

**ACTIVITY A.T1.1.4-6**  
**ANALYSIS OF CURRENT SITUATION OF BROWNFIELD**  
**IN FUNCTIONAL URBAN AREA HALLE (SAALE) - GERMANY**

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# 1. General Description of FUA Halle & mapping of brown-fields

## 1.1 Description of Functional Urban Area Halle

### 1.1.1 Location, Geographie and Structure

The Functional Urban Area integrates the city of Halle (Saale) and the rural district Saalekreis. The region is located in the center of the central German economic region, with an area of about 1.569 km<sup>2</sup> and almost 420.000 inhabitants. The Free State of Thuringia borders on the south of the FUA Halle and a close connection to Leipzig exists westward.

The urban center of the FUA Halle is the city Halle (Saale), as the biggest city of Saxony-Anhalt and with its traditional Martin-Luther-University and as a place with a manifold of research facilities. The Saalekreis is known as an industrial core of the region, which is characterized by the great chemical sites in Leuna and Schkopau. Large companies like Dow Chemical and Total have been sitting since the end of the German Democratic Republic.



Figure 1: Functional Urban Area Halle

Source: [www.saalekreis.de](http://www.saalekreis.de)

The region of Halle unites factors of an urban center with traditional and modernized industrial regions, industrial landscapes as well as rural areas with a focus on agricultural production and tourism.

### **1.1.2 General Description of socio-economic indicators**

Table 1 compares the FUA Halle and the average values of specific socio-economic factors of the region.

About one third (11.3 Billion Euro) of the economic performance of Saxony-Anhalt is produced in the region of Halle, but less than one fifth of Saxony-Anhalt's population is living in this area. The data of the GDP per capita allows a comparison with the averages on the federal and regional level.

Indicator	HAL	SK	Sum FUA Halle
<b>Statistical Indicators</b>			
Total area (in km <sup>2</sup> ) (2014)	135,01	1433,66	1.568,67
Total population (2014)	231.565	187.690	419.255,00
<b>Society</b>			
Unemployment rate for all civilian workers [%] (2014)	11,9	9,5	10,70
Population density (inhabitants per km <sup>2</sup> ) (2013)	1715	131	267,27
Percentage of school leavers in the same age as the population without secondary school leaving certificate [%] (2013)	11,3	8,4	9,85
Share of graduates with a general university entrance qualification in the same age population [%] (2013)	36	19	27,50
<b>Economy</b>			
Gross domestic product (GDP) total (in Mill. Euro) (2012)	5.877	5.432	11.309,00
GDP per employee [€] (2012)	47.304	65.533	54.606,47
GDP per capita [€] (2012)	25.379	28.941	26.974,03
Industrial density (Employees subject to social security contributions in the mining and manufacturing industries per 1,000 inhabitants (2014)	19,1	79,6	98,7
Export quota [%] (2014)	38,4	21,5	
Industrial density (number of establishments per 10,000 inhabitants) (2012)	355	392	
Industrial investment per employee [€] (2011)	6.288	11.452	
<b>Finance</b>			
Tax revenue per inhabitant [€] (2014)	534,71	901,92	1.436,63

Table 1: socio-economic indicators FUA Halle

Source: "Strukturkompass" Statistical bureau Saxony-Anhalt, designed by isw

As seen in the table, the data for Halle and Saalekreis is above the regional average (24.367 €/inh), but below the federal average (34.047 €/inh).

The high levels of GDP/capita and the industry density for the Saalekreis show the strong industrial activities with high added value in this part of the FUA Halle. Also the indicator tax income shows the economic strengths of the Saalekreis compared to the City of Halle. The City of Halle has experienced a strong decline of processing industry in the past 25 years. Since then it has profiled itself as university and service industry location.

