

01.13 Planning Notes for Soil Protection (Edition 2015)

Overview

Precautionary soil protection aims to protect the efficacy and natural characteristics of soils as well as to prevent adverse effects upon the soil. With the presentation of the individual soil functions in the maps [01.12.1 through 01.12.5](#) and the efficacy of soils in the map [01.12.6](#) (Faensen-Thiebes et al. 2006, SenStadtUm 2013) the technical basics for the stipulations relevant to soil protection for regionally significant plannings and requirements are developed (Faensen-Thiebes & Goedecke 2007).

Moreover, in the application of the planning process, notes as to how the differences in the efficiency of the soils are to be evaluated, and which of the results derived from this are to be implemented, are useful from the aspect of soil protection (Gerstenberg et al. 2007 and 2015).

In the present map 01.13 the information of the individual soil functions are combined and weighted. The result shows the degree of vulnerability of the Berlin soils against interventions in the soil due to development plans and construction projects. The present map is designed to assist involved soil-protection authorities to evaluate interventions in the soil in the context of assessments of environmental effects or urban land use plannings. It also supports an efficient classification and evaluation of the planning case and in the derivation of any required stipulations to protect the soil. Planning decisions and planning processes can thus be improved, in terms of soil protection.

The variety and spatial small-scale differentiation of the respective assessments and suggested measure can no longer be adequately portrayed in an analogue map. The present map is hence built on the digital data display of FIS Broker, which shows the detailed factual information, and the assessments and suggested measures for the sections selected, which would be no longer be displayable in an analogue map.

Statistical Base

The Map is based on the assessment of the soil functions as shown in the Environmental Atlas Maps [01.12.1 through 01.12.5 \(2013 Edition\)](#). Also used was the soil-association Map [01.01 \(2013 Edition\)](#), from which the danger of toxic wastes, i.e. from rubble-soil associations, sewage farms and railway track beds, was taken.

The data of the Environmental Atlas Map [01.02 \(Edition 2012\)](#) were used for the presentation of imperviousness classes.

Methodology

Specific Assessment of Soil Functions

For the solution of these two tasks - a differentiated assessment of soil functions, and implementation of soil-function assessment in the Planning Notes - the following considerations and work steps have been implemented in Map 01.13:

First of all, the soil functions ([Maps 01.12.1 through 01.12.5](#)) have been weighted differently, in accordance with their significance to the specific conditions in Berlin (in detail in Gerstenberg et al., 2007 and 2015):

- **Archive soils** and soils which offer **site potentials for rare and near-natural plant communities** are classified as deserving of extraordinary protection, due to their non-restorability.
- Soils which are efficient with respect to the **regulation function for the water balance and the buffering and filtration function** are deserving of protection generally; the significance rises at these locations still further if these two functions appear together, with a high assessment.

- Soils which show a high **yield function for crops** exist in agriculturally used sections.

This establishes a prioritization regarding the significance and sensitivity of soil functions.

Moreover, soils with considerable potentials for material contamination (e.g. sewage farms) are removed from the assessment process regarding the regulation, filtration and buffering functions as well as the yield function for crops, since they represent a possible source of burden for the groundwater and the food chain.

For the assessment of soils with regard to their **protection-worthiness**, five protection categories have been established, graduated from the maximum to the lowest protection status. They imply consequences for requisite action, and recommendations regarding interventions in the soil due to development plans and construction projects.

The protection requirements of soils are classified into the following soil protection categories:

- **maximum protection level,**
- **very high protection level,**
- **high protection level,**
- **medium protection level and**
- **low protection level (soils with no special requirements).**

As in the case of all Environmental Atlas maps on the topic Soil, except the Imperviousness map, the information and assessments shown here refer to the pervious portion of the soil. However, since the extent of imperviousness is of great importance, the degree of imperviousness is not shown only in the display of factual data, but also in the coloring of sections by protection category: these are shown in three degrees of intensity, decreasing with the increasing degree of imperviousness.

The imperviousness levels 5 % and 30 % have been chosen here as the boundaries between the three categories of intensity shown by this shading: with imperviousness of **5 % or less**, a section can be considered completely pervious, interrupted only by scattered buildings, pathways or the like; this includes forests, fields and pastureland. Allotment gardens, single-family homes, parks and other open areas, which may also have near-natural soils, dominate in the medium-level category with an imperviousness level of **more than 5 % up to 30 %**. **Imperviousness greater than 30 %** occurs primarily in residential and commercial sections, and in transportation areas, which for the most part have no natural soil associations at all any more.

Maximum protection level

This category is based on high assessments for the "habitat function for rare and near-natural plant communities" and/or for the "archive function for natural history."

This category shows the **highest protection status**, and covers only approx. 5 % of the area evaluated. With respect to possible planning, there are special requirements to consider alternative sites and avoid interventions, since the habitat function for rare and near-natural plant species is virtually unrecoverable, and the archive function for natural history is definitely unrecoverable (Smettan & Litz 2006). Therefore, projects or plans for which interventions in soils with maximum protection level cannot be avoided should only be authorized in consultation with the soil protection authority.

