

01.15 Engineer's Geological Map (Edition 2017)

Overview

The Geological Survey Working Group of the Senate Department for the Environment, Transport and Climate Protection has drafted an Engineer's Geological Map Series of Berlin which is, first, an important aid for construction and project planning, and secondly makes possible guiding statements on environmentally relevant issues on soil conditions of the subsoil and on foundation-relevant facts.

The digital production of the basic mapping "Engineer's Geological Map of Berlin, 1:5,000" was initiated in 1993. It is developed in sheet lines of the official "Map of Berlin 1: 5,000". As of December 2015, it is electronically accessible in 71 single sheets. For 58 sheets exist particular maps.

The maps available to date cover all or most of the boroughs of Pankow, Marzahn-Hellersdorf, Lichtenberg, Friedrichshain-Kreuzberg, Mitte, Neukölln and Treptow-Köpenick. Currently, only some parts of the boroughs of Reinickendorf, Spandau, Tempelhof-Schöneberg and Steglitz-Zehlendorf are covered.

The geological structure of loose rock is described in detail stratigraphically (the time sequence), petrographically (the composition of the rock) and genetically (the development), as well as with physical soil key values to a depth of 10 m.

To make digital application possible even for more large-scale tasks, and to make the map available via the Internet to a broad audience, the existing single sheets have been joined together for a combined map without sheet lines.

Statistical Base

The basis for the combined map is the Engineer's Geological Map Series of Berlin, 1 : 5,000, with a total of 71 single sheets to date, which were drafted between 1993 and 2015.

In order to process the single maps, the descriptions of strata from approx. 73,000 bore holes in the geological database of the Berlin State Geological Survey were evaluated.

The basis for the ascertainment of the physical key values of the subsoil were extensive examinations over the past forty years.

Methodology

Generally, the Engineer's Geological Map shows the geological structure of the loose rock to a depth of 10 m; deeper if necessary.

Surface layers (topsoil and deposits of more than 5 m in thickness) aren't taken into account in the map-like representation.

The individual areas were ascertained on the basis of the available bore-hole results. This means that identical sequences of stratification in neighboring bore holes constitute a common geological unit and are distinguished from other, adjacent sequences of stratification by delimitation of areas on the map. As a rule, the denser the distribution of bore holes, the more precise the information will be. At the surface, geomorphological factors such as dunes, plateau edges, bog hollows, etc., can also play a role in the delimitation of areas.

In the Engineer's Geological Map, the upper horizon is shown two-dimensionally, with stratigraphic, petrographic and genetic representations. The thickness is expressed by different intensities of the primary colour.

For the stratification, the following depths have been selected:

< 2 m	(light shade)
2 - 5 m	(medium shade)
5 - 10 m	(dark shade)

The available single maps were joined together, as a result of which geological units which had been divided by sheet-line boundaries were united to form complete areas. Via the interactive map from an appended table, it is possible, if necessary, with the aid of the FIS Broker data display, to access additional information beyond that of the stratum displayed, on other strata below it, down to 10 meters. Up to five overlaying layers are shown, with the appropriate stratigraphy, petrography and genesis.

Map Description

The following units characterize the municipal area geomorphologically, which was formed by the Weichselian Glaciation stage, the most recent glacial stage, during its Brandenburg sub-stage:

- Barnim Plateau, with the Panke Valley
- Warsaw-Berlin Glacial Spillway
- Teltow Plateau

The Barnim Plateau, a Weichselian Glaciation ground moraine plate, is located in the northern part. Here, the ground moraine, interspersed with meltwater sands of the Weichselian Glaciation stage, determines the surface. The Weichselian Glaciation ground moraine is largely directly underlain by the ground moraine of the Saalian Glaciation. However, there are also meltwater sands in considerable quantity which separate these two ground moraines. In the Hermsdorf neighbourhood of Reinickendorf Borough, there is a small area where tertiary layers, usually appearing in the deeper underground, are pushed by salt tectonics just below the surface. Under a shallow sand cover there lies the rupelium of the lower oligocene.

In the northwest, the plateau is bisected by the Panke Valley with its valley-sand deposits, running coarsely northeast to southwest.

