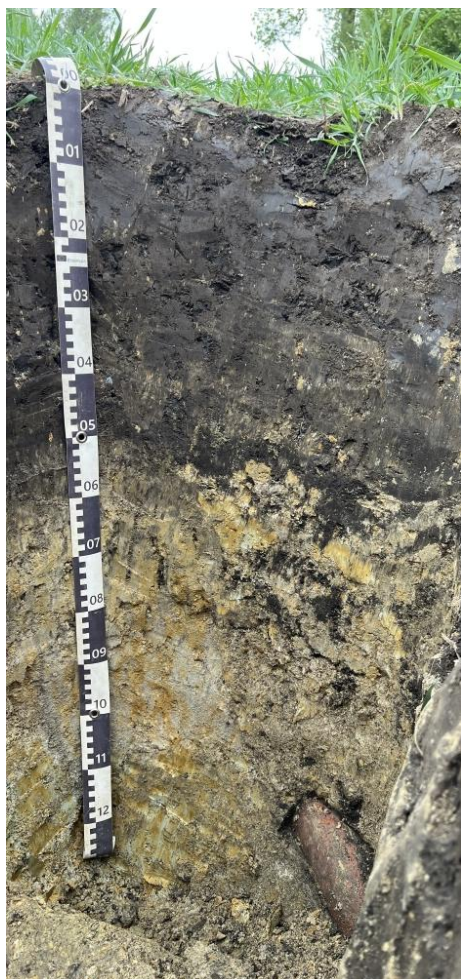
Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pHw** – pH in distilled water (1:2.5 v/v), **pHkcl** – pH in 1 M KCl (1:2.5 v/v)

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Ap1	0-18	0	0	24.0	0.99	0.43	0.06	25.4	25.4	23.5	100	100	100
Ap2	-35	0	0	24.9	0.73	0.21	0.06	25.9	25.9	24.1	100	100	100
Ap(b)3	-50	0	0	27.8	0.75	0.18	0.08	28.9	28.9	17.5	100	100	100
ABkg	-60	0	0	20.5	0.90	0.11	0.05	21.5	21.5	14.0	100	100	100
2BCkg	-85	0	0	19.6	1.36	0.13	0.06	21.2	21.2	7.6	100	100	100
3BCikcg	-100	0	0	24.6	4.05	0.25	0.12	29.0	29.0	22.3	100	100	100
3BCikg	-150	0	0	45.5	6.26	0.31	0.16	52.2	52.2	26.9	100	100	100

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** - Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** - extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V=S*100/T$, **eBS** – effective base saturation $sBS=S*100/S+Al^{3+}$, **BS** – ‘real’ base saturation $BS=S*100/CEC$

SOIL PROFILE 07

Localization:	Małkowice, 11/6, Kąty Wrocławskie municipality, Wrocław county, Lower Silesia voivodshaft
Coordinates:	51°04'30.9" N, 16°51'02.9" E; PUWG: X 358692, Y 349486
Physiographical units:	Silesian Lowland, Wrocław Plain
Altitude:	128 m above sea level
Landform:	slightly undulating plain; soil profile located in a lower position on the field, drained by ceramic pipes and deep ditch
Land use:	arable field (2026: wheat)
Parent materials:	Pleistocene loess-like sediments and glacial tills (colluvium?) on Miocene clays
Classification WRB2022:	Calcic Chernozem (Epiloamic, Endosiltic, Humic, Pachic, Stagnic, Endogeoabruptic, Protovertic)
Classification SGP6:	Czarna ziemia kalcikowa
Original agric. evaluation:	class RIVa, complex 8D gsp:i



