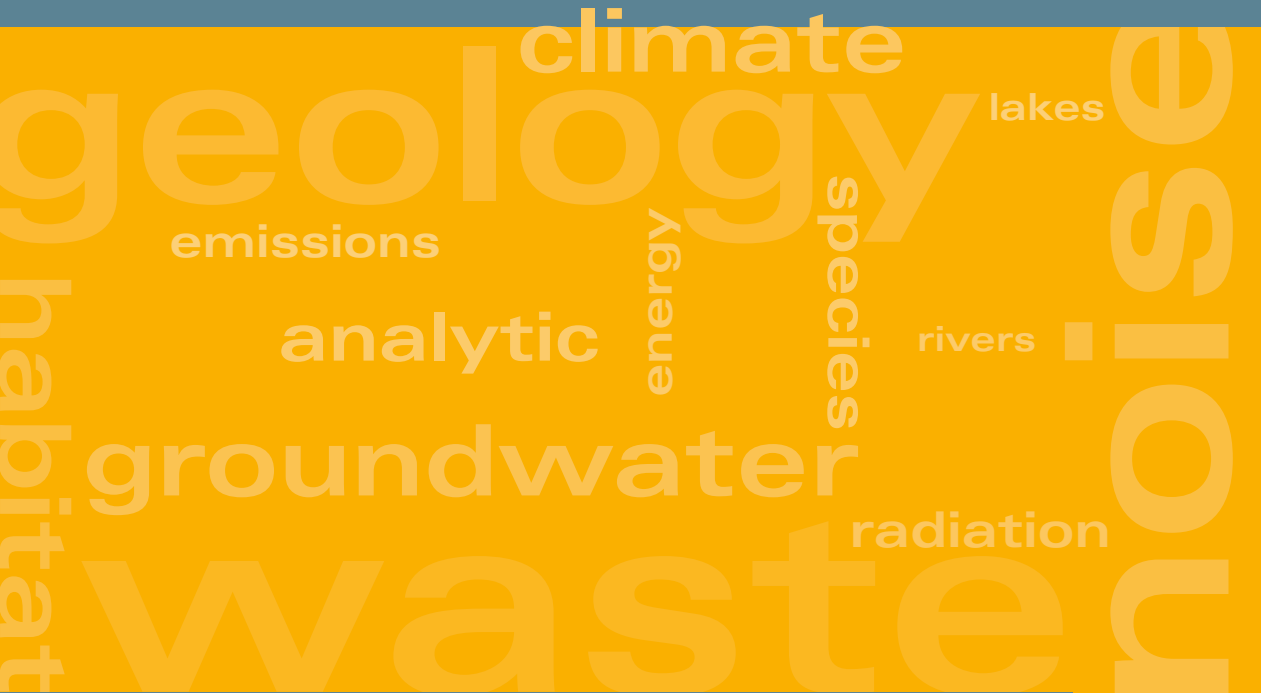


Bavarian Environment
Agency



Water, Soil, Air, Nature
The Bavarian Environment Agency

www.lfu.bayern.de

Imprint

Water, Soil, Air, Nature

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Foreword

Dear Readers,

Whether in the Alps or the Spessart, in Swabia or the Upper Palatinate: the wide variety of landscapes, the diversified nature, the soils, rivers, streams and lakes of Bavaria are essential for our life and form the very basis for sustainable development. A valuable asset that we are determined to preserve.

For that reason the Bavarian Environment Agency with its headquarters in Augsburg and Hof and its four field offices unites the necessary competencies. In an interdisciplinary approach we address all the environmental media – water, soil, air and nature and work both area-wide as well as on special case-related topics to serve the protection of the environment. Over 45 programs with some 9,000 monitoring points continuously deliver data on the quality of our environment. This sound basis helps us to develop targets, strategies and plans for the use and protection of the environment.

Preventive care is a top priority for us: only those who recognise dangers and potential pollution of the environment at an early stage, can create effective ways and means and set a wise course for the future. Our applied environmental research furnishes the technical foundations for such an approach – as in the case of climate change for example.

We place great importance on environmental information. Very often both precision and speed are called for, as prompt action is essential when it comes to protecting mankind against natural hazards. That is why the latest measurements taken by our reporting and warning systems are always accessible

over the Internet giving information about flooding, avalanches or ozone levels in the air, for instance.

The energy transition is well underway. The Bavarian Environment Agency works in achieving an environmentally friendly development of renewable energies in the state of Bavaria: Our Eco-energy Institute of Bavaria sets priorities in the fields of ecological research and eco-innovation. The goal is to help shape the expansion of renewable energies through pilot projects in an environmentally sustainable manner.

We also provide environmental information geared to target groups with state-of-the-art media. An excellent example is the Infozentrum Umwelt Wirtschaft (Information centre for corporate environmental management) of the Environment Agency. We intend to continue pursuing this course.

The purpose of this brochure is to stimulate your enthusiasm for Bavaria's environment and its protection and encourage you to find out more. With our experience and competence, we will continue to be a reliable and objective partner as the interface and information hub for all environmental matters in Bavaria. Because: The environment has a future – and the future needs the environment.



Claus Kumutat,
President of the Bavarian
Environment Agency





environment water, soil, air, nature

Water, soil, air and nature – mankind depends on these four resources being available in adequate quantity and quality at all times. Securing and using these natural resources in an ecological manner are key objectives of the Bavarian Environment Agency, as is protecting the people against hazards arising from the environment.

The LfU in short

Regardless of whether it is a matter of air quality or water quality, waste or wastewater, use of soil, raw materials or groundwater, radiation, noise or plant safety, nature conservation or climate change, floods, avalanches or the behaviour of contaminants in the environment: Our role is

- to collect, compile and evaluate environmental data,
- as the agency responsible for the whole of Bavaria, to develop basic principles and concepts to ensure that uniform standards are applied throughout the State in protecting the environment and conserving nature and that the people are protected against hazards arising from the environment,
- to inform and advise science, industry, municipalities, public authorities, policymakers and the general public.