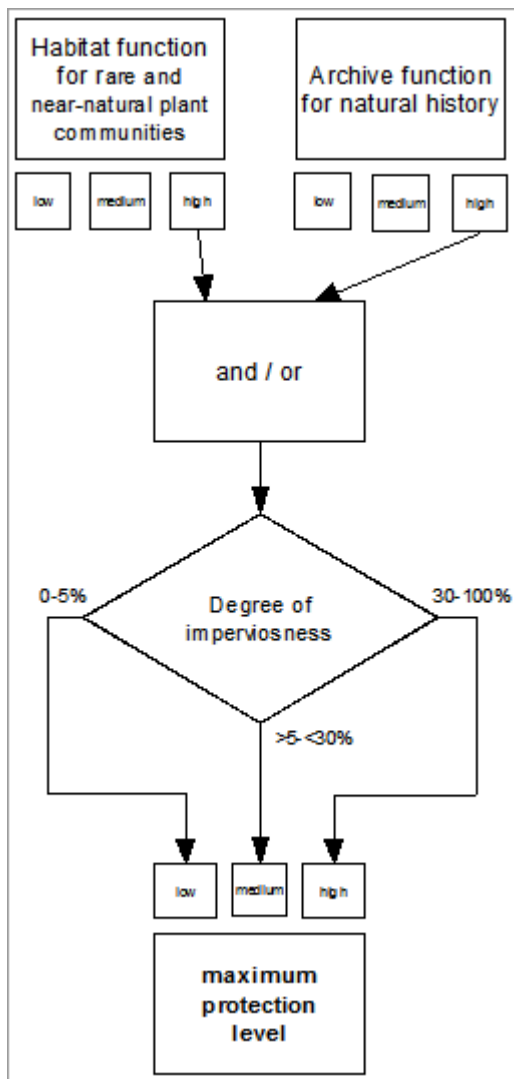


Figure 1: Chart for assignment to the protection category "Maximum protection level"

Very high protection level

The category "Very high protection level" may be based on any of several assessment factors:

1. The "**habitat function for rare and near-natural plant communities**" and likewise the "**archive function for natural history**" was assessed as medium, or
2. the "**yield function for crops**" was assessed as high on land used agriculturally (farmland, pasture or tree nursery / horticulture), or
3. the "**regulation function for the water balance**" and likewise the "**buffering and filtration function**" were assessed as high.

The majority of the sections in this protection category have been assigned to it due to their habitat and archive functions, a somewhat smaller number due to their regulatory or buffering and filtration functions, and only a few sections because of their yield function for crops.

The area category "Very high protection level" means that for reasons of soil protection planned interventions should be avoided as a matter of priority, or suitable alternative sites should be sought in keeping with other requirements. Moreover, no net loss of pervious soil and of functions should be permitted.

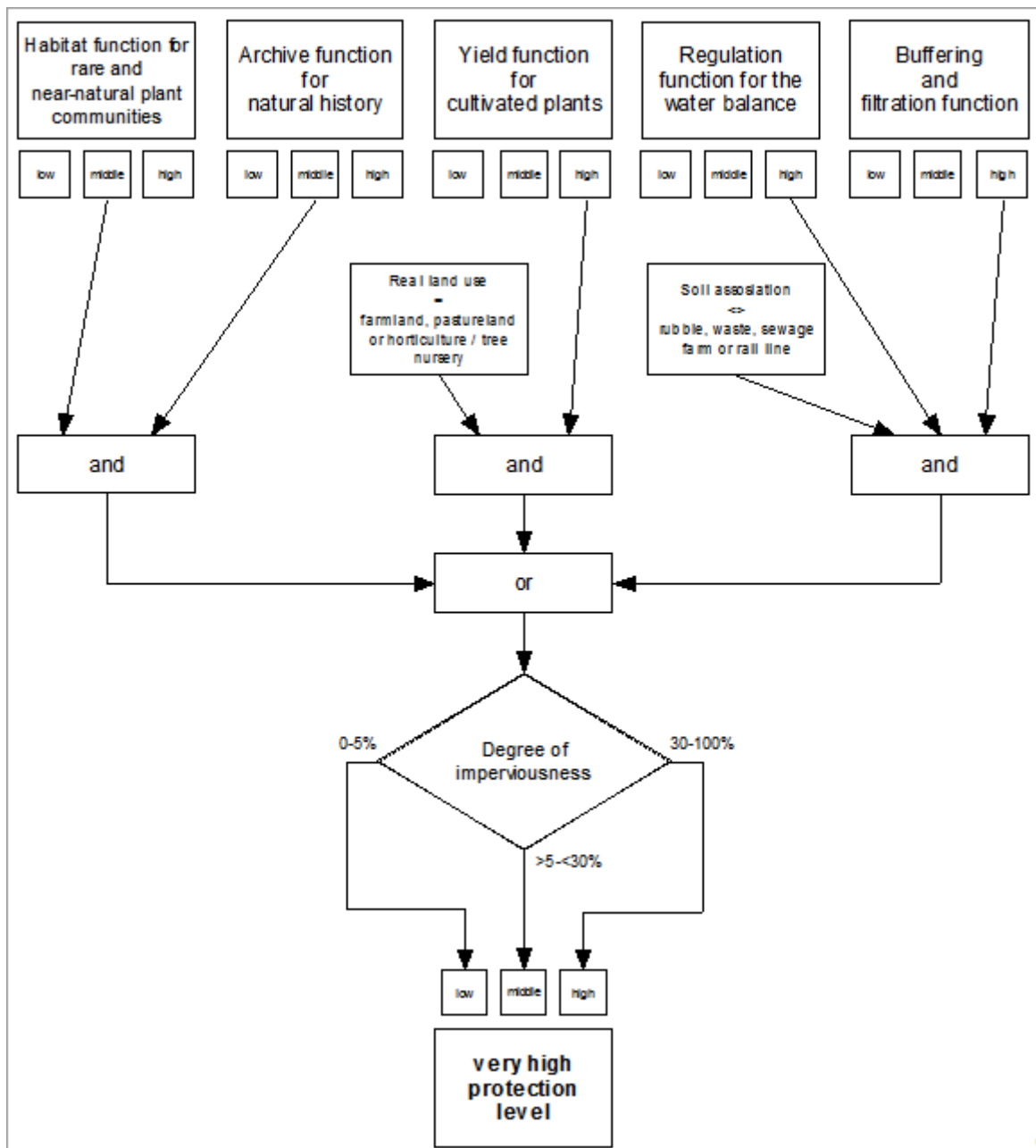


Figure 2: Chart for assignment to the protection category "Very high protection level"

High protection level

The category "High protection level" is based on a high assessment for the "regulation function for the water balance" or for the "buffering and filtration function."