Soil profile 07 description

Horizon SGP	Ap1	Ap2	2ABkcg	2Bkcg	3Bikg
Horizon WRB	Ap1	Ap2	2ABkcg	2Bkcg(l)	3Bikg
Depth, cm	0-30	30-50	50-62	62-98	98-140
Colour, moist	2.5Y 2/1	2.5Y 2/2	10YR 5/2	10YR 6/8	10YR 6/8
Boundary	gradual	gradual	gradual	clear wavy/irregular	-
Structure	granular/ blocky subangular fine	blocky angular/ subangular fine	blocky subangular fine	blocky angular/ subangular fine/medium	blocky angular medium
Consistence	friable	firm	firm	firm	very firm
Texture	L	L	SiL	SL	C
Skeleton	<5%	<5%	<5%	<5%	0
Carbonates	+ (lime)	(+)	++ fine nodulae	++ fine nodulae	++
Reductomorph. features	-	-	30%	50-70% 5GY 7/1	40% 5GY 7/1
Oximorphic features	-	-	30% 10YR 5/6	30-50%	60%
Redox accumulations	-	-	fine Mn masses	fine Mn masses	fine Mn masses
Clay accumul.	-	-	-	-	-
Slickensides	-	-	-	-	+
Earthworm channels/coasts	++	++	+	+	-
Other	-	-	-	-	ceramic drain at 110 cm
Diagnostics	chernic	chernic	stagnic protocalcic	stagnic (+ gleyic?)* calcic	stagnic protocalcic protovertic

* Note criterion 5 of the stagnic properties (WRB 2022).

Analytical data for soil profile 07

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0- 1.0	1.0- 0.5	0.5- 0.25	0.25- 0.1	0.1- 0.05	0.05- 0.02	0.02- 0.005	0.005- 0.002	< 0.002	sand	silt	clay	
		%	%									%			
Ap1	0-30	<5	0.7	2.8	7	8.5	10	25	17	4	25	29	46	25	L
Ap2	-50	<5	0.8	3.5	7.7	7	11	24	16	6	24	30	46	24	L
2ABkcg	-62	<5	1	2.5	4.5	4	8	32	19	7	22	20	58	22	SiL
2Bkcg	-98	<5	1.5	3	7	6.5	9	29	16	7	21	27	52	21	SiL
3Bikg	-140	0	0	1.3	1.8	2.9	6	12	15	8	53	12	35	53	C

Explanation: L – loam (glina zwykła), SiL* – silt loam (pył ilasty), C – clay (ił zwykły)

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl
		g cm ⁻³	%			%		
Ap1	0-30	1.44	1.93	0.14	14	0	7.6	6.9
Ap2	-50	1.66	1.41	0.09	17	0	7.6	7.0
2ABkcg	-62	-	0.89	0.07	14	11	7.9	7.3
2Bkcg	-98	1.62	0.49	0.03	-	18	8.1	7.5
3Bikg	-140	1.5	0.23	0.01	-	10	8.0	7.0

Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pHw** – pH in distilled water (1:2.5 v/v), **pHkcl** – pH in 1 M KCl (1:2.5 v/v)

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Ap1	0-30	0	0	22.2	1.45	0.72	0.06	24.4	24.4	18.2	100	100	100
Ap2	-50	0	0	23.9	1.63	0.33	0.06	25.9	25.9	19.3	100	100	100
2ABkcg	-62	0	0	45.6	1.90	0.19	0.09	47.8	47.8	13.3	100	100	100
2Bkcg	-98	0	0	45.6	1.81	0.12	0.09	47.6	47.6	9.1	100	100	100
3Bikg	-140	0	0	39.7	5.99	0.26	0.15	46.1	46.1	25.8	100	100	100

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** - Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** - extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V=S*100/T$, **eBS** – effective base saturation $sBS=S*100/S+Al^{3+}$, **BS** – ‘real’ base saturation $BS=S*100/CEC$

SOIL PROFILE 08

Localization:	Kębłowice, 5/132, Kąty Wrocławskie municipality, Wrocław county, Lower Silesia voivodshaft
Coordinates:	51°04'40.1" N, 16°51'05.5" E; PUWG: X 358975, Y 349548
Physiographical units:	Silesian Lowland, Wrocław Plain
Altitude:	131 m above sea level
Landform:	slightly undulating plain; soil profile located in a higher, flat section of the field
Land use:	arable (2026: phacelia)
Parent materials:	Pleistocene glacial tills on glaciofluvial sands
Classification WRB2022:	Brunic Phaeozem (Epiloamic, Katoarenic, Amphiraptic, Bathyglyeyic)
Classification SGP6:	Gleba szara typowa (średnio głęboko gruntowo-glejowa)
Original agric. evaluation:	[[class RIIIb, complex 2D gsp:i]]