Depending on the scope of activities, we also act as technical consultants, supervisory body or licensing authority.

Environmental quality – more than just a few measurements

Water, soil, air and nature can interact with each other in many different ways. Contamination in one area can frequently impact other areas and affect individuals; the consequences of which are often unpredictable and strongly time-delayed. Hundreds or even thousands of factors affect the condition of the environment. We therefore analyse the quality of the environment on a cross-sectoral basis. In addition, we have developed a reasonable number of parameters (= environmental indicators) from our large volume of recorded data. They enable the concise description and evaluation of the quality of Bavaria's environment, highlight long-term environmental trends and create a basic framework for our environmen-

tal reports. Examples of such indicators are carbon dioxide emissions, endangerment of species, nitrates in groundwater, climate development, consumption of energy, renewable energies, volume of waste, land use, road traffic noise and the state of the forests.

Informing and advising

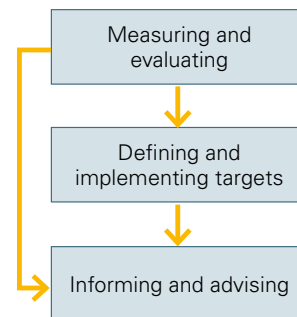
Information and advice are crucial to successful environmental protection and nature conservation as well as in handling natural hazards. We provide advice during the design development and building permit phase for technical facilities, transport projects or spatially significant plans, and for environmentally compatible and sustainable use of resources.

We organise conferences on topical subjects and new developments, take part in trade fairs and issue publications. For the general public, we organise exhibitions and publish brochures that are easy to understand.

Our most important information medium is the Internet. This is where you can find information and maps covering a wide range of environmental topics as well as our environmental hazard warning services. You can also order and download publications and – most important of all: this is also where our measurements are published – in some cases they are even updated every hour.

Did you know ...

At over 9,000 measuring and observation points, we monitor the quality of the Bavarian environment for you – round the clock in some cases. We also determine the quality of the air, groundwater and surface water, the degree of pollution in natural habitats, water levels, radioactivity and electromagnetic fields as well as the distribution of animal and plant species.



These three steps are common to nearly all our tasks.

The only way to protect and improve the environment is by adopting a cross-sectoral approach.

LfU's website – www.lfu.bayern.de – offers some 2,800 webpages, 10,500 PDF documents and several warning, mapping, data and information services. Have a look!

Publications can be ordered at: www.bestellen.bayern.de

A detailed photograph of a laboratory setup. In the foreground, a clear glass round-bottom flask is mounted on a metal stand. Above it, a larger glass vessel with a spiral internal structure is connected to a white plastic manifold with red stopcocks. To the right, another glass flask is partially visible, also connected to the manifold. The background shows a yellow wall and a circular mirror. The overall scene is brightly lit, highlighting the glass and metal components.

analysis **keeping track**

Our life would be unthinkable without them: plastics, drugs, fertilisers, pesticides, cleaning agents, preservatives, solvents. Many of these substances and their decomposition products are harmful to the environment. To prevent hazards, the LfU measures what and how many contaminants enter the environment, whether and where they accumulate and what impact they have.

Keeping track

Using highly sensitive analysis methods, we examine samples of water, soil, air and waste as well as organisms to detect any substances that might have an impact on the environment and determine their concentration. We test, for example, for the presence of heavy metals, drugs, pesticides, hormones and dioxins. We have security labs for highly poisonous and radioactive samples. In the case of acute damage, our experts assist the local relief forces, make measurements and take samples.

Exploring distribution and impact

Do contaminants decompose in the environment, are they absorbed by organisms or, for example, transported from the soil into the

groundwater? To identify short- and long-term risks for the environment, we operate model sewage treatment plants and observe the decomposition and migration of substances in soil in special testing facilities. To analyse substances of environmental relevance, it is essential to determine not only their concentration, but also their impact. Biological test procedures provide data directly indicating how poisonous environmental chemicals are.

Guarantee of quality

The methods by which samples are taken and treated for the purpose of analysis can have considerable influence on the values measured. High quality standards are therefore essential for reliable results. Companies that analyse environmental samples as required by law therefore have to be approved by the LfU.

OUR KEY FIELDS OF ACTIVITY

+++ inorganic and organic analysis +++ bio and toxicity tests +++ eco-toxicology +++ issues relating to behaviour of substances (decomposition, migration) +++ nanotechnology +++ microbial ecology +++ molecular biological analysis (PCR) +++ pathology +++ analysis of substances +++ investigation into damages +++ European regulation on chemicals REACH +++ approval of laboratories +++



Did you know ...

At present around 100 million artificial and natural chemical compounds are known to mankind. Some 100,000 are produced industrially and several hundred new chemicals are manufactured each year. With our analysis facilities, we can, for example, detect less than one billionth gram of a substance in one litre of water.

Look us up

www.lfu.bayern.de: Under the link Analytik/Stoffe [Analysis/Substances] you will find, among other things, our testing and monitoring programmes, research results, information on environmental pollutants, lists of recognised test centres and laboratory approval forms. Internet address of particular interest to companies: www.izu.bayern.de: Chemikalien/REACH

Does the sample contain any contaminants? – How are they dispersed in the soil? – What effect do they have on organisms?

A large pile of various waste items including plastic containers, a soccer ball, a metal tray, and bags of trash. The items are scattered and appear to be in a storage or disposal area. A red rectangular box is overlaid on the top left corner of the image.

waste

moving away from a throwaway society

Waste accumulates everywhere: at home, at work-places and during production. A large proportion of it can be recycled. After waste prevention, recycling is therefore the most important principle of waste management. We play an active part in developing concepts for the avoidance and reutilization of waste, promoting recycling and upholding a state of the art technology in the reutilization and elimination of waste.

Safe recycling and disposal

In order to avoid relevant environmental pollution from recycling- and incineration sites, we examine such facilities at the planning stage and monitor them during construction and operation.