The Warsaw-Berlin Glacial Spillway, which runs coarsely from east to west, and is characterized by great thickness (up to about 50 m) of accumulated glacio-fluvial, and also some fluvial sands and gravels, occupies the central portion of this area. Locally, rubble horizons and till residues are embedded. Locally, this covers sands of glacial valleys of younger holocene sediments (sands, peat and peat clay mixed with organic material), sometimes of considerable thickness.

The southern area is occupied by the Teltow plateau, also a Weichselian Glaciation ground-moraine plate. Here, the ground moraine, interspersed with meltwater sands of the Weichselian Glaciation stage, determines the surface in the eastern part of the area. The Weichselian Glaciation ground moraine is in some parts underlain directly by the ground moraine of the Saalian Glaciation. However, there are also meltwater sands in considerable quantity which separate the two ground moraines on. The western part is predominantly characterized by thick sequences of meltwater sand.

The sediments portrayed on the map can be described as follows, from top (from the younger strata) to bottom (to the older strata):

Holocene Sediments

Holocene sediments (humus sand, peat, gyttja, qh//Hm, Hn, F), some with thicknesses of more than 10 m, can be found primarily in the area of the glacial spillway and the Panke Valley. They usually are in the area of former or existing watercourses or bodies of water, and are as a rule unfavourable construction land (Tab. 1 and 2).

Fig./group symbol as per DIN 18 196:	HN - HZ
Organic components cf.:	17.0 - 95.0 %
Density of damp soil ρ :	0.95 - 1.75 g/cu.cm
Dry density ρ_d :	0.1 - 0.5 g/cu.cm

Stiffness Modulus E_s ($\sigma = 0.1 - 0.2$ MN/sq.m):	0.4 - 3.0 MN/sq.m
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Tab. 1: Physical Soil Values of Peat (qh//Hn)

Fig./group symbol as per DIN 18 196:	F
Organic components cf.:	3.0 – 60.0%
Density of damp soil ρ :	1.0 – 1.8 g/cu.cm
Dry density ρ_d :	0.3 – 1.3 g/cu.cm
Stiffness module E_s ($\sigma = 0.1 - 0.2$ MN/sq.m):	0.8 – 2.7 MN/sq.m

Tab. 2: Physical soil values of peat clay (qh//F)

Dunes which were blown on in the fading-away Weichselian Glaciation and in the early holocene consist of medium-sandy fine sands (qw-qh//d). They are usually few meters thick, however, also can reach altitudes over 10 meters.

Particle size distribution:	Fine sand; Fine to medium sand; Medium sand: fine-sandy
Fig./group symbol as per DIN 18 196:	SE
Non-uniformity U:	1.4 – 2.5
Density of damp soil ρ :	1.45 – 1.9 g/cu.cm
Dry density ρ_d :	1.4 – 1.85 g/cu.cm
Water content w:	2 - 6 %
Deposit density:	loose

Tab. 3: Physical soil values of dune sand (qw-qh//d)

Sand of Glacial Valleys in the Area of the Glacial Spillway and the Side Valleys

In the Warsaw-Berlin glacial spillway, the sand of glacial valleys (qw/S/ut) is mostly more than 10 m thick; under it are the sediments of the Saalian Glaciation.

In the upper strata, the sand of glacial valleys is fine to medium-granular, to some extent slightly silty; with increasing depth, it becomes coarser, and frequently contains gravelly additions.

The Weichselian and also the Saalian Glaciation ground moraine is largely eroded, so that the Weichselian Glaciation sands are here usually underlain directly by older sands (sometimes to depths of more than 50 m).

The same sand sequence (qw/S/ut) can be found in the Panke Valley, a side valley of the glacial spillway, except that its thickness is only seldom more than 10 m.

Locally, till layers occur as erosion residues, traces both of the Weichselian and the Saalian Glaciation ground moraines.

Due to its friable nature, the sand of glacial valleys has high water conductivity, and is a good aquifer.