Soil profile 08 description

Horizon SGP	Ap1	Ap2	2ABv	2BvC	3C	4Cgg
Horizon WRB	Ap1	Ap2	2ABw	2BwC	3C	4Cl
Depth, cm	0-20	20-38	38-50	50-65	65-80	80-150
Colour, moist	10YR 3/2	10YR 3/2	10YR 4/3	10YR 5/3	10YR 6/2-3	10YR 7/2
Boundary	gradual	gradual	gradual	clear wavy	clear wavy	-
Structure	granular/ blocky subangular fine	blocky subangular fine	blocky subangular fine	single grain	single grain	single grain
Consistence	very friable	friable	very friable	loose	loose	loose
Texture	SL	SL	LS	LS	S	S
Skeleton	<5%	<5%	15% fine gravel	0	60% fine/very fine gravel	0
Carbonates	-	-	-	-	-	-
Reductomorph. features	-	-	-	-	-	-
Oximorphic features	-	-	-	-	-	5-25% 10YR 6/6
Redox accumulations	-	-	-	-	-	-
Clay accumul.	-	-	-	-	-	-
Slickensides	-	-	-	-	-	-
Earthworm channels/coasts	++	++	+	+	-	-
Other	-	-	-	-	-	-
Diagnostics	mollic	mollic	(brunic)	(brunic)	stagnic	gleyic

Analytical data for soil profile 08

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.02	0.02-0.005	0.005-0.002	< 0.002	sand	silt	clay	
		%	%									%			
Ap1	0-20	<5	7.5	22.5	17	10	6	16	8	2	11	63	26	11	SL
Ap2	-38	<5	10	24	17	10	4	16	6	3	9	65	25	9	SL
2ABv	-50	15	18	34	20	9	3	8	2	1	5	84	11	5	LS
2BvC	-65	<5	11	35	22	8	8	10	1	1	4	84	12	4	LS
3C	-80	60	35	40	11	2	4	4	1	1	2	92	6	2	S
4Cgg	-150	0	4	37	47	7	1	1	1	1	1	96	3	1	S

Explanation: SL – sandy loam (głina piaszczysta), LS – loamy sand (piasek gliniasty), S* – sand (piasek luźny)

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl
		g cm ⁻³	%			%		
Ap1	0-20	1.69	0.78	0.08	10	0	6.0	4.7
Ap2	-38	-	0.85	0.08	11	0	5.8	4.5
2ABv	-50	1.84	0.36	0.02	16	0	6.2	5.1
2BvC	-65	1.68	0.16	0.01	14	0	6.4	5.2
3C	-80	-	0.10	0.01	-	0	6.7	5.6
4Cgg	-150	1.71	0.06	0.01	-	0	6.9	6.6

Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pH_w** – pH in distilled water (1:2.5 v/v), **pH_{KCl}** – pH in 1 M KCl (1:2.5 v/v)

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Ap1	0-20	2.15	0	1.48	0.14	0.18	0.00	1.79	3.94	3.20	45	100	56
Ap2	-38	1.76	0	1.45	0.14	0.21	0.03	1.82	3.58	3.21	51	100	57
2ABv	-50	0.36	0	1.15	0.11	0.11	0.03	1.39	1.75	1.92	79	100	72
2BvC	-65	0.10	0	0.95	0.11	0.05	0.01	1.11	1.21	1.29	92	100	86
3C	-80	0.05	0	0.82	0.11	0.05	0.01	0.99	1.04	1.15	95	100	86
4Cgg	-150	0.05	0	0.75	0.11	0.04	0.01	0.91	0.96	0.94	95	100	97