In case of hazardous waste (= special waste) like chemicals, oil or asbestos we also check whether any special waste has been properly disposed of. This is monitored by controlling records which generators, transporters and disposers of hazardous waste are legally obliged to keep.

In constant change

Just as lifestyles and consumption patterns of individuals change, so does the type, origin and volume of waste. We gather annual information on how much packaging, paper, metals, biodegradable waste, sewage sludge and residual waste the counties and cities in Bavaria produce and analyze how these waste materials are utilized and the residual waste is eliminated. This also applies to hazardous waste generated by companies. New materials and products are consistently being developed. We compile concepts and strategies to facilitate the environmentally compatible disposal or reuse of such materials in keeping with the prevailing legal regulations.

OUR KEY FIELDS OF ACTIVITY

+++ waste prevention +++
waste management concepts +++
recycling and disposal plants +++
waste balances +++
hazardous waste +++
sewage sludge +++
landfill sites and sites contaminated by accumulated deposits +++
contaminants in waste +++
integrated product policy +++



Did you know ...

On a per capita basis, about 470 kilograms of domestic waste and similar commercial waste are accumulated in Bavaria each year. Of these about 310 kilograms are utilized for a substance-based, biological and thermal use, while roughly 160 kilograms remain as residual waste. This demonstrates the need for waste prevention concepts. The reclamation rate in 2013 was recorded at nearly 66 %.

Look us up

www.lfu.bayern.de: Under the link **Abfall [waste]** you will find information on waste avoidance, reutilization and elimination, the annual waste record, statistics on hazardous waste, an Online Waste Guide and a database listing **Bavarian disposal and recycling companies**. Further information about waste in companies can be found at: www.izu.bayern.de: **Abfall**

Principles for handling waste: prevention – recycling unavoidable waste – disposing of non-recyclable waste, while mineralising combustible waste and safely depositing waste that cannot be incinerated.



soil

life on solid ground

In many respects, soil is an essential prerequisite for human life: we walk on it, we build our houses and roads on it and we use it to produce food and wood. Plants have their roots in the soil and animals live there. Soil filters rainwater and forms a protective layer on top of our groundwater. The LfU defines the fundamental principles for preventive soil protection.

What soils where?

The properties of soil determine where it is particularly susceptible to contamination. We explore the structure, dynamics and function of soils, what natural and man-made contaminants they contain and how they are regionally distributed – information that is needed for preventive protection of soil and groundwater.

Legacy from the past

In the past, substances that are harmful to the environment were often handled rather carelessly and disposed of on former industrial sites and refuse tips for example. The soil and in some cases also the groundwater are therefore polluted in many of these places. We identify contaminated sites and potentially contaminated areas and create

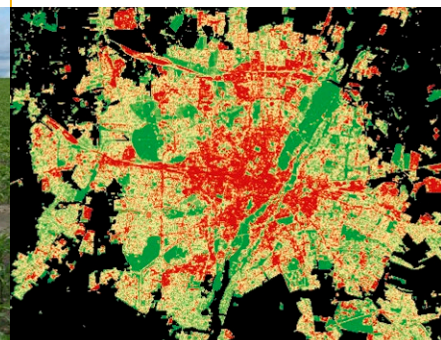
the technical parameters for examining them more closely. Contaminated sites are remediated in such a way that they can be used in new ways (land recycling).

Less soil sealing – land management

Another factor having a negative impact on soil resources is the increasing amount of land needed for urban development and transport infrastructure. Some 5% of the surface of Bavaria is sealed, while landscaped urban and traffic areas account for another 6%. These are no longer available for agricultural use and nature and only to a limited extent for the replenishment of groundwater. We draw up concepts and devise instruments to reduce land use by developing urban settlements in a sustainable manner.

OUR KEY FIELDS OF ACTIVITY

+++ soil mapping +++ soil analysis +++ contaminated site cadastre +++ rehabilitation of contaminated sites +++ environmental remediation of contaminated sites +++ contaminated military sites +++ assessment of soil pollution +++ soil protection +++ approval of experts +++ soil sample archive +++ long-term soil observation +++ land recycling +++ land management +++



Did you know ...

Soil is alive. There are, for example, millions of soil organisms living underneath one hectare (10,000 square metres) of quasi-natural meadowland. Altogether they weigh 10,000 kilograms, which is as much as 20 cows. The size of the organisms ranges from microscopically small bacteria and fungi to insects and earthworms all the way to small mammals.

Look us up

www.lfu.bayern.de: Under the link **Boden [soil]** information can be found on Bavaria's soils, soil hazard and soil protection. Under the link **Altlasten [historically contaminated sites]** you will find a land register on contaminated sites. For online maps, the direct address is www.bis.bayern.de. At www.lfu.bayern.de: **Kommunen [municipalities]** you will find information on land economization.

Three of many hazards, to which soil is exposed: contamination – erosion – sealing (Picture: metropolitan area of Munich; the ground is built on in the areas marked in yellow, orange and red)



geology in depth

There is more than rock and stone to be found under the ground. We extract water and energy from below the surface in the form of geothermal energy. Gravel, sand, clay and hard rock like limestone and granite are important raw materials. Although Bavaria's subsoil is well explored, more extensive investigations are needed before its resources can be used in an ecologically beneficial manner in the long term.

Rocks, water, energy

We are gradually exploring the geological structure of the whole of Bavaria. Which rocks can be found where? Where is groundwater and how does it move in the subsoil? Where can geothermal energy be exploited? The maps we produce to answer these questions provide essential information on natural resources, potable water supply and on subsoils. The database called Informationssystem Oberflächennahe Geothermie [information system for near-surface geothermal energy] provides information on possible options for use of near-surface geothermal energy throughout the state of Bavaria.

Falling rocks, landslides, earthquakes

Weathering and erosion have a strong impact on the earth's surface. The situation is ex-

acerbated by heavy precipitation, which now occurs more frequently as a result of climate change. The likelihood of landslides is particularly high in the Alpine region. We identify the areas that are at risk.