The unemployment rate of the Saalekreis is with 9,5% one of the lowest rates in Saxony-Anhalt. Halle has a higher rate with 11,9% compared to. The average unemployment rate of 10,7% in the functional urban area still remains fairly beneath the federal average. It needs to be noticed, that the unemployment is decreasing constantly over the past years, but still remains higher than the federal average unemployment rate.

### 1.1.3 Regional Transport Infrastructure

The good assets of the transport infrastructure within the FUA Halle is an essential factor for economic development in the southern regions of Saxony-Anhalt. Figure 2 illustrates the close connection of the highways and railroad networks as well as the regions close range to Germany's second largest freight hub, the airport Leipzig/Halle.

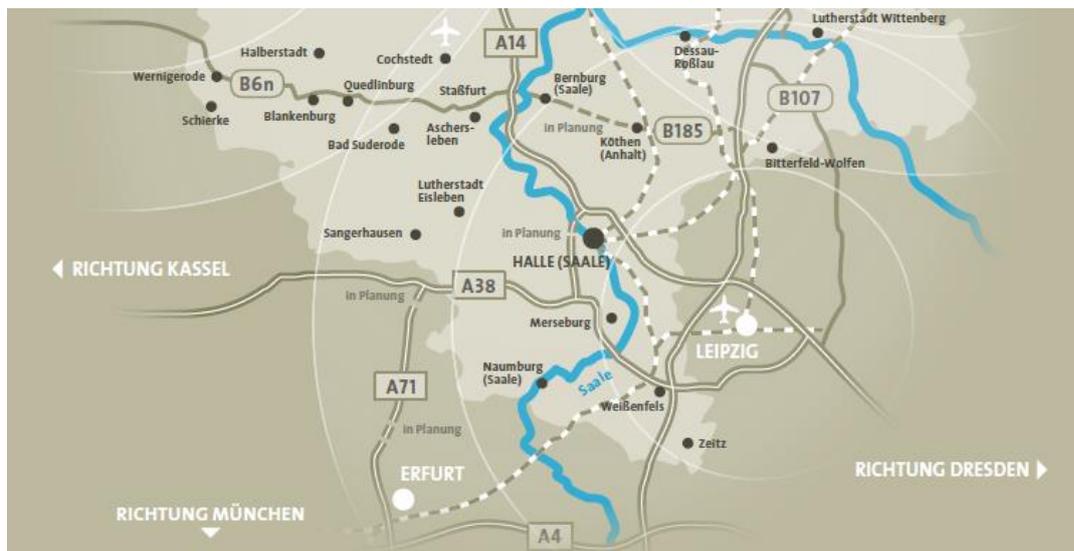


Figure 2: Transport infrastructure in the southern Saxony-Anhalt

Source: IMG Sachsen-Anhalt (2015) Logistik in Sachsen-Anhalt

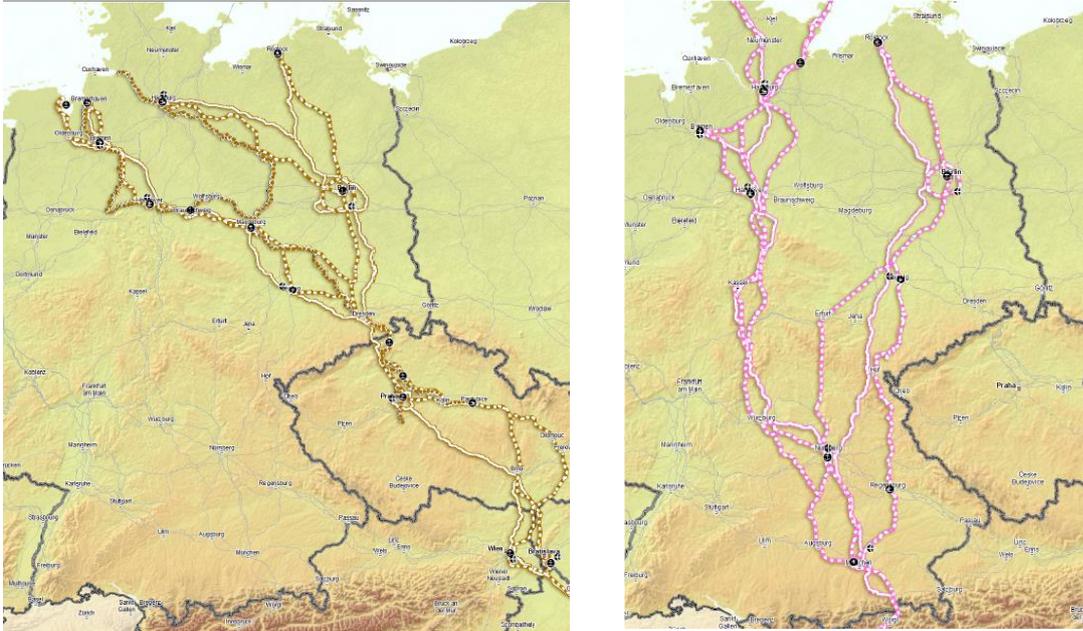


Figure 3: Important TEN-Corridors of the region Halle left site: Orient-East-Med Corridor, right site: Scandinavian Mediterranean Corridor

Source: European Commission (2015), *Transeuropean Transport Network: TEN-T Corridors*

Important transport corridors from west to east and north to south are crossing the Functional Urban Area Halle, as seen in figure 3. Especially two of the TEN-T corridors determined by the European Union are essential. The Corridor “Orient- eastern Mediterranean Sea” is leading from the North Sea via Halle/Leipzig to South Europe and the corridor “Scandinavia-Mediterranean Sea” leads from Sweden via Germany until the South of Italy.

### 1.1.4 Regional Economic Structure

#### Historical Background

The region Halle has been an important economic driver since the industrial revolution. The region benefited from its central position in the German Reich and its brown coal deposits. For this reason, many of the first companies and organization of an early chemical industry were established in the region of Halle. The city Halle were constantly established as a preferential location for the chemical industry since World War I. The chemical plant Leuna (“IG Farben” until 1945) were founded during the World War I. In 1936 the chemical plant Buna were built in Schkopau and their synthetic rubber production was important for the arms industry. Because of the combination of an established chemical industry with mechanical engineering industry and food production, Halle was the center of an advancing economic area, that was closing the economic performance gap between leading German industrial regions.