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** – Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** – extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V=S*100/T$, **eBS** – effective base saturation $sBS=S*100/S+Al^{3+}$, **BS** – ‘real’ base saturation $BS=S*100/CEC$

SOIL PROFILE 06

Localization:	Jarząbkowice, 17/1, Kostomłoty municipality, Środa Śląska county, Lower Silesia voivodshaft
Coordinates:	51°05'53.3" N, 16°45'45.5" E; PUWG: X 361418, Y 343392
Physiographical units:	Silesian Lowland, Wrocław Plain
Altitude:	132 m above sea level
Landform:	undulating plain; soil profile located in a lower position on the field, drained by ditch
Land use:	arable field (2026: buckwheat)
Parent materials:	Pleistocene loess-like sediments on glaciofluvial sands
Classification WRB2022:	Luvic Stagnic Chernic Phaeozem (Anosiltic, Humic, Pachic, Endoraptic, Solimovic?, Relictiturbic?)
Classification SGP6:	czarna ziemia (wyługowana) iluwialna
Original agric. evaluation:	class RII, complex 1D gsp



Soil profile 08 description

Horizon SGP	Ap1	Ap2	Ap3	ABg	Btg	2Cgg	2Cg
Horizon WRB	Ap1	Ap2	Ap3	ABg	Btg	2Cl	2Cg
Depth, cm	0-18	18-40	40-55	55-70	70-85	85-100	100-150
Colour, moist	10YR 2/1	10YR 2/1	10YR 2/1	10YR 3/2	10YR 4/2	10YR 5/2	10YR 5/6
Boundary	clear smooth	clear smooth	gradual	gradual	clear wavy	gradual	-
Structure	granular medium	blocky angular/subangular fine	blocky angular fine	blocky angular/subangular fine	blocky angular fine	single grain	single grain
Consistence	very friable	firm	friable	friable	friable	loose	loose
Texture	SiL	SiL	SiL	SiL	SiL	SL	S
Skeleton	<5%	<5%	<5%	<5%	<5%	0	0
Carbonates	-	-	-	-	(+)	-	-
Reductomorph. features	-	-	-	10% 10YR 5/2	10% 10YR 5/2	80%	25% 10YR 5/2
Oximorphic features	-	-	-	-	80%	20% 10YR 6/6	75%
Redox accumulations	-	-	-	very fine Mn masses	very fine Mn masses	fine Mn masses	-
Clay accumul.	-	-	-	(coatings)	coatings	-	-
Slickensides	-	-	-	-	-	-	-
Earthworm channels/coasts	++	++	++	+	+	-	-
Other	-	-	-	-	-	-	-
Diagnostics	chernic	chernic	chernic	-	argic stagnic	gleyic* (turbic)	stagnic

* Note criterion 5 of the stagnic properties (WRB 2022).

Analytical data for soil profile 06

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0- 1.0	1.0- 0.5	0.5- 0.25	0.25- 0.1	0.1- 0.05	0.05- 0.02	0.02- 0.005	0.005- 0.002	< 0.002	sand	silt	clay	
		%	%									%			
Ap1	0-18	<5	1	3	10	5	11	28	22	12	8	30	62	8	SiL
Ap2	-40	<5	1	2	9	7	9	26	24	9	13	28	59	13	SiL*
Ap3	-55	<5	1.5	4.5	11	9	8	23	19	9	15	34	51	15	SiL*
ABg	-70	<5	1.5	3.5	7	9	7	26	21	4	21	28	51	21	SiL*
Btg	-85	<5	0	0	2	4	11	34	18	5	26	17	57	26	SiL*
2Cgg	-100	0	0	0	2	64	12	9	2	1	10	78	12	10	SL
2Cg	-150	0	0	0	2	79	10	4	0	1	4	91	5	4	S

Explanation: SiL – silt loam (pył gliniasty), SiL* – silt loam (pył ilasty), SL – sandy loam (glina piaszczysta), LS – loamy sand (piasek gliniasty)