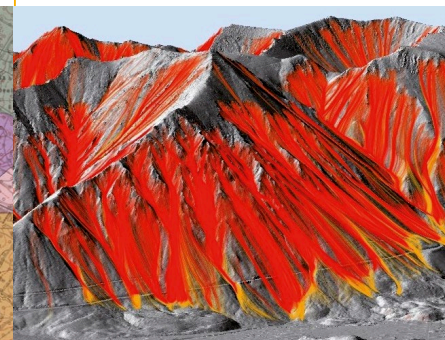
Earthquakes in Bavaria, – although quite rare – do occur and can cause damage. In collaboration with the University of Munich, we have therefore established an earthquake warning service.

Witnesses of time

Outcrops of rocks, caves and stone quarries all bear witness to the geological history of the Earth. They are called geotopes and have been recorded in our maps. The 100 most distinctive of these have been developed for tourism; information on these is available on the Internet and they are explained in brochures and can be viewed on-site on display panels.

OUR KEY FIELDS OF ACTIVITY

+++ geological maps of Bavaria +++ hydrogeology +++ geothermal energy +++ exploration of raw materials +++ rock analysis +++ geological-tectonic modelling +++ geotopes +++ georisks +++ earthquake service +++ permafrost research +++ landslides +++ drill core archive +++ rock collection +++ deposits archive +++



Did you know ...

The drill core archive of the LfU covers 750 drill cores with a total length of 70 kilometres and there are over 100,000 specimens in the geoscientific collection. These are available for investigations to explore new questions and methods.

Look us up

www.lfu.bayern.de: Under the link Geologie [Geology] you can find out more about our wide-ranging geological tasks and also about geothermal energy. Direct addresses: www.bis.bayern.de (online service with geological maps, risk maps, drillings and much more), www.geotope.bayern.de www.erdbebendienst.de www.bestellen.bayern.de

Exploration – examination – mapping – risk identification

noise

not to be overheard

More than two thirds of the population claim to suffer from the impact of traffic noise. Noise is therefore the pollutant most strongly felt by individuals. Its sources are wide-ranging: road, rail and air traffic, car parks, industrial facilities and leisure amenities. The LfU assesses exposure to noise and proposes measures to reduce its impact.



Mapping traffic noise

A Directive of the European Union stipulates that noise maps must be created for main roads, metropolitan areas, major airports and main railway routes. The LfU prepares these maps for main roads, metropolitan areas and major airports in Bavaria and publishes them on the Internet. The maps clearly show where people are particularly severely affected by noise and where measures need to be taken to reduce its impact.

Vibrations that produce noise

Vibrations can, for example, be caused by industrial facilities, construction sites or transportation routes. Humans perceive even slight tremors as significantly disturbing. We therefore analyze vibrations in and around

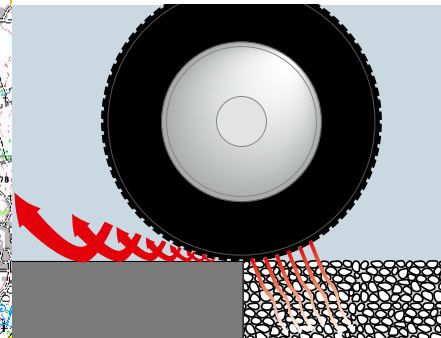
commercial facilities and transport routes and provide recommendations for reduction.

Reducing noise – at source, actively and passively

We measure the sources of noise: transport routes, industrial and leisure facilities and equipment. The data obtained help to minimize problems caused by noise. New plants can be designed in such a way that conflicts do not arise in the first place. Active and passive noise abatement (noise protection walls and windows) reduces the residual noise. The ideal place for noise abatement measures is at the source, e.g. quiet engines. We are in the process of developing and testing the efficiency of a type of asphalt that will reduce the noise produced by car tyres by 80 %.

OUR KEY FIELDS OF ACTIVITY

+++ noise measurements
+++ noise pollution cadastre
+++ EU Directive on Environmental Noise
+++ “low-noise asphalt”
+++ passive noise abatement
+++ active noise abatement
+++ jolts and shocks
+++ secondary airborne noise
+++



Did you know ...

Every day, more than 16,400 motor vehicles drive on some 3,000 kilometres of main roads in Bavaria (= one vehicle every six seconds). The noise maps have already been created for these roads. Since 2012 we have been gathering information on roads that are frequented by more than 8,200 vehicles per day including around 7,000 kilometres of road networks.

Look us up

www.lfu.bayern.de: Under the link Lärm [Noise] you will find not only basic information on noise, how noise develops and the reduction of noise, but also specific information on various sources of noise. The address www.umgebungslaerm.bayern.de will take you directly to the noise pollution cadastre. Address of particular interest to companies: www.izu.bayern.de: Lärm

Measuring sources of noise – highlighting pollution (noise map) – reducing pollution (e.g.: noise-absorbing asphalt, where tyre noise is not reflected, but “absorbed” by asphalt)

air

allowing you to take a deep breath

Industry, road traffic and households all pollute our air. High concentrations of pollutants can be harmful to people, animals, plants and materials. Nearly everyone is aware of the debate about particulate matter in our cities. The level of pollution – where it comes from and how it can be reduced – these are issues addressed by the LfU.



Measuring air quality

We monitor the air quality at over 50 stations and take measurements of fine particles, ozone and nitrogen oxides, among others. The stations are located in cities, industrial areas, on the outskirts of urban centres and in the country. Additionally, mobile measuring devices and vehicles are being utilized. The values measured by the stations are published on the Internet along with forecasts of the expected development of pollutant concentrations. If elevated ozone levels are indicated, warnings are issued in the press and on radio and TV.

Detecting sources, decreasing emissions

To proactively reduce air pollution, we must know where it comes from. We therefore plot all the major sources (industry, agriculture,

households, natural sources, traffic) in charts and maps.

As the state-of-the-art technology on emissions reduction constantly evolves, we also play an active role by conducting our own emissions measurements. Our insights are incorporated into the work of monitoring and authorization agencies.