The lower protection status compared with "Very high protection level" is due to the considerably lower number of soil functions involved. It is sufficient that **only one criterion** (either the regulation function for the water balance or the buffering and filtration function) be assessed as high. Despite the lower protection level, here too an effort should be made to avoid as far as possible or compensate for a net loss of land and functions, in consultation with the soil protection authority.

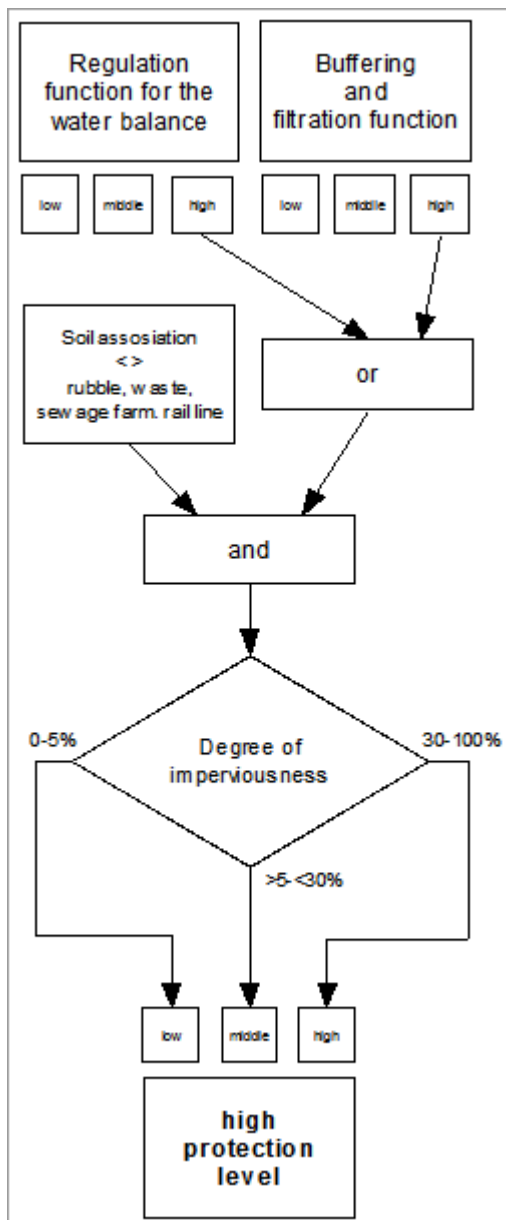


Figure 3: Chart for assignment to the protection category "High protection level"

Medium protection level

The category "Medium protection level" is based on a medium-level assessments for the "**regulation function for the water balance**" and simultaneously for the "**buffering and filtration function.**"

Where applicable, the affected functions can also be improved in this specific form by technical measures, such as retention of precipitation or use of soil coverage pervious to water and air. Thus, here the focus is on avoiding a net loss of functions and keeping the net loss of land as low as possible with the participation of the soil protection authority.

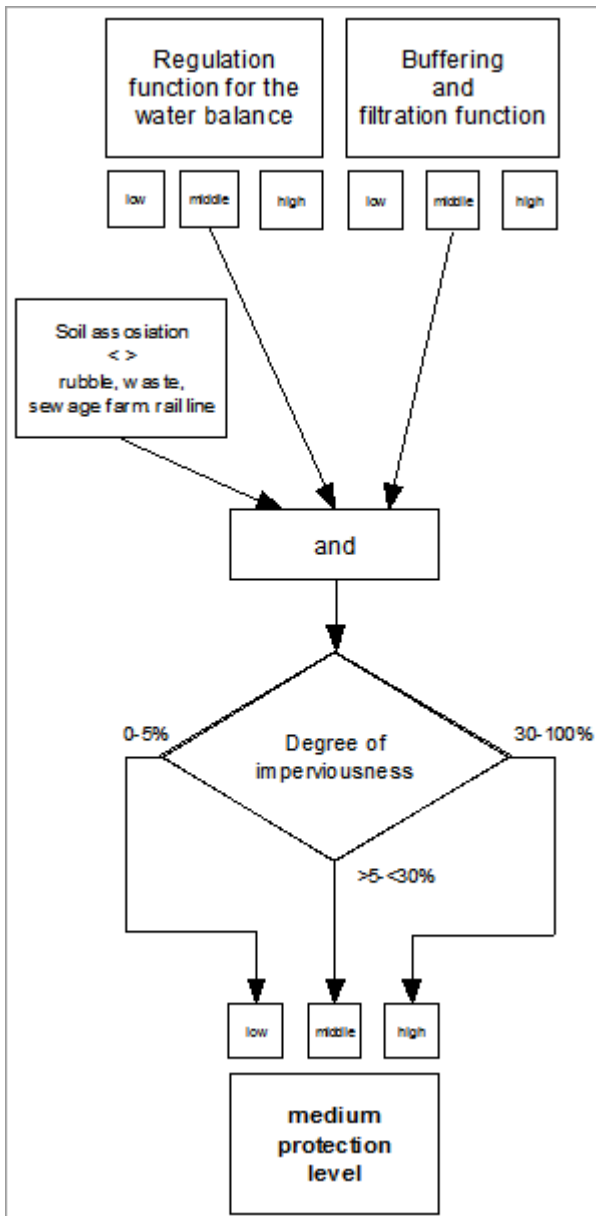


Figure 4: Chart for assignment to the protection category "Medium protection level"

Low protection level (soils with no special requirements)

The remaining soils (26,453 ha) are assigned to the category "Low protection level."

Here the **general legal soil protection requirements** (Federal Soil Protection Law 1998, Federal Soil Protection and Residual Waste Ordinance 1999, Berlin Soil Protection Law 2004, Building Code 2004) apply.