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl
		g cm ⁻³	%			%		
Ap1	0-18	1.51	1.96	0.16	13	0	6.4	5.5
Ap2	-40	1.55	1.31	0.09	14	0	6.3	5.4
Ap3	-55	1.6	1.08	0.06	17	0	6.5	5.5
ABg	-70	1.61	0.77	0.05	17	0	6.8	5.7
Btg	-85	1.73	0.40	0.03	-	tr.	7.6	6.6
2Cgg	-100	-	0.24	0.02	-	0	7.6	6.6
2Cg	-150	1.53	0.14	0.01	-	0	7.8	6.8

Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pHw** – pH in distilled water (1:2.5 v/v), **pHkcl** – pH in 1 M KCl (1:2.5 v/v)

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Ap1	0-18	1.58	0	8.3	1.12	0.54	0.03	10.0	11.6	17.1	86	100	58
Ap2	-40	1.88	0	7.7	0.94	0.17	0.04	8.9	10.8	15.0	83	100	59
Ap3	-55	0.76	0	7.6	0.90	0.10	0.03	8.6	9.4	12.5	92	100	69
ABg	-70	0.46	0	7.7	0.93	0.13	0.05	8.8	9.3	11.6	95	100	76
Btg	-85	0	0	11.6	1.89	0.19	0.07	13.7	13.7	13.2	100	100	100
2Cgg	-100	0.2	0	2.8	0.36	0.05	0.01	3.2	3.4	3.3	94	100	99
2Cg	-150	0.1	0	1.0	0.26	0.03	0.01	1.3	1.4	1.4	93	100	96

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** - Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** - extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V = S \cdot 100 / T$, **eBS** – effective base saturation $eBS = S \cdot 100 / S + Al^{3+}$, **BS** – ‘real’ base saturation $BS = S \cdot 100 / CEC$

[illegible]

SOIL PROFILE 09

Localization:	Kąty Wrocławskie, 2551, Kąty Wrocławskie municipality, Wrocław county, Lower Silesia voivodshaft
Coordinates:	51°00'48.8" N, 16°45'09.8" E; PUWG: X 352039, Y 342416
Physiographical units:	Silesian Lowland, Wrocław Plain
Altitude:	144 m above sea level
Landform:	undulating plain; soil profile located in a concave basin/valley drained by ditches
Land use:	in the past: meadow; presently afforested
Parent materials:	Pleistocene loess-like sediments (colluvium) on Miocene clays
Classification WRB2022:	Eutric Endostagnic Chernic Gleysol (Anosiltic, Endoclayic, Endogeoabruptic, Humic, Solimovic, Uterquic)
Classification SGP6:	czarna ziemia wylugowana
Original agric. evaluation:	class -, complex LsF gcp:i



Soil profile 09 description

Horizon SGP	Ah1	Ah2	Ahgg	A/G	2Big
Horizon WRB	Ah1	Ah2	Ahl	A/Cr	2Big
Depth, cm	0-12	12-30	30-46	46-70	70-100
Colour, moist	10YR 2/2	10YR 2/2	2.5Y 1/1	5Y 6/1	7.5YR 5/8
Boundary	gradual	clear wavy	clear irregular	abrupt/clear wavy	-
Structure	granular fine/medium	blocky subangular fine	blocky angular fine	blocky angular/subangular fine	blocky angular /wedge
Consistence	very friable	friable	firm	firm	very firm
Texture	SiL	SiL	SiL	SiL	CL
Skeleton	0	0	0	10% remains of pavement	0
Carbonates	-	-	-	-	-
Reductomorph. features	-	-	matrix colour?	80%	45% 5GY 6-7/1
Oximorphic features	-	-	-	10% 7.5YR 5/8	45%
Redox accumulations	-	-	-	fine Mn masses	fine Mn masses
Clay accumul.	-	-	-	-	-
Slickensides	-	-	-	(+)	+
Earthworm channels/coasts	+	+	+	+	+
Other	-	-	-	-	vertical cracks
Diagnostics	chernic	chernic	chernic gleyic?	gleyic?*	stagnic vertic

* Note criterion 5 of the stagnic properties (WRB 2022).