Particle size distribution:	1 - 4 m depth: Fine sand: \pm medium-sandy, Fine to medium sand, weakly coarse sandy 4 - 10 m depth: Medium sand: fine sandy, \pm coarse sandy,
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	partially weakly gravelly Medium sand: ± coarse sandy, partially gravelly <u>At the edge of the glacial spillway:</u> frequently with higher silt portion, within the glacial spillway, locally with till residues, rubble horizons, silt layers
Fig./group symbol as per DIN 18 196:	mostly SE
Non-uniformity U:	mostly 1.6 - 2.8; in layers > 3.2
Density of damp soil ρ :	1.5 g/cu.cm (1.5 - 2.5 m depth) 1.8 g/cu.cm (2.5 - 6.0 m depth) 2.1 g/cu.cm (6.0 - 7.0 m depth)
Dry density ρ_d :	1.45 – 1.9 g/cu.cm
Water content w:	5 % (above groundwater) 20 % (in groundwater)
Deposit density:	medium-dense; at greater depth, dense

Tab. 4: Physical soil values of sand of glacial valleys (qw/S/ut)

Meltwater Sand of the Plateaus

These sediments include the meltwater sands (qw/S/gf) above, within (intralattice) and beneath the Weichselian Glaciation ground moraine.

The extensive meltwater sands ascertained above the ground moraine can contain a share of late Pleistocene to Holocene outwash mass. They show a wide range of granulation thickness, from silty fine sand to coarse sand, and also very variable thickness.

Locally, meltwater sands are also present under the Weichselian Glaciation ground moraine. These glacio-fluvial fine to coarse sands separate the upper ground moraine (qw//Mg) from the lower ground moraine (qs//Mg) in these areas.

Moreover, intralattice sands occur within the till, usually only locally, and generally with low thickness. Petrographically, it is not possible to distinguish between these sands and the glacio-fluvial meltwater sands, so that it is often difficult to delimit between the Weichselian and the Saalian Glaciation till.

The meltwater sands have high water conductivity and constitute a good aquifer, due to their friable character.

Particle size distribution:	Fine sand: partially weakly silty, partially medium sandy, partially gravelly Fine to medium sand: partially coarse sandy Medium sand: partially coarse sandy, partially with stones Coarse sand: medium-sandy, partially gravelly, partially with stones
Fig./group symbol as per DIN 18 196:	SU - SW
Non-uniformity U:	1.7 – 11.0
Density of damp soil ρ :	1.5 – 1.95 g/cu.cm
Dry density ρ_d :	1.4 – 1.9 g/cu.cm
Water content w:	2 - 17 %
Deposit density:	medium-dense

Tab. 5: Physical soil values of the meltwater sand of the plateaus (qw/S/gf)

Debris Loam/-Marl of the Weichselian Glaciation

The ground moraine of the Brandenburg substage of the Weichselian Glaciation forms a coherent horizon of till (gw//Mg) of 5 -10 m (in some cases, more than 10 m) thickness, overlaid locally by meltwater sands. Petrographically, it consists mostly of weakly clayey, silty, and chalky sands, with a small proportion of gravel and stones and, rarely, ice-age boulders. At the surface, the till has been decalcified by weathering to debris loam.

Due to its clay and silt portions, the till or loam constitutes a binding sediment which has very low water conductivity (aquitard).

The areas of the ground moraine covered by sands as well as those on the plateau edge have been reduced in thickness, largely due to erosive use.

Particle size distribution:	Sand, weak clayey, silty, partly gravelly, some stones
Fig./group symbol as per DIN 18 196:	SU - ST*
Non-uniformity U:	10 - 50
Density of damp soil ρ :	1.85 – 2.25 g/cu.cm
Dry density ρ_d :	1.65 – 2.0 g/cu.cm
Water content w:	7 - 15 %
Yield point w_L :	0.075 – 0.3
Plastic limit w_P :	0.05 – 0.2
Plasticity coefficient I_P :	2.5 - 12
Consistency number I_c :	0.4 – 1.7
Stiffness module ES ($\sigma = 0.1 - 0.3$ MN/sq.m):	5 - 30 MN/sq.m
Plasticity range:	slight plasticity

Tab. 6: Physical soil values of the till/-loam of the Weichselian Glaciation (qw//Mg)

Sediments of the Eem Interglacial

The sediments of the Eem interglacial (humus sand, peat, gyttja, qee//Hm, Hn, F) can essentially be found only in the area of the Barnim plateau, and there mostly in the Panke Valley. They are as a rule confined to small-scale occurrence of very low thickness.