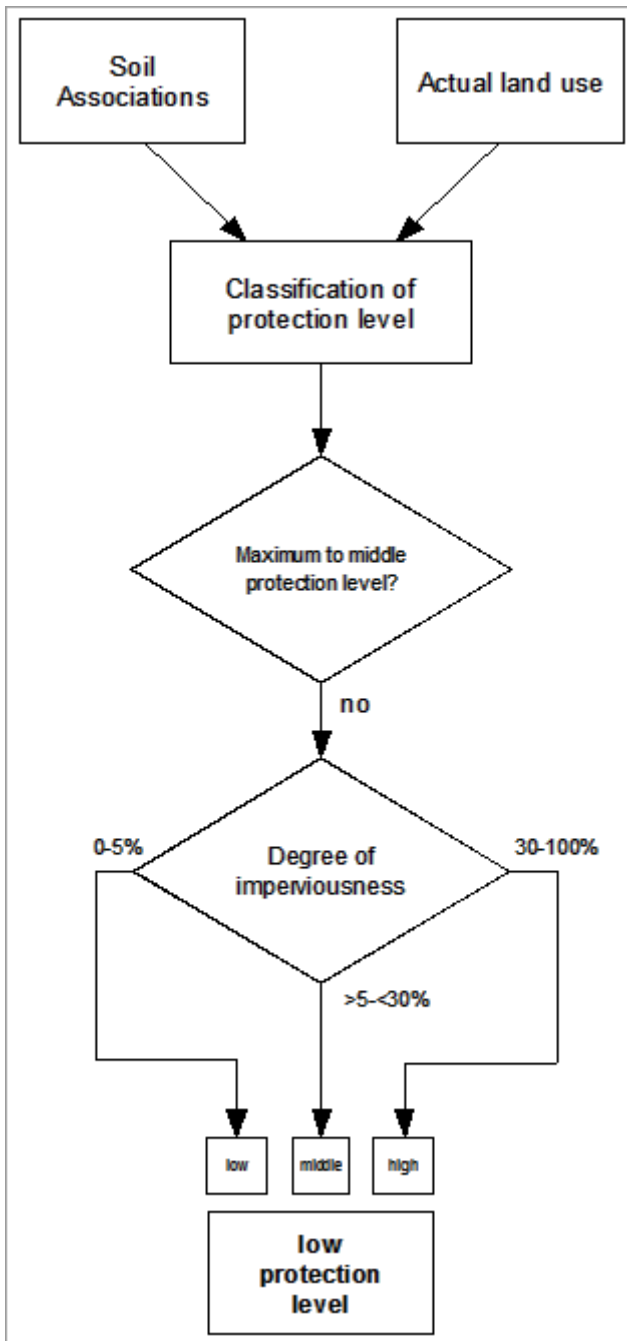


Figure 5: Chart for assignment to the protection category "Low protection level"

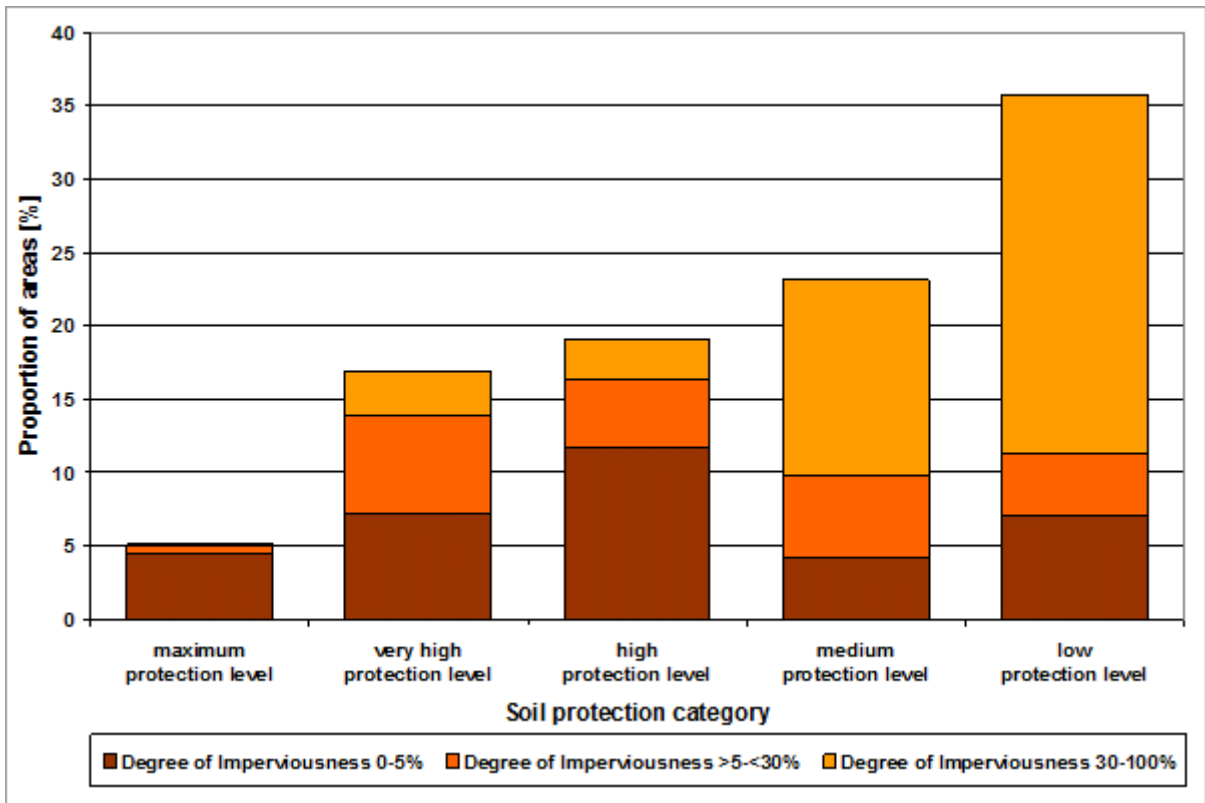


Figure 6: Area shares of soil protection categories by imperviousness class (percentages, without roads and waters)