Investigating impact

Measurements alone do not say much about the impact of substances in the environment. We therefore also examine how air pollution affects habitats (e. g. due to nutrient enrichment), how air pollutants are accumulated in organisms and whether there is any direct harm caused.

OUR KEY FIELDS OF ACTIVITY

+++ air pollutants +++ dispersion models +++ forecasts +++ air quality plans +++ German Federal Control of Pollution Act +++ PRTR +++ monitoring of industrial plants +++ Industry Emissions-Guideline (IE): Best Available Techniques +++ emission cadastre +++ incident precautions taken for industrial plants +++ bio-monitoring +++ immission ecology +++



Did you know ...

Our stations measuring air pollutants are fully automated and unmanned, except during maintenance work. Air is continuously directed through pipes from the roof to the analysis devices in the interior of the stations.

Look us up

www.lfu.bayern.de: Under the link Luft [Air] we provide you with measurement data and air pollution forecasts. You can also find information on plant safety as well as an emission registry (maps showing sources of air pollutants). The link Umweltqualität [Environmental quality] also addresses the impact of air pollutants in the environment. Address of particular interest to companies: www.izu.bayern.de: Luft

Measuring concentrations – investigation of impact on habitats and organisms



nature

it's diversity that counts

Plants, animals, landscapes - with their exciting diversity and often fascinating beauty, make our life possible and give us quality of life. But by living from nature and exploiting it, we can be putting it at risk - also in Bavaria. The LfU collects data and develops concepts for forward-looking, ecological use of nature and the countryside.

Keeping track of diversity

Bavaria is home to some 60,000 animal and plant species (including fungi). We are the central body for collecting and analysing data and for the systematic registration of valuable habitats, rare species and heritage landscapes. We use these data on species and biotopes to assess which habitats and species are endangered. In doing so, we compile and update a "Red List" for Bavaria.

What's to be done?

Many species and habitats will only continue to exist if man uses nature and landscapes in an environmentally compatible manner. Wetlands are also an important factor for climate protection since large amounts of carbon are enclosed in peat bogs. Should these be drained, this carbon would escape into the

atmosphere as the greenhouse gas carbon dioxide. We develop species and biotope conservation programmes and initiate specific aid schemes for endangered species such as the Montagu's Harrier, Mountain Apollo butterfly and Lake Constance forget-me-nots. Support programmes and projects implementing nature conservation measures are today a major pillar in the conservation of nature. By monitoring their success we can enhance these programmes on an ongoing basis.

Protecting and using go hand in hand

Landscape management develops concepts for the ecologically compatible use of land for recreation and sport and helps to bring the environment, man and industry into harmony with each other. In this respect, we are both a contact partner and a source of ideas.

OUR KEY FIELDS OF ACTIVITY

+++ protection of biodiversity +++ species and habitat mapping +++ Natura 2000 +++ species aid programmes +++ marshland protection +++ State Ornithological Station +++ game management +++ Red Lists +++ heritage landscapes and natural scenery +++ landscape planning +++ ecological use of regenerative energies +++ tourism and compatibility with nature +++ registry of ecologically valuable sites +++ neophytes and neozoa +++ water body ecology +++



Did you know ...

Out of the nearly 3,000 flowering plants indigenous to Bavaria, 54 species are not found anywhere else in the world, the so-called endemic species. Another 64 species are restricted to Bavaria and its neighbouring countries: Bavaria carries very high and in some cases sole responsibility for protecting and preserving these species.