The corner stone for a comprehensive dismantling of the transport infrastructure has been made in an early stage, which was essential for advancing industrial developments. One of the first railway section were launched in 1840.

It was the section Magdeburg-Halle-Leipzig. For this reason, Halle became a hub for the central German railway network and its fundamental structures.

The industrial sites of the big places where the chemical industry was an important factor, were continuously developed in the GDR. After the end of the Cold War and the German Reunion, Leuna and Schkopau were two of the few sites that were transformed into the market economy successfully. Foreign investments by Dow and Total and great amounts on funds maintained the sites as highly modern and productive industrial sites that are internationally competitive.

Companies in the food production too could manage the transition towards a free market economy successfully on the base of traditional brands and were able to follow a national and international way for economic growth. The Kathi Company and Halloren Company are two examples for this development.

## **1.2 Challenges of Brownfield Remediation in Eastern Germany after Unification**

After the peaceful revolution in Germany in 1989 and until today, the reunification and harmonization of two former sovereign political entities has posed a variety of societal challenges. Among these, East Germany's brownfields were considered a long-term and highly complex issue with major societal impact. Heavily contaminated sites formed a considerable part of the ecological and economic burdens which the GDR had left behind. Economically significant regions, such as the so-called chemical triangle Leuna-Buna-Bitterfeld in the middle of reunified Germany, were strongly associated with environmental hazards of unforeseeable consequences. The GDR government and industry had been known for their disregard for the environment. Hazardous substances had been handled inappropriately and with levity. Waste had been disposed without care and necessary investment in environmental protection had been neglected. The goal to fulfil the economic plan had promoted the disregard for environmental concerns and the lack of effective environmental policy and regulations. All industrial areas in East Germany contained sites with severe soil and water contamination. As a consequence many sites were put out of operation in the years 1989 and 1990 and brownfield remediation remained one of the major tasks of East German's economic and environmental catch-up.