Till of the Saalian Glaciation

In the area shown, the ground moraine of the Saalian Glaciation (Warthe substage) is the oldest geological formation to a depth of 10 m. The Saale-stage till consists of weakly clayey, silty to strongly silty chalky sands, with a small proportion of gravel and stones (qs//Mg). Ice-age boulders can also be found occasionally.

Intralattice sands can also be found in the Saale-period till.

Due to its clay and silt portions, the till constitutes a binding sediment with very low water conductivity (aquitard).

Particle size distribution:	Sand, weakly clayey, silty, partially strong silty, partially weak gravelly, some stones
Fig./group symbol as per DIN 18 196:	SU - ST*
Non-uniformity U:	10 - 50

Density of damp soil ρ :	1.95 – 2.45 g/cu.cm
Dry density ρ_d :	1.6 – 2.1 g/cu.cm
Water content w :	5 - 15 %
Yield point w_L :	0.1 – 0.5
Plastic limit w_P :	0.1 – 0.2
Plasticity coefficient I_P :	6 - 26
Consistency number I_c :	1.2 – 2.3
Stiffness module ES ($\sigma = 0.1 – 0.3$ MN/sq.m):	6 - 40 (most > 20) MN/sq.m
Plasticity range:	slight to medium plasticity

Tab. 7: Physical soil values of the till of the Saalian Glaciation (qs//Mg)

Sediments of the Tertiary

Tertiary sediments are found only in the neighbourhoods of Hermsdorf and Lübars in Reinickendorf borough. This involves a small-scale deposit in the area of Lake Hermsdorf, where marine rupelium from the lower oligocene is found near the surface.

Petrographically, this involves light gray to olive gray, calcareous silty clays and clayey silts with low sand content. Embedded concretionary limestone islands are called septaries and gave the clay the name "septary clay".

Because of its clay and silt content, rupelium is a cohesive sediment with very low water-conductive capacity (aquitard).

Particle size distribution:	Clay, silty, partially weakly sandy
Fig./group symbol as per DIN 18 196:	TA
Non-uniformity U :	5 - 40
Density of damp soil ρ :	2.2 – 2.9 g/ cu.cm
Dry density ρ_d :	2.6 – 2.8 g/ cu.cm
Water content w :	7 - 10%
Yield point w_L :	0.6 – 0.8
Plastic limit w_P :	0.2 – 0.3
Plasticity coefficient I_P :	30 - 50
Consistency number I_c :	> 1
Stiffness module ES ($\sigma = 0.1 – 0.3$ MN/sq.m):	20 - 40 MN/ sq.m
Plasticity range:	Very plastic

Tab. 8: Physical soil values of the rupelium of the Tertiary

Deposits

The anthropogenic deposits belonging to the latest Holocene deposits are shown only when their thickness exceeds five meters. This is usually construction rubble mixed with varying proportions of sand, gravel or till. The deposits may have been dumped over a large area, or in the form of rubble hills.

Former Watercourses, Ditches and City-Fortification Systems

Also, in the area of the historical centre of Berlin, former watercourses and ditches and those filled in more recently, as well as those of the city fortification systems (moats, etc.), are shown by cross-hatching.

Deep Foundations

Single buildings with a foundation depth of more than 10 m are drawn in and numbered only in the central area of the city, on Maps 423 C and 423 D. This representation is not complete, and corresponds to the state of knowledge at the time of the preparation of these particular maps of 1993. More detailed information on deep foundations are shown on Table 9.