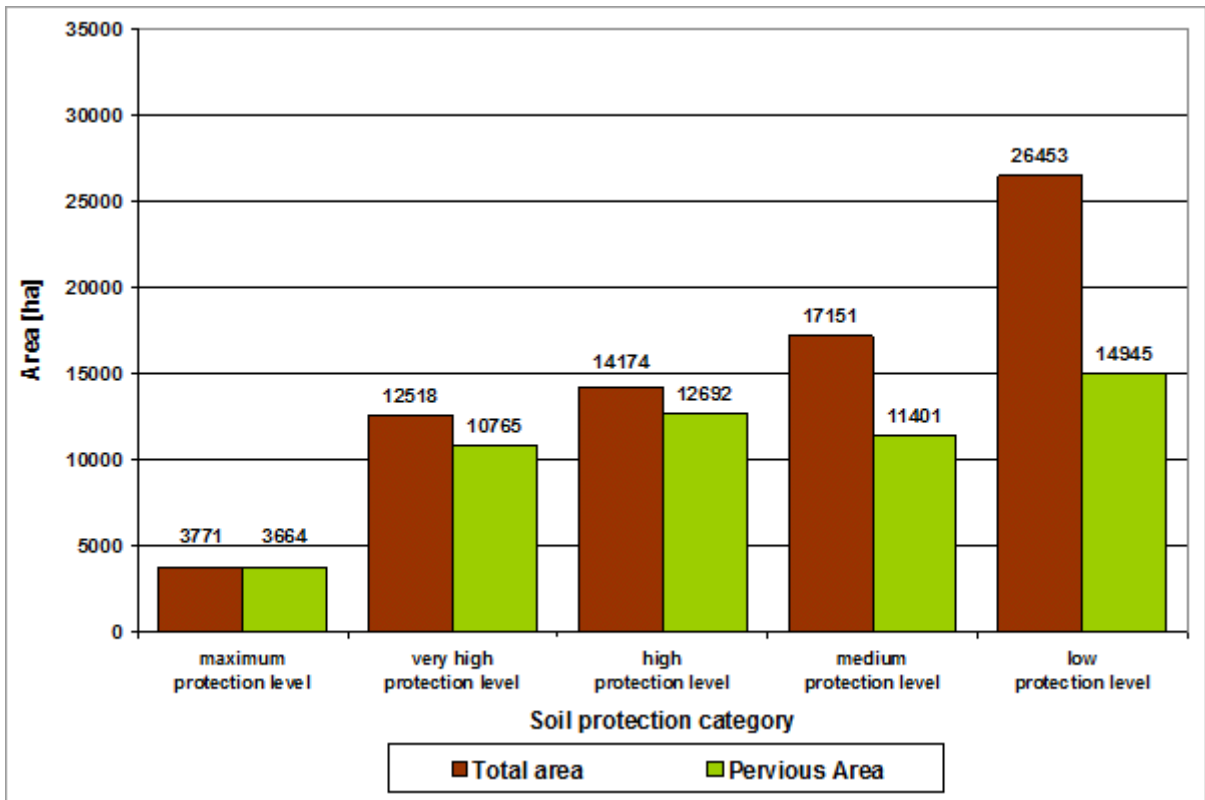


Figure 7: Total area and pervious area of soil-protection categories

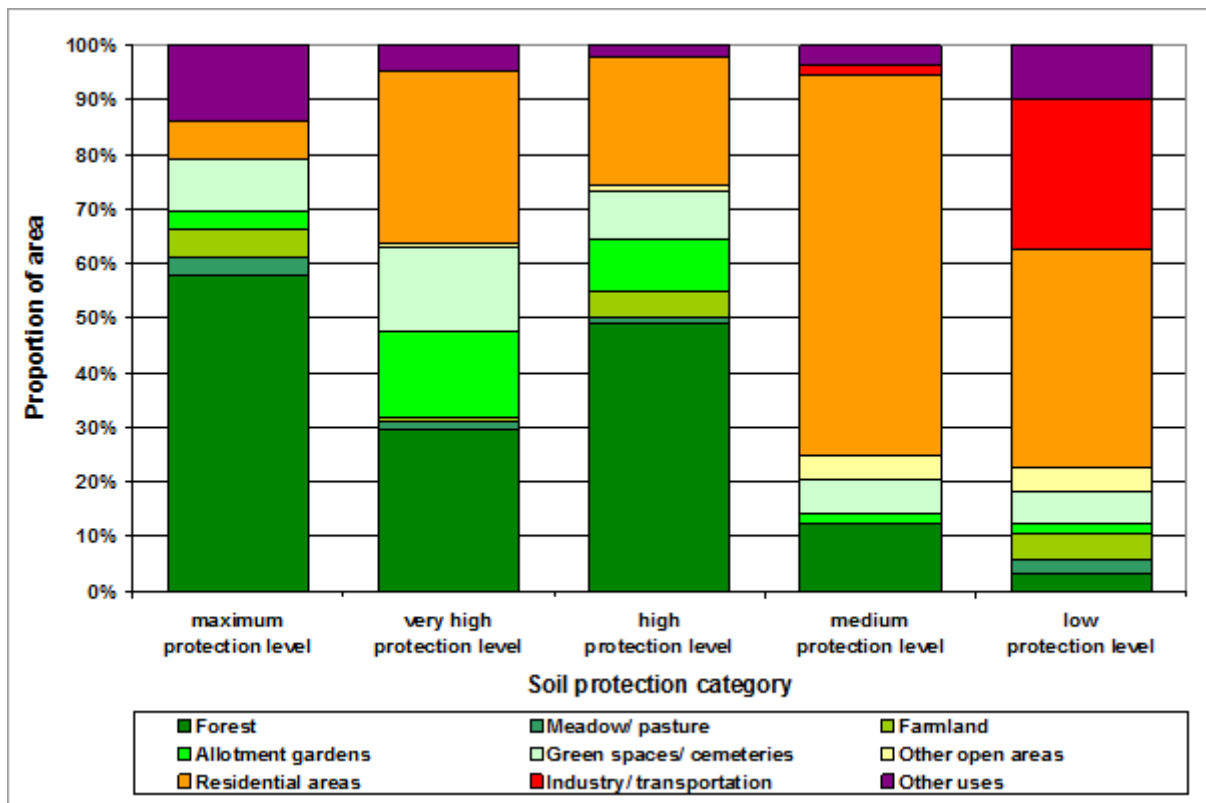


Figure 8: Area shares of use classes per soil-protection category

Soil protection category	Area [ha]	Area [%]	Area pervious [ha]	Area of soil protection category [%]		
				Degree of imperv. cov. 0-5%	Degree of imperv. cov. >5-<30%	Degree of imperv. cov. 30-100%
Maximum protection level	3,771	5	3,664	87	10	2
Very high protection level	12,518	17	10,765	43	39	18
High protection level	14,174	19	12,692	61	25	14
Medium protection level	17,157	23	11,401	18	24	58
Low protection level	26,453	36	14,945	20	12	68

Table 1: Area balance of the soil protection categories

Notes for Implementation in Planning Practice

From the soil-protection aspect, the planning notes are relevant requirements and stipulations for the relevant categories of soil protection. They refer to the level of **development planning**, but can be substantively transferred analogously to another spatially relevant plans or projects. For methodological reasons, the representation is shown in the map only in very general form in the legend. Detailed information is available in the display of factual data for each section for the map via the FIS Broker, in tabular form. The terms used, such as "avoidance" and "compensation," should not be seen as legal categories, but rather represent technical soil protection stipulations. In this connection, it should be recalled that the weighted soil functions refer exclusively to the **pervious segments** of the blocks.

The factual data display shows i.a. the soil protection category, the soil association and land use upon which the assessment is based, the assessment of the five individual soil functions ([from Maps](#)

[01.12.01 to 01.12.05](#)) as well as the degree of imperviousness. The planning requirements table, which can also be shown for each section separately, is of special interest, however.

Structure and contents of the planning requirements table:

- Line 1 states the **soil protection category**.
- Line 2 states the general soil protection **goal**.
- Line 3 represents the **reasons for the classification** (cf. "Methodology Item 1") into shortened form. The statements in the additional lines justify themselves respectively by these value giving soil functions.
- Line 4 shows in detail the fundamentally desirable **avoidance and reduction steps**. No distinction has been made between avoidance and reduction, since assignment in the context provided will be decided differently, depending on point of view of the actor. The key goal is the prevention of interventions in the soils deserving protection, not the precise language of the terminology.
- Line 5 gives suggestions for **compensation**, as function-related as possible. Accordingly, such requirements are stated which can conditionally be imposed as per the stipulations of the Building Code.
- Line 6 contains in some cases additional **measures** which would be useful from the soil-protection aspect to compensate for considerable impairments of soil functions.
- Line 7 contains **other notes** and explanations.

Very high protection level of the soil	
Protection target and plan assessment	Avoid interventions as a priority. an alternative location takes precedence oder Optimize planning. Avoid net loss of unsealed ground and functions primarily.