Brownfield remediation usually generates enormous cost. With regards to the liability, the new German Länder<sup>1</sup> were confronted with a problem:

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<sup>1</sup> English: new federal states

The state-owned businesses of the GDR had ceased to exist and could not be made liable anymore for environmental hazards. Potential purchasers were confronted with these hazards and, where required, with the costs of remediation and prevention because in Germany land owners are liable for residual pollution risks on their estate even if they are not the hazard causer. Therefore, these sites were not attractive for investors. That constituted a major hindrance to privatization.

In 1990, in order to support economic and ecological development the so-called clause on the exemption from liability for residual pollution for investors (short: residual pollution exemption for investors, RPEI) was enacted as part of the Environmental Frame Act (short: EFA, German: Umweltrahmengesetz). Its purpose was and is to eliminate residual pollution risks resulting for landowners from §4(3) Soil Protection Act (German: Bundesbodenschutzgesetz) by means of exemption. Subsequently, the German government provided several billion Euros to cover the costs incurred by that clause.

The RPEI was intended as a framework for the re-use of brownfield sites and thus to sustainable development of the new Länder. However, the actual implementation of the RPEI and the management of the remediation process within the given administrative structures turned out to be highly ineffective. Although the basic legislation and the financial funds had been provided the actual brownfield management was extremely difficult to bring about because of the following circumstances:

- (i) The RPEI was a legislative novelty and throughout Germany, there was no experience available.
- (ii) The financing was split between the National Government and the Länder which in practice resulted in an infringement of constituted Länder autonomy because their coordination turned out to be dysfunctional.
- (iii) The Länder's administrative structures and processes proved to be inadequate for RPEI implementation. The budgetary system in particular proved to be too rigid for managing brownfield projects as it involved approval of all administrative levels (local and district authorities as well as the ministry).

In summary, an effective implementation of the RPEI would require more financial flexibility and Länder autonomy in brownfield matters. In the state of Saxony-Anhalt, this was accomplished by means of two institutional changes.

1. Re-establishment of Länder autonomy: As of 2001 Saxony-Anhalt took over the sole and unlimited responsibility for all brownfield management issues on its territory by stipulating a lump sum payment by the Bund of 1,0 Bill Euros. With this, the Bund finally disposed of all responsibilities in the brownfield matter in Saxony-Anhalt.
2. Creation of a new organization: With effect from January 2000 Saxony-Anhalt created a new organizational body for the management

of its RPEI related brownfield matters, the so-called State Agency for Exemption from Contamination Liability in Saxony-Anhalt (SECL)<sup>2</sup>.

With these two changes an institutional structure for brownfield management was generated which is unique in Germany. The arrangement has since efficiently promoted investments by means of applying the RPEI.

### **Environmental Problems of the GDR**

The GDR (1949-1990) had inherited a diverse industrial infrastructure from the Third Reich which included innovative mechanical engineering, electronics, aircraft industry and major chemical industry complexes. The industry was self-sustained by its own natural resources including one of Europe's largest brown coal deposits as well as copper and other ores. The GDR economy focused on the expansion of the heavy and chemical industries which were given priority over the growth of consumer oriented light manufacturing. Throughout the 1960s and 1970s, a major concentration and centralization of the heavy and chemical industries took place which resulted in enormous state conglomerates that usually held major shares in their market. In particular, coal, petrol and gas processing industries including synthetic fibre production, and mechanical manufacturing featured the highest net production growth rates in the GDR. The respective methods of production were extremely resource intensive. In the 1980s the real capital stock was based on technologically out-dated facilities which could no longer be rehabilitated to meet international technology standards.