No.	Place	Bottom edge + m above sea level	Top edge + m above sea level	Remarks
1	Wilhelmstraße	24.7	-	Former <i>Führer's</i> bunker
2	Voßstraße	29.7	-	Bunker of the former New Reich Chancellery
3	Ebertstraße	27.9	-	<i>Führer's</i> bunker
4	Wilhelmstraße	unknown	-	Bunker, Foreign Ministry
5	Wilhelmstraße	unknown	-	Former Reich Propaganda Ministry bunker
6	Wilhelmstraße	unknown	-	Former Reich Aeronautics Ministry bunker
7	Mohrenstraße	unknown	-	Former Hotel Kaiserhof
8	Wilhelmstraße	unknown	-	Bunker under Wilhelmplatz
9	Stresemannstraße	unknown	-	Bunker above urban-rail tunnel
10	Potsdamer Platz	19.0	-	Urban rail station
11	Potsdamer Platz	unknown	-	Bunker
12	Straße des 17. Juni	18.1-27.8	22.7-32.1	Tunnel at Soviet Memorial
13	Platz der Republik	21.75-27.6	26.75-33.6	Tunnel to Reichstag
14	North of Otto-von-Bismarck-Allee	30.0	-	Bunker next to Swiss Embassy
15	Pariser Platz	24.4	-	Hotel Adlon bunker
16	Pariser Platz	19.4	-	Bunker at Brandenburg Gate
17	Ebertstraße	30.0	-	Tunnel from Reichstag to former Presidential Palace
18	Friedrichstraße	-	-	Gallery Lafayette
19	Schloßplatz	16.0	-	Former Palace of the Republic
20	Alexanderplatz	28.8	-	Department store
21	Alexanderplatz	25.75	-	Hotel Stadt Berlin
22	Kochstr. 50	27.45	-	Axel Springer Building

23	Am Karlsbad 11-14	28.0	-	New building
24	Matthäikirchstraße	25.06	-	Chamber Music Hall
25	Spree bend	30.5	-	Alsen quarter, former buildings
26	Otto-von-Bismarck-Allee Platz der Republik	-	-	Tunnel
27	Kommandantenstr. 7-14	-	-	New building
28	Schützenstraße	12.7	-	New building
29	Ebertstraße	31.6	-	Former buildings
30	Potsdamer Platz	East 28.7 West 23.2	-	Former Hertie department store
31	Potsdamer Straße	30.0	-	National Library
32	Alexanderplatz	31.5	-	Tunnel system
33	Alexanderplatz	15.5	-	Television Tower
34	Georgenstr. 37-38 Universitätsstr. 4-36	21.5	-	Former International Trade Center
35	Karl-Marx-Allee / Alexanderplatz	30.0	-	Traffic tunnel at Alexanderplatz

Tab. 9: Remarks

Bore-Hole Points and Bore-Hole Depths

The bore holes used for the map are shown with different point markings, according to their depths. The documented density and depth of the bore-hole points serves to estimate the precision of the information on the areas shown on the Engineer's Geological Map.

Hydrogeologic Situation

The glacial-spillway sands form a thick aquifer (main aquifer) within the overall freshwater system, in which several separate aquifers are hydraulically connected. The groundwater in the sands is present in an unconfined condition (cf. Maps [02.07](#) and [02.12](#)).

The depth to groundwater generally comes to 2-4 m, frequently however more than 4 m. In low-lying areas, it is less than 2 m (Map [02.07](#)).

It should be considered that the groundwater levels are in some cases strongly affected in the vicinity of the waterworks wells by the withdrawal of water by the Berlin Waterworks for the city's water supply.

The aquifer in the glacial spillway is uncovered; it is not protected against pollutants penetrating over broad areas.

The velocity of flow can be assumed to be ≤ 0.25 m/d. Near well facilities, it can be considerably higher.

In the area of the plateaus, the main aquifer is in most places covered by thick Saalian and Weichselian Glaciation till. Generally, confined groundwater conditions can be assumed here, with depths to groundwater of usually more than 10 m. Towards the Glacial Spillway, the depth to groundwater becomes less, in accordance with the diminishing thickness of the till.