Evaluation Criteria (affected soil functions)	Yield function of the soil for cultivated plants = high AND Land use field (121) or grassland (122) or nursery / horticulture (200)
Avoidance- and Minimization Measures	<ul style="list-style-type: none"> o Find alternative location, Use of agricultural land lower order o Designation of days when built o Excluding parking places and Garages according § 12 the Land Use Ordinance (BauNVO) outside the buildable plots of land. o Exclusion of acillary facilities in sense § 14 BauNVO outside the buildable plots of land.
Function-related compensation (fixable in the development plan, possibly also elsewhere than at the surgical site)	<ul style="list-style-type: none"> o Extensifying the use by use change o Increasing the humus content o Enriching the landscape with landscape elements such as hedges or articulating rows of trees
Measures (normally not be fixed according to the Federal Building code, possibly regulated in the context of urban development contracts)	<ul style="list-style-type: none"> o Liming, possibly after circumstances (depending on the pH) o Rest for the land by growing of perennial agricultural crops without mechanical cultivation o Reduction of working funds
Other notes	Create coordination with appropriate soil protection authority..

Table 2: Example of a planning requirements table

Map Description

The map shows the sections differentiated according to five soil-protection categories. In addition, each protection category is distinguished by graduations of color intensity (shading) into the three imperviousness classes: 0 - 5 %, >5 - <30 % and 30 - 100 %.

Maximum protection level

The areas of the highest protection category are concentrated primarily in **near-natural sections** with rare plant communities or outstanding remnants of the Ice Age in the **outer areas** of the city. Major contiguous areas of this protection category are located in the Spandau Forest on valley sand with eutrophic and oligotrophic eutric-histosols (i.e., bogs). These **groundwater locations** are associated with calcaric eutro-gleyic cambisols, calcaric cambisols, calcaro-gleyic cambisols and eutro-gleyic dystric cambisols (brown earths, largely with lime). Other locations near groundwater of the highest protection-worthiness category are at Tegel Creek, with eutrophic eutric-histosols, rare dystric gleysols and calcaro-dystric histosol; in the Buch Forest with eutric histosols, gleysols and stagno-gleyed cambisols on valley sand areas; and in Köpenick/ Müggelheim with fluvic and calcic-eutric histosols (bogs in flood-plains), in a deflation basin, filled with fine-grain drifting sands. These eutric histosols (bogs) are associated with dystric gleysols (wetland soils) in transition to dystric cambisols on **low-**

nutrient locations. in the southwest of Berlin, in Kladow; dried eutric-histosols with fossil gleysols and dystric cambisols in a glacial runoff in the Glienicke Lake area have been assigned this high protection status. Other sections located at the edge of the Grunewald chain of lakes consist of eutric-histosols, in some cases dried, stagnic gleysols, fossil gleysols and dystric cambisols, and in the Tegel Airport/Jungfernheide area, with fluvic (flood-plain) soils. A special phenomenon are the drained fluvic soils with thick lime mud in Teerofen.