Analytical data for soil profile 09

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.02	0.02-0.005	0.005-0.002	< 0.002	sand	silt	clay	
		%	%									%			
Ah1	0-12	<5	0	1	2	2	10	38	21	8	18	15	67	18	SiL*
Ah2	-30	0	0.3	1	1.3	1.4	7	34	25	7	23	11	66	23	SiL*
Ahgg	-46	5	0.3	1	1.5	2.2	7	32	23	7	26	12	62	26	SiL*
2A/G	-70	10	0	0	0	1	10	39	22	5	23	11	66	23	SiL*
2Big	-100	0	1	3	5	8	14	21	12	5	31	31	38	31	CL

Explanation: SiL* – silt loam (pył ilasty), CL – clay loam (glina ilasta)

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl
		g cm ⁻³	%			%		
Ah1	0-12	-	3.22	0.24	13	0	5.4	4.6
Ah2	-30	1.05	1.81	0.12	15	0	5.3	4.4
Ahgg	-46	1.40	1.44	0.08	18	0	6.0	5.0
2A/G	-70	1.56	0.33	0.03	-	0	6.5	5.3
2Big	-100	1.59	0.24	0.03	-	0	6.2	5.0

Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pHw** – pH in distilled water (1:2.5 v/v), **pHkcl** – pH in 1 M KCl (1:2.5 v/v)

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Ah1	0-12	6.4	1.5	10.4	2.46	0.42	0.06	13.3	19.7	24.9	68	90	54
Ah2	-30	7.2	1.3	9.9	2.42	0.22	0.08	12.6	19.8	20.0	64	91	63
Ahgg	-46	2.8	0.2	12.3	3.52	0.27	0.15	16.2	19.0	25.6	85	99	64
2A/G	-70	1.4	0	6.1	1.87	0.21	0.13	8.3	9.7	13.3	86	100	62
2Big	-100	0.46	0	9.2	3.04	0.27	0.19	12.7	13.1	20.6	96	100	62

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** – Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** – extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V = S * 100 / T$, **eBS** – effective base saturation $sBS = S * 100 / S + Al^{3+}$, **BS** – ‘real’ base saturation $BS = S * 100 / CEC$

SOIL PROFILE 11

Localization:	Wrocław - Żerniki, 79, Wrocław municipality, Wrocław county, Lower Silesia voivodshaft
Coordinates:	51°07'43.3" N, 16°55'46.5" E; PUWG: X 364473, Y 355172
Physiographical units:	Silesian Lowland, Wrocław Plain
Altitude:	116 m above sea level
Landform:	slightly undulating plain; soil profile located in a low flat position drained by ditches
Land use:	in the past: arable fields; presently: fallow; mainly goldenrod (<i>Solidago canadensis</i> L.)
Parent materials:	Pleistocene loess-like sediments (colluvium) on lacustrine and fluvial (?) sediments
Classification WRB2022:	Epicalcaric Chernic Thionic Gleysol (Episiltic, Katoloamic, Aric, Drainic, Humic, Limnic, Amphiraptic)
Classification SGP6:	czarna ziemia podmokła murszowata
Original agric. evaluation:	class ŁIII, complex 2zM ms:pl/5D pgm:pl



Soil profile 11 description

Horizon SGP	Aphca	Apcagg	2A/Lgg	3G
Horizon WRB	Apha	Apal	2A/BCrλ	3Cr
Depth, cm	0-30(35)	30-46	46-60	60-100
Colour, moist	10YR 2/1	2.5Y 1/1	7.5Y 4/4	10GY 4/1
Boundary	abrupt wavy	abrupt wavy/irregular	clear smooth	-
Structure	granular medium/coarse	blocky angular fine/medium	massive	blocky angular /massive
Consistence	friable	firm	(plastic)	firm
Texture	SiL	SiL	SL	SL
Skeleton	0	0	0	0
Carbonates	++	+	-	-
Reductomorph. features	-	matrix colour?	60%	90%
Oximorphic features	-	-	40% 7.5YR 5/6 (around root channels)	10% 7.5YR 4-5/6-8 (around root channels)
Redox accumulations	-	-	-	fine Fe masses
Clay accumul.	-	-	-	-
Slickensides	-	-	-	-
Earthworm channels/coasts	+	+	-	-
Other	-	-	jarosite?	H ₂ S smell
Diagnostics	chernic calcaric	chernic	thionic? gleyic	gleyic