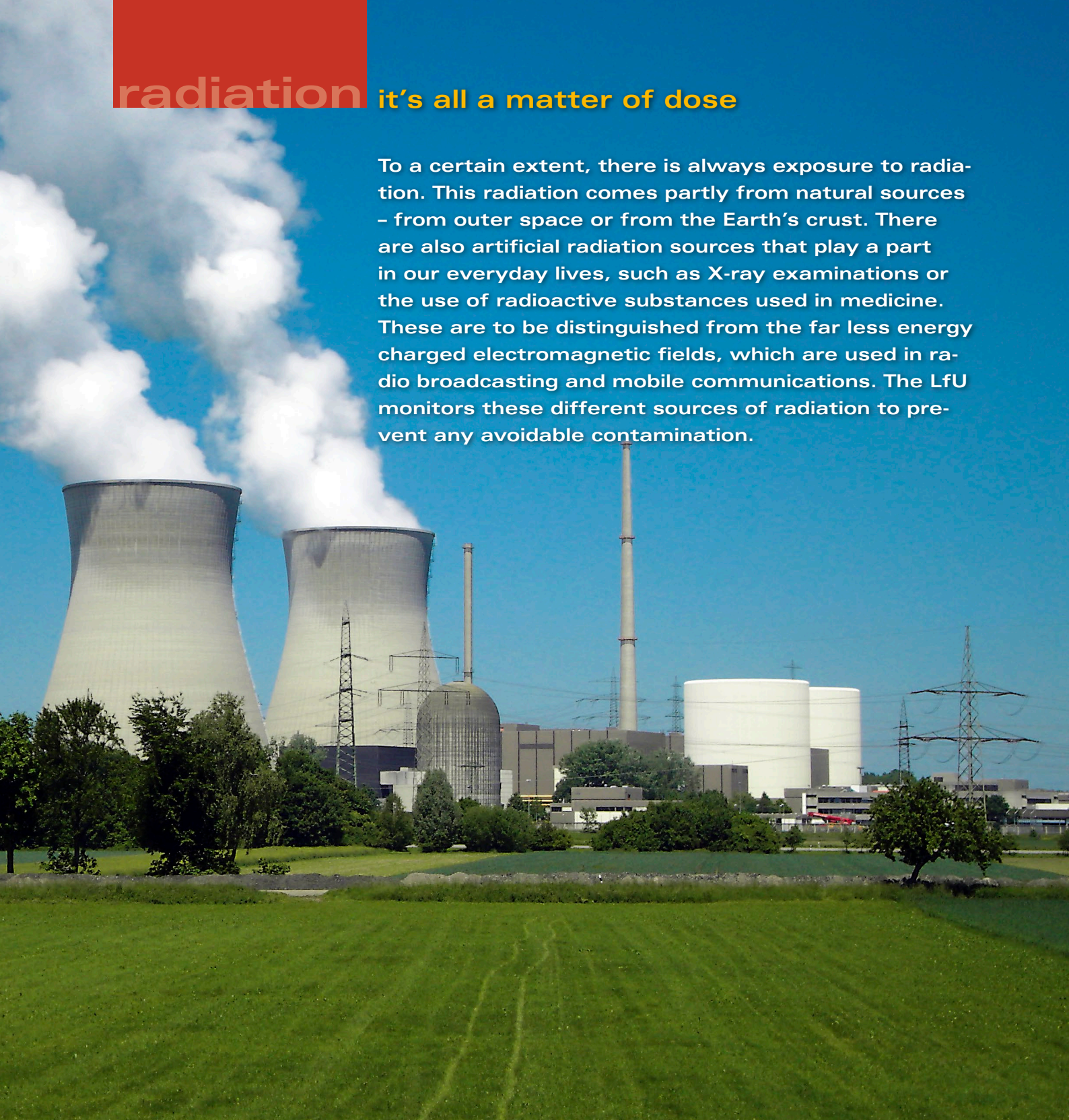
Look us up

www.lfu.bayern.de: Under the link Natur [Nature] we have collected data, facts and figures on the state of Bavaria's nature, descriptions of species, information on conservation programmes and much more. fisnat.bayern.de/finweb will take you directly to an interactive map showing all the areas and biotopes that are protected.

Man and nature: both need space to live in.

radiation it's all a matter of dose

To a certain extent, there is always exposure to radiation. This radiation comes partly from natural sources – from outer space or from the Earth's crust. There are also artificial radiation sources that play a part in our everyday lives, such as X-ray examinations or the use of radioactive substances used in medicine. These are to be distinguished from the far less energy charged electromagnetic fields, which are used in radio broadcasting and mobile communications. The LfU monitors these different sources of radiation to prevent any avoidable contamination.



Two different types of radiation

When we talk about radiation exposure we generally differentiate between two types of radiation: the radiation emitted by radioactive materials as well as X-rays and, on the other hand, electromagnetic radiation that comes from radio and TV broadcasting and mobile communications.

Where authorization and supervision are required

Radioactive substances and particle accelerators are used in the field of medical diagnostics and therapy, in research and also in industrial measuring equipment. We authorize and supervise the appropriate systems and practices. We carry out radiation measurements at workplaces where exposure to artificial or natural radiation can occur (e.g. radon in water supply facilities). At our measuring centre for radiotoxicology we monitor the intake of radioactive substances by persons handling radioactive material. To supervise nuclear power plants and the research reactor in Garching we have set up a fully automated system with an output of over 100,000 measurements per day.

Did you know ...

The average annual amount of radiation from medical applications that, statistically, everyone in Germany is exposed to is roughly the same as the radiation exposure from natural sources from outer space and the Earth's crust.



All levels normal?

To measure radiation at various sites in Bavaria, we operate a fully automated network around the clock. We also carry out measurements of the radioactivity in soil, plants, agricultural products, foodstuffs and other samples.

Radio waves & Co.

Radiation required for news broadcasting has been present in our environment ever since the invention of the radio. Mobile communication has now added a new source of radiation. We are watching this development with sophisticated monitoring systems that measure electromagnetic fields.

Look us up

www.lfu.bayern.de: Under the link **Strahlung [Radiation]** you will find information on radiation protection, on natural and artificial radioactivity, mobile communication and the recordings of our monitoring systems.

OUR KEY FIELDS OF ACTIVITY

nuclear regulatory authority
+++ radiation protection ordinance
+++ radiotoxicology
+++ nuclear plant and research reactor supervision
+++ radiation protection in medical and non-medical fields
+++ radon measurements
+++ electromagnetic fields
+++ mobile communications
+++



ground-
water fresh and pure

Nothing is more essential to life than drinking water. In Bavaria 86 percent of drinking water comes from groundwater - for the most part the quality of groundwater is so good that it can be fed into the supply grid without requiring any preliminary treatment. The LfU issues principles and concepts for groundwater protection.

Naturally good

The quality of the groundwater depends on the surrounding and overlying strata. It are the dissolved minerals that make water such a precious good. To make sure you always have a reliable supply we support water suppliers in organizational, scientific and technical issues.

Dissolved und percolated

The soil works like a filter. It binds pollutants – but not in unlimited quantities. Percolating water may therefore transport hazardous substances into the groundwater, such as nitrate, pesticides or substances from contaminated soil. Depending on the type of subsoil, pollutants may also naturally occur in groundwater in dissolved form, such as uranium. Because groundwater flows beneath the surface, the contamination may occur far away from the actual pollution source.

We draw up inspection programmes, which make sure that only water that is safe and harmless to health, is fed into the water supply systems. We develop parameters for groundwater-friendly land use, for drinking-water protection areas and disposal of contaminated soil.

Did you know ...

Bavaria requires on average around 2 billion litres of drinking water per day. This is supplied by 2,260 water companies. Some 3,200 water protection areas contribute to the fact that the water coming from approximately 8,400 operated wells and springs meant for the public water supply is not contaminated.



Making sure it doesn't run dry

To ensure that groundwater resources do not run dry it is essential that the amount extracted does not exceed the gross precipitation input. We therefore assess groundwater extraction and also construction projects, drilling projects and the extraction of raw materials, as these can have a detrimental effect on the protective layer or actually expose groundwater. We develop special models for this purpose.

Look us up

www.lfu.bayern.de: Under the link **Wasser [Water]** you will also find information about groundwater, the hazards it is exposed to and its protection, data relating to groundwater levels and quality, regulations on the handling of substances hazardous to water and lists of experts.