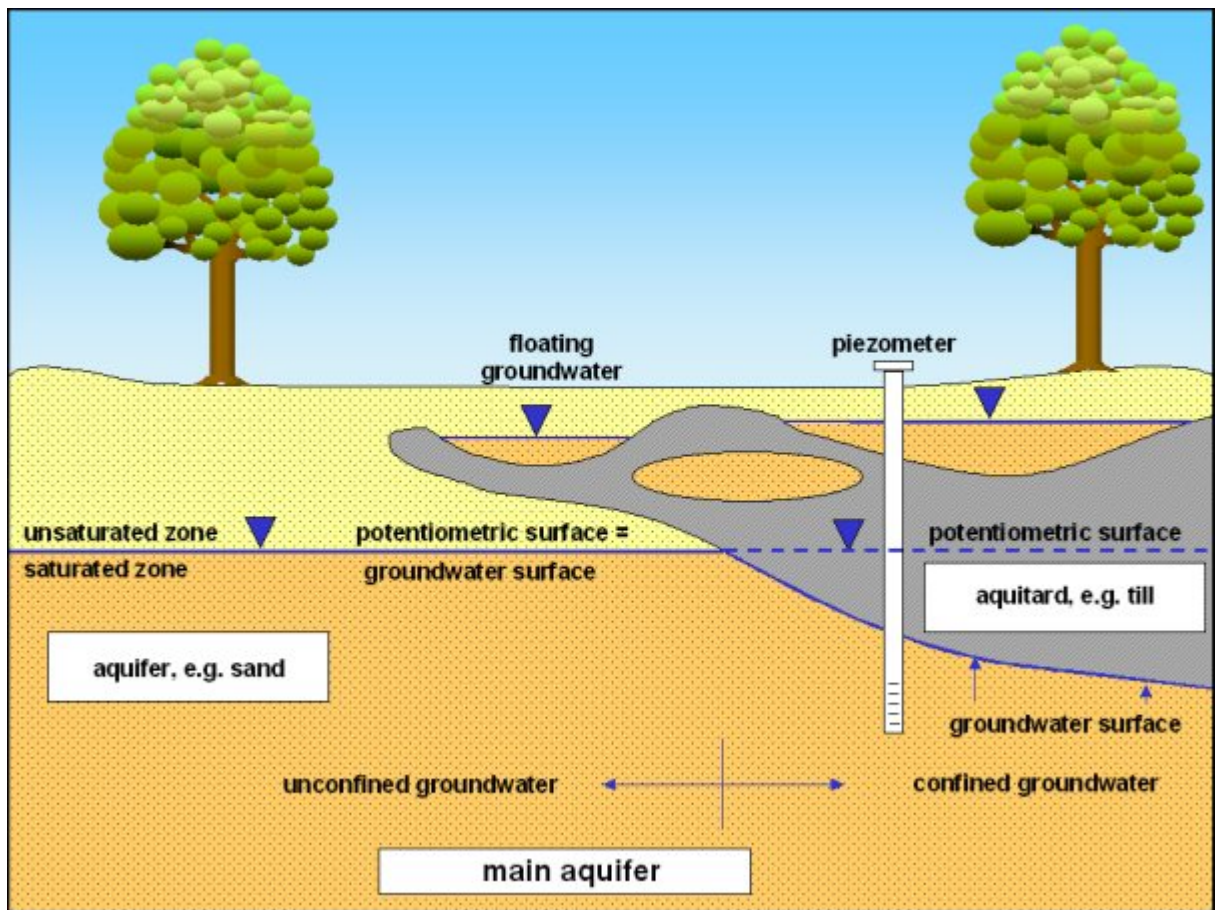


Fig. 1: Hydrogeologic Terms

In small channel and basin-like depression in the Saalian and Weichselian Glaciation till, in which meltwater sands and also drainage products of the debris loam or till occur, there is often an upper aquifer of low thickness. Here, near-surface groundwater must be assumed, depending on the precipitation level. This is also described as so-called "floating groundwater" (Fig. 1). In addition, it cannot be ruled out that such "floating groundwater" will occur in sandy islands within the till.

These conditions have to be taken into account in subsurface construction work and in the construction of buildings with cellars.

An unconfined, uncovered, independent aquifer separated from the confined main aquifer by the ground moraine in between, has developed in the sands of glacial valleys of the Panke Valley on the Barnim Plateau (Fig. 2).