Analytical data for soil profile 11

Horizon	Depth cm	Skeleton	Sand fractions					Silt fractions			Clay	Sum			Class
		>2 mm	2.0-1.0	1.0-0.5	0.5-0.25	0.25-0.1	0.1-0.05	0.05-0.02	0.02-0.005	0.005-0.002	< 0.002	sand	silt	clay	
		%	%									%			
Aph	0-28	0	2	5	9	14	7	31	23	5	4	37	59	4	SiL
Ap _{gg}	-47	0	1	2	11	15	15	37	10	4	5	44	51	5	SiL
2LG	-60	0	1	1	5	26	23	26	12	2	4	56	40	4	SL
3G1	-80	0	1	2	12	19	22	30	11	1	2	56	42	2	SL
3G2	-100	0	0.5	0.5	1	4	25	50	15	2	2	31	67	2	SiL

Horizon	Depth cm	BD	SOC	N	C:N	CaCO ₃ eq.	pHw	pHkcl	EC	S _{xrf}
		g cm ⁻³	%			%			dS/m	
Aph	0-28	-	5.90	0.477	12	32	7.8	7.4	0.49	2870
Ap _{gg}	-47	-	3.24	0.176	18	0 / (tr.)	5.0	4.7	2.35	8400
2LG	-60	-	0.64	0.048	13	0	3.0	2.7	3.09	3200
3G1	-80	-	0.48	0.031	-	0	3.0	2.8	3.53	6300
3G2	-100	-	1.42	0.100	-	0	3.3	3.2	3.29	4300

Explanation: **BD** – bulk density, **SOC** – soil organic carbon, **N** – total nitrogen, **pH_w** – pH in distilled water (1:2.5 v/v), **pH_{kcl}** – pH in 1 M KCl (1:2.5 v/v), **EC** – electric conductivity (1:2.5 v/v), **S_{xrf}** – total sulphur, mg/kg

Horizon	Depth cm	Kh	Al ³⁺	Ca ²⁺	Mg ²⁺	K ⁺	Na ⁺	S	T	CEC	V	eBS	BS
		cmol kg ⁻¹									%		
Aph	0-28	-	-	70.0	2.48	0.32	0.18	73.0	-	51.8	-	-	100
Ap _{gg}	-47	-	-	54.4	1.57	0.14	0.23	86.3	-	50.2	-	-	100
2LG	-60	-	-	11.1	1.05	0.09	0.16	12.4	-	11.3	-	-	100
3G1	-80	-	-	6.1	1.24	0.11	0.07	7.5	-	13.9	-	-	54
3G2	-100	-	-	9.5	2.00	0.17	0.13	11.8	-	11.9	-	-	99

Explanation: **Kh** – hydrolytic acidity, **Al³⁺** – Al extracted by 1 M KCl, **Ca²⁺**, **Mg²⁺**, **K⁺**, **Na⁺** – extracted by 1 M ammonium acetate buffered at pH 7, **S** – sum of cations (Ca+Mg+K+Na), **T** – ‘extractable’ cation exchange capacity (S+Kh), **CEC** – ‘real’ cation exchange capacity (extracted by 1 M ammonium acetate buffered at pH 7), **V** – base saturation $V = S \cdot 100 / T$, **eBS** – effective base saturation $sBS = S \cdot 100 / S + Al^{3+}$, **BS** – ‘real’ base saturation $BS = S \cdot 100 / CEC$

[illegible]