OUR KEY FIELDS OF ACTIVITY

+++ groundwater quality and protection +++ groundwater reconnaissance +++ transfer of substances in percolation water +++ mathematical groundwater models +++ water and emergency water supply +++ EC Water Framework Directive +++ approval of experts +++



Groundwater is concealed and protected – as long as the protective layer is not removed or overused by man (top picture: gravel quarrying in a water-bearing stratum and application of pesticides).

Picture on the left: Underground gallery to the south of Munich (upper Mangfall valley) to extract groundwater for drinking purposes. Groundwater flows in from the side.



surface
water in motion

Rivers and lakes serve as a habitat, as a food and energy source and as a transport route. They also absorb our treated sewage. All these forms of use harbour hazards for water bodies. Floods can also endanger the population. The LfU coordinates the surveillance of water quality and water levels as well as the protection of water bodies.

“Good status”

All rivers and lakes are meant to be in a “good environmental and chemical condition.” Meaning they should only vary minimally from their natural status as defined by the European Union in the Water Framework Directive. To accomplish this task we evaluate the current state of water bodies based on the analysis of water organisms such as fish and plants as well as the impact of pollutants. Together with industry and associations and municipalities we develop strategies and measures to maintain and preserve a good ecological status and sustainable utilization.

Discharged into rivers – once it’s clean

We draw up concepts for sewage disposal, steer the supervision of sewage treatment plants and initiate ideas on storm water man-

agement and rehabilitation of sewers. We make sure that industrial and commercial enterprises implement environment protection measures and treat sewage efficiently. It is our task to define different sources of pollution and make proposals for remedial action.

Risk of flooding?

We coordinate investigations to determine which areas along rivers are exposed to flooding and need to be left undeveloped. For already existing built-up areas we develop protection concepts: urban river landscapes are designed close-to-nature so that they can hold back flood water e. g. by means of alluvial plains. Where capacities are likely to reach their limits, dykes are built or safeguards are erected when flooding is imminent. Dams can also help to control flooding. If there is a risk of flooding, our flood information service sends out a warning.

OUR KEY FIELDS OF ACTIVITY

+++ EC Water Framework Directive +++ EC Flood Risk Management Directive +++
+++ flood water protection +++ river control +++ mountain torrents +++ near-natural water development +++
low water +++ ecological and chemical status of water bodies +++ water body maintenance +++
technical water supervision +++ urban sewerage +++ sewage reports +++
sewage treatment communal and industrial +++ sewage treatment plant surveillance +++
pipelines +++ waterbody neighborhoods – cooperations between government agencies, teachers and municipalities +++



Did you know ...

Bavaria has some 100,000 km of rivers and streams. The overall length of the public sewer system exceeds 90,000 km. For the treatment of sewage and wastewater there are roughly 2,150 industrial/commercial facilities, round 2,700 municipal plants and about 100,000 private small-scale wastewater treatment plants.

Look us up

www.lfu.bayern.de: Under the link Wasser [Water] you will find information on river and lake water quality, on water body protection measures and on sewage treatment. For maps of areas exposed to flooding the address is: www.iug.bayern.de and the address of our flood information service is www.hnd.bayern.de. An Internet address of particular interest to companies is www.izu.bayern.de: Wasser

Water control structures, sewage, impact from the surrounding environment and flood water: water bodies must be protected from man and vice versa.

climate & energy in transition

Climate protection and the energy transition are currently the center of attention in the public eye. Both have the agenda to expand renewable energies. Additionally, in climate change issues we are currently dealing with adaptation to unavoidable consequences. The energy transition will only succeed when excessive energy consumption is avoided and efficient technologies are introduced. Climate protection and energy transition are cross-sectoral tasks. Nearly all departments of the LfU therefore devote some of their work on addressing climate and energy issues.

Taking action

What type of climate and which consequences are we to expect in the future? How will we be able to react? – These are questions, which we work on in conjunction with research facilities. Long-term measurement series, climate and water balance models show that precipitation is estimated to be distributed differently in Bavaria. In the summertime, for example, we will have more regional droughts and more heavy rainfall and flooding at the same time. For climate protection reasons we should not be releasing as many greenhouse gas emissions as we currently do. Possible approaches for which we develop the bases are, for example, the energy transition, the protection and the re-waterlogging of dry wetlands or reducing the methane emissions in waste and sewage treatment. Preventative measures include, for example, improved flood protection and our real-time information services for floods and droughts or

geo-hazards. These services supply important planning data for land and water usage.

Environmentally sound?

The energy transition can only be managed with the joint cooperation among state institutions, private enterprises and citizens alike. We support them in the process and ensure that the various protection goals are incorporated into the further expansion of renewable energies: This concerns groundwater protection when using geothermal energy for example, or considering air quality when wood is fired, nature conservation when planting biomass crops, protecting landscapes and dealing with noise mitigation from wind power plants and taking into account aquatic ecology in terms of hydro power. In this regard, we develop professional principals, guidelines, supply data and initiate pilot projects. Tips on how everyone can make a contribution can be found in the Bavarian energy atlas.

OUR KEY FIELDS OF ACTIVITY

+++ Environmental indicators +++ environmental reporting +++ sustainable development +++ climate change +++ consequences of climate change +++ climate adaptation +++ Eco-energy Institute of Bavaria +++ Bavarian energy-atlas +++ energy triple-jump +++ saving energy +++ energy efficiency +++ sustainable expansion of renewable energies +++ land conservation +++ data site +++ targeted proposals for businesses, municipalities, citizens +++



Did you know ...

A global increase in temperature by 2 °C is regarded as only just controllable. To limit the increase to this level, the Intergovernmental Panel on Climate Change is calling for annual greenhouse emissions to be globally reduced by at least 50 % by 2050 with reference to the year 2000.