Smaller areas with eutric-histosols and gleyic (i.e., wetland) soils are located at the edges of unspoiled watercourses such as the Krumme Lake and the Kuhgraben in Köpenick, the Mill Stream in the Rahnsdorf Forest and the Wuhle Valley in Marzahn-Hellersdorf. The groundwater-characterized soil associations in the Havel lowlands in Spandau and in the Königsheide ("king's heath") in Treptow, and the fluvic soils in Heiligensee, also deserve mention.

Examples of sections with the highest protection category and with an additional main emphasis on the **archival function** are primarily the Ice-Age-characterized arenic dystric cambisols (brown earth turned to gley) associated with the podzoluvisols in the Frohnau Forest, and the arenic dystric cambisols associated with luvisols and gleyic cambisols in Gatow, which are used as farmland.

For the most part, these sections are **forests** or other uses, including predominantly mixed stands of meadowland, scrubland and forest. They also include agricultural sections (meadow/pasture and farmland), parks and residential sections (cf. Fig. 8). Most sections are already subject to protection status in other legal contexts. The highest protection is provided by conservation law, with the certification of official protected areas.

The total area of this protection category amounts to 3,771 ha. Of these, 3,295 ha (87 %) are up to 5 % impervious, 394 ha (10 %) >5 - < 30 % and 82 ha (2 %) 30 % and more impervious.

As expected, imperviousness degrees up to 5 % dominate within this protection category. The quota of sections with an imperviousness degree of > 5 % is small and amounts to 12 % (cf. Fig. 6 and Tab. 1). Altogether, of the total area of 3,771 ha in this category, 3,664 ha are pervious (cf. Fig. 7).

Very high protection level

All sections with a **high degree of efficiency** with respect to **yield function, regulatory function for the water balance or buffering and filtration function**, or a medium degree of efficiency as a rare plant location, together with an archive function, are assigned to this protection category.

Major contiguous areas in this category, pervious or minimally impervious, are located at the end moraines or drumlins, with dystric cambisol - regosol - colluvial cambisol/gleysol soil associations, at the slopes of the Havel, at the Wannsee Lake and in the Gatow Heath. Another typical soil association with soils exceptionally deserving of protection soils are the soil associations of dune-sand with the series spodo-dystric cambisol - podzol - colluvial dystric cambisol in the Tegel Forest, Frohnau and Köpenick. At the latter location, these soils are in some cases interlocked with the associations described for the end moraines and drumlins.

Other areas are located in the Tegel Creek, with eutrophic eutric-histosol - histo-humic gleysol - eutrogleytic dystric cambisol. Occasional small areas can be found on the Barnim Plateau, with sandy basin fillings, in Malchow and Wartenberg. The soil associations which occur here are dystric cambisol - colluvial cambisol and dystric cambisol - luvisol - eutric-histosol. Other occurrences of soil associations deserving of protection with basin filling are located in Spandau.

Sections with this assessment with medium imperviousness of > 5 %, < 30 %, are concentrated on the Barnim and Teltow plateaus, with bolder clay or bolder marl. The certified locations are generally in small segments, and located in the outer areas, in loosely built-up single-family home neighborhoods, such as in Lichtenfelde, Lichtenrade, Rudow, Bohnsdorf, or in parks and allotment gardens. The soil associations deserving exceptional protection are of loamy substrata with luvisol - arenic cambisol associations.

The total area of this protection category amounts to 12,518 ha. Of these, 5,329 ha (43 %) are up to 5 % impervious, 4,940 ha (39 %) >5 - < 30 % and 2,251 ha (18 %) 30 % and more impervious.

This category contains 17 % of the area evaluated, with 12,518 ha, of which 10,765 ha (86 %) are pervious (cf. Fig. 7). The distinctive factor is the relatively high share with a degree of imperviousness of 0 - 5 % and > 5 - < 30 % (cf. Fig. 6 and Tab. 1).

The predominant uses in this protection category are **forests, allotment gardens, parks and residential sections** (cf. Fig. 8).

High protection level

This category of soils deserving special protection is based on the **high contribution** of the soils to maintaining the **water balance**, or for their **filtration and buffering capacity**.

On large pervious complex at Müggel Lake is particularly striking, where the entire forest area on valley sand with dystric cambisol - stagno-gleyed cambisol - gleyic cambisol satisfies these criteria. In addition, there are smaller areas with acidic soil associations of drifting sand, like spodo-dystric cambisol - stagno-gleyic dystric cambisol. These dune-sand and valley-sandy soil associations, which are very much deserving of protection, can also be found in the Tegel Forest/Hermsdorf area, and at Tegel Lake. Smaller pervious areas are located primarily in the north and south of Berlin, on the Teltow and Barnim plateaus. The typical soil association is luvisol (gray soil) - arenic cambisol of boulder clay. The moderately impervious sections in this category up to a degree of imperviousness of 30 % are small and scattered. They include the luvisol - arenic cambisol soil association of boulder clay at Tempelhof Airport, on farmland sections in Gatow, and in the loosely built residential sections with single-family homes in Marzahn-Hellersdorf, Karow and Französisch-Buchholz. Other areas include the groundwater-affected soil associations on valley sand with cambisol - gleysol - eutric-histosol in the Königsheide, and dystric cambisol, stagno-gleyed cambisol and gleyic cambisol in the Plänterwald Forest. Soils of detrital sands on moraine areas with dystric cambisol - colluvial cambisol in the Westend neighborhood of Charlottenburg and in Tempelhof, used as allotment gardens, also fulfill these criteria. Such parks as the Rehberge Park, with spodo-dystric cambisol - dystric cambisol - colluvial cambisol of drifting sand, also deserve mention.

Soils deserving special protection with a high imperviousness degree of 30 - 100 % are limited to a few small areas, some in residential sections. These are primarily sandy deposit soils with the soil types loose lithosols (rock-fragment soil), calcaric regosol (lime), regosol (non-descript soil) and hortisol (garden soil). Certified sections include for example the West Berlin Zoo, areas along the Spree in Rummelsburg, and residential areas in Hermsdorf.