The carbon based chemical production processes generated high levels of dust and CO<sub>2</sub>-emissions. More than half of the pollutant discharge, such as chlorinated hydrocarbons, mercury, tensides, cyanides, and heavy metals, was released into water bodies without treatment. Of all water supplies, 47% were unsuitable for drinking. The intensive use of agro-chemicals led to pesticide and fertilizer input, e.g. nitrate, to ground and surface waters. By 1988 91.3 million tons of industrial solid waste were annually produced of which only 39.9% were recycled; the majority was released to the natural environment. The continuous expansion of brown coal mining generated a major reduction of arable land. Between 1971 and 1985, 45,729 hectares were abstracted for brown coal mining alone.

In the process of reunification, the acute environmental hazards did not allow for delays of environmental measures. Therefore, in the preparation of the re-unification the two German Ministers for Environment established a conjoint environmental commission as early as in February 1990.

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<sup>2</sup> German: Landesanstalt für Altlastenfreistellung (LAF)

Among other things, the commission was responsible for the production of strategic remediation and development plans.

Major progress was made with the Environmental Frame Act (EFA) in June 1990, including fundamental regulations for brownfield management in East Germany.

### **Residual Pollution Exemption for Investors (RPEI)**

For the purpose of overcoming the obstacles to privatization and investment as soon as possible the RPEI as part of the EFA was passed on June 29, 1990. The RPEI allows for the exemption from those contamination risks for investors which were generated before July 1, 1990 (Article 1, §4, section 3, EFA20). This implies that the Bundesrepublik and the Länder, not the private investor, bear the cost of complying with the laws for soil and ground water protection for any risk on sites contaminated before July 1990. The exemption clause applies only to private investors who are not responsible for these hazards and only in cases of economic investment which includes the privatization of business and the creation of employment. Aside from the goal of environmental protection and preservation, its purpose is to eliminate hindrances to investment and to promote economic development.

As supplement to EFA provisions, 21 so called Major Ecological Projects (MEP)<sup>3</sup> were defined. These are industrial mega-sites on the territory of the former GDR. They feature:

- A high potential for ecological hazards (indicated by major industrial activity in the past with high potential for heavily contaminated sites)
- A large volume of estimated total decontamination cost (min. 100 million DM ~ 50 million Euros), and
- A major impact on the region's economic development.

The exemption clause, however, did not automatically secure the financing of decontaminations. In addition, the new Länder were already overstrained by their limited budgets. Therefore, a General Administrative Agreement between the Bundesrepublik and the Länder to finance remediation measures was stipulated in 1992. Among others, the agreement stipulated cost shares for exemption related remediation projects. For non-MEP projects, they were 60% for the Bundesrepublik and 40% for the Länder whereas for MEPs they were 75% for the Bundesrepublik and 25% for the Länder. The financial commitment of the Bundesrepublik was managed by the Treuhand Agency.

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<sup>3</sup> German: Ökologische Großprojekte (ÖGP)

## **The Treuhand Agency and the FAUST**

On March 1, 1990 the Council of Ministers of the GDR established the “Institution for the fiduciary administration of public property” (German: Anstalt zur treuhänderischen Verwaltung des Volkseigentums, short: Treuhand Agency). The Treuhand Agency was to preserve the public property and to administer it according to the interest of the general public. Stipulated in the Treuhand Act its main tasks were:

- 1) The privatization of public property in line with the principles of the social market economy.
- 2) The facilitation of the structural economic adaptation according to market requirements and in particular the restructuring of businesses.
- 3) The retirement and liquidation of those businesses which were not possible to restructure.

Hence, its task was to demerge the state conglomerates and to transform their successor companies into incorporated capital businesses, i.e. the restructuring and selling of roughly 8,500 firms with initially more than 4 million employees. The Treuhand Agency also became mainly responsible for administrating the federal funds related to the exemption clause. As of January 1, 1995 the Treuhand functions were reorganized