Look us up

www.lfu.bayern.de: Under the link **Klima und Energie [climate and energy]** you will find amongst others, a CO₂ emissions calculator. Especially for communities: see the link **Kommunen**, for businesses: www.izu.bayern.de. Information on energy conservation, energy efficiency and renewable energies can be found on the Bavarian energy atlas website at: www.energieatlas.bayern.de

The energy triple-jump is a LfU strategy which is geared towards energy transition and climate protection (reduction of carbon dioxide emissions) in 3 steps: reducing energy consumption, improving energy efficiency and increasing renewable energy (left picture). The expansion of renewable energy options should not take place at the expense of other protection goals (center picture). Moors serve as carbon sinks (right picture).

Organisation Chart

	Department 1 Multidisciplinary Tasks	Department 2 Air, Noise, Plant Safety	Department 3 Closed Substance Cycles	Department 4 Radiation Protection	Department 5 Nature Conserva- tion, Landscape Management and Ecology of Waters
Presidium President, Vice-President	Unit 11 (Authorized) Experts, Technical Information Water, Environmental Law	Unit 21 Air Quality Control in Plants	Unit 31 Strategies and Systems of Closed Substance Cycles	Unit 41 Radiation Protection in Industry, Transpor- tation and at Natural Radioactivity	Unit 51 Basics of Nature Conservation
President's Staff	Unit 12 Communication, International Cooperation	Unit 22 Principle of Emission Protection and Plant Safety	Unit 32 Information Service Closed Substance Cycles	Unit 42 Monitoring of Radio- activity and Emergency Planning	Unit 52 Natura 2000, Land- scape Development, Protection Areas
Special Unit ■ Eco-energy Institute of Bavaria	Unit 13 Printed Media, Cartography	Unit 23 Clean Air Planning and Traffic	Unit 33 Supervision of Waste Streams	Unit 43 Radiation Protection in Nuclear Facilities in Southern Bavaria	Unit 53 Landscape Manage- ment, Wildlife Management
	Unit 14 Libraries, Web Services, Data Management	Unit 24 Air Quality Monitoring	Unit 34 Thermal Waste Treatment Facilities	Unit 44 Radiation Protection in Northern Bavaria	Unit 54 Fish and Freshwater Ecology
	Unit 15 Sustainability, Indica- tors and Intermedia Environmental Protection	Unit 25 Emission Measure- ments and Quality Assurance	Unit 35 Waste Recovery Facilities, Centre for Basic Materials Efficiency	Unit 45 Radiation Protection in Medical and Research	Unit 55 Protection of Species and Habitats, Ornitho- logical Station
	Unit 16 Intermedia Environmen- tal Monitoring	Unit 26 Noise Protection in Fa- cilities and in Planning, Noise Measurements and Vibrations	Unit 36 Landfills	Unit 46 Radiation Laboratory Northern Bavaria and Radiotoxicological Monitoring	
		Unit 27 Noise Protection in Traffic, Electromagnetic Fields	Unit 37 Waste Management, executive Northern Bavaria	Unit 47 Radiation Protection Laboratory Southern Bavaria	

Department 6
Hydro Engineering,
Flood Protection,
Water Protection

Unit 61
Flood Protection
and Alpine
Natural Hazards

Unit 62
Dams and Reservoirs,
Hydraulic Structures,
Hydro Engineering
Technology

Unit 63
Basics of River
Engineering,
Hydro-Morphology,
Hydraulic

Unit 64
Water Body Develop-
ment Concepts and
Floodplains

Unit 65
Protection and Man-
agement of Surface
Waters

Unit 67
Water Protection in
Municipal and Domes-
tic Wastewater
Disposal

Unit 68
Water Protection in
Industrial Facilities

Unit 69
Flood Risk Management

Department 7
Analytical
Laboratories,
Evaluation of
Chemicals

Unit 71
Laboratory Planning,
Analysis of Basic
Inorganic Compounds

Unit 72
Analysis of Heavy
Metals

Unit 73
Aquatic Toxicology,
Pathology

Unit 74
Analysis of Organic
Compounds

Unit 75
Specific Analysis
for Environmental
Monitoring

Unit 76
Evaluation of Substanc-
es and Chemicals

Unit 77
Bioassays, Microbial
Ecology

Department 8
Hydrological
Services

Unit 81
Climate Change and
Water Balance

Unit 82
Implementation of the
EU-Water Framework
Directive

Unit 83
Ecology of Rivers

Unit 84
Ecology of Lakes

Unit 85
Quantitative Hydrology
of Rivers and Lakes,
Flood Forecast River
Main

Unit 86
Flood Information
Centre, Flood Forecast
Rivers Danube and Inn,
Catchment Hydrology

Unit 87
Avalanche Warning
Centre, Avalanche
Protection

Department 9
Groundwater
Protection, Water
Supply, Contamina-
ted Sites

Unit 91
Groundwater Quality,
Technology Transfer
Water – TTW

Unit 92
Groundwater
Monitoring

Unit 93
Groundwater
Protection

Unit 94
Groundwater Manage-
ment, Drinking Water
Protection

Unit 95
Water Supply Plants,
Coordination,
Strategies

Unit 96
Contaminated Sites,
Harmful Soil Changes

Department 10
Geological Survey

Unit 101
Geoinformation,
Geodata
Management

Unit 102
Geological Mapping,
Geohazard Assess-
ment

Unit 103
Soil Mapping

Unit 104
Deep Geology,
Subsurface Potential

Unit 105
Economic Geology

Unit 106
Analysis of Soils and
Rocks

Unit 107
Soil Quality Monitoring
and Soil Protection

Department Z
Central Services

Unit Z1
Internal Operations,
Property Management

Unit Z2
Budget

Unit Z3
Human Resources and
Travel Services

Unit Z4
Spatial Data Infra-
structures and Inter-
disciplinary ICT
Applications

Unit Z5
ICT – Services and
Operation

Unit Z6
ICT Regulation,
Development of
Environmental
Information Systems

Unit Z7
ICT Applications –
Operation and Support

Unit Z8
Allocation and
Contracts, Contract
Assistance

Augsburg – Office of the President



Hof – Office of the Vice President

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