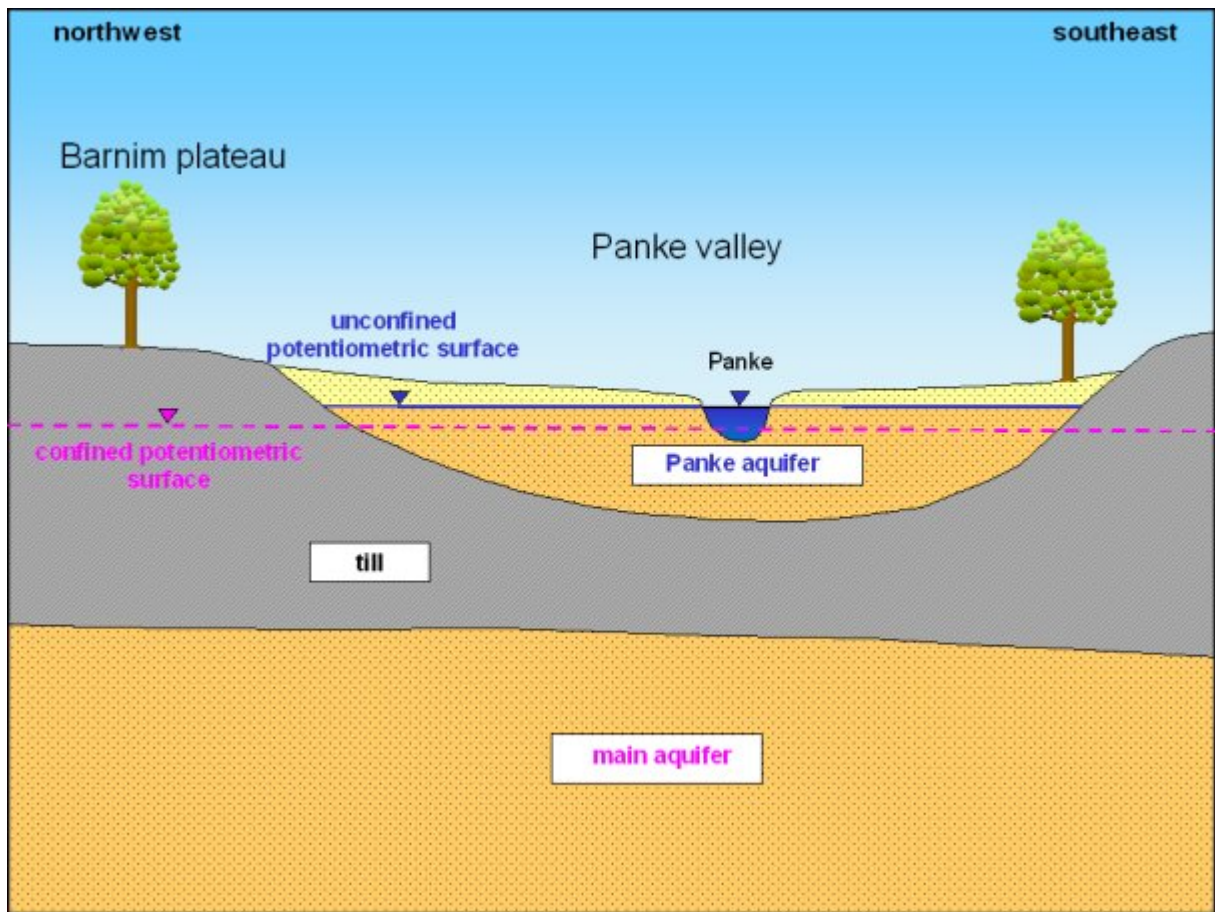


Fig. 2: Hydrogeologic Situation in the Panke Valley

For more information, see the maps [02.12 Groundwater Levels of the Main Aquifer and Panke Valley Aquifer](#), [02.19 Expected Highest Groundwater Level \(EHGL\)](#) and [02.20 Expected Mean Highest Groundwater Level \(EMHGL\)](#).

Additional information on groundwater can be obtained from the [Senate Department](#) for the Environment, Transport and Climate Protection, Working Group II B 3 Geological Survey in the [internet](#) [in German].