The total area of this protection category amounts to 14,174 ha. Of these, 8,626 ha (61 %) are up to 5 % impervious, 3,526 ha (25 %) >5 - < 30 % and 2,020 ha (14 %) 30 % and more impervious.

This category accounts for approx. 19 % of the area evaluated, and thus for a similar share as the category "Very high protection level" (cf. Fig. 6). The order of magnitude of 12,692 ha (90 %) of pervious area, is also similar to that in the category "Very high protection level" (cf. Fig. 7). The share with a degree of imperviousness of up to 5 % constitutes the largest part of the area for this category (cf. Fig. 6 and Tab. 1).

Soils with **forest utilization** account for the major share of the areas in this protection category, followed by **residential areas, farmland and allotment gardens** (Fig. 8).

Medium protection level

The category of the soils deserving protection is based on their **medium-level fulfillment of the function** both for the **water balance** and for the **filtration and buffering fortune**.

The pervious or slightly impervious share (0 - 5 %) of this category is a large contiguous area, the Grunewald Forest and the Düppel Forest. The dominant soil associations include acidic dystric cambisols with colluvial cambisols of detrital sands. Scattered areas of detrital sands, but over marl, are located in the Gatow Heath, and in Bohnsdorf, with colluvial cambisol - dystric cambisol - luvisol. In Heiligensee, soils of drifting sands with loose lithosols, cambisol/dystric cambisol - stagno-gleyed cambisol - gleysol, too, are characteristic soils in this protection category.

The share with a medium level of imperviousness (>5 - < 30 %) is small, and consists of very small, non-contiguous areas. Examples are sections in the valley sands, such as the East Berlin Zoo, shore areas on the Spree in Köpenick, and Tegel Airport with dystric cambisol - stagno-gleyed cambisol - gleyic cambisol. In residential sections with more loosely-built single-family homes in Frohnau, the soils of drifting sand with spodo-dystric cambisol - dystric cambisol - colluvial dystric cambisol are deserving of protection. In the residential sections of Zehlendorf and Dahlem and the Hasenheide Park, the dystric cambisol - regosol-cambisol - colluvial cambisol soil association of detrital sand fulfill these prerequisites. In the loosely-built areas in Kladow and to some extent in Gatow, luvisol - colluvial cambisol is present. Groundwater-affected associations of this protection category exist in the residential sections of Müggelheim and Rahnsdorf with dystric cambisol - stagno-gleyed cambisol - eutro-gleyic cambisol on valley sand, to some extent linked with podzol (coniferous-forest) soil associations of drifting sand. On the Barnim Plateau, in Wittenau and Pankow, there is primarily dystric cambisol - luvisol associated with dystric cambisol - colluvial cambisol or gleyic cambisol of detrital sands (mixed with Ice-Age material).

The highly impervious sections (30 - 100 %) account for the major share of this protection category. They are concentrated on the Barnim and Teltow Plateaus, in the south and north of the city. These locations are chiefly located in such densely built-up areas as Steglitz, Prenzlauer Berg, Pankow, Lichtenberg or the Märkisches Viertel in Reinickendorf. The soil associations are anthropogenically characterized, and sandy deposits are frequently the basic material for their soil formation. The dominant soil types are therefore little developed A - C soils, such as loose lithosols, regosols, calcaric regosols and hortisols.

The total area of this protection category amounts to 17,151 ha. Of these, 3,084 ha (18 %) are up to 5 % impervious, 4,144 ha (24 %) >5 - < 30 % and 9,923 ha (58 %) 30 % and more impervious.

This category accounts for the second-largest area among the protection categories, with 23 %. Of the total area, 11,401 ha (66 %) are pervious (cf. Fig. 7). Where in the other protection categories, sections with degrees of imperviousness of less than 30 % predominated, this category is primarily characterized by sections with a high degree of imperviousness, of 30 - 100 %. These are largely located on the residential sections of the plateaus, some even within the urban-rail ring line. Sections with a low degree of imperviousness of < 5 % are negligible (cf. Fig. 6 and Tab. 1).

The sections of this protection category are found predominantly in the **residential sections**, but also in **forests** (Fig. 8).

Low protection level (soils with no special requirements)

Under this evaluation system, most soils and soil associations in Berlin are subject only to the **general soil protection requirements**. These soils frequently constitute large contiguous complexes. These are primarily densely built-up sections with a high degree of imperviousness, especially in the center city, and also include industrial sites along the Spree in Treptow and along the Havel in Spandau as well as in Lichtenberg, Neukölln, Tempelhof and Reinickendorf. The soil associations in these areas are predominantly anthropogenically characterized, and have developed mostly from sandy deposits. Their common characteristic is a short development time with weakly developed A - C horizon formation. They are primarily loose lithosols, regosols and calcaric regosols.

Natural soil associations on bolder marl, glacial sand or valley sand with the soil types regosol, dystric cambisol-regosol, gleyic regosol and luvic regosol are located on former sewage-farm areas in the north of Berlin, in Pankow and Weissensee, and on a small scale in Gatow. These areas have no particular protection status, due to their potential or real pollutant content. The same applies to the soils of contaminated landfill, such as dumps, industrial and bolder marl landfills, and railway track beds.

The total area of this protection category amounts to 26,453 ha. Of these, 5,206 ha (20 %) are up to 5 % impervious, 3,193 ha (12 %) >5 - < 30 % and 18,055 ha (68 %) 30 % and more impervious.

These soils can be found on 36 % of the areas evaluated. Only 14,945 ha (56 %) of the soils of this category are pervious (cf. Fig. 7 and Tab. 1).

The soils with low protection level are largely located in **residential sections, industrial and transportation areas, and areas with other uses**. The high share of **farmland** with low assessment is due to areas with former sewage-farm use. Due to the existing pollution, these are excluded from classification in a higher protection category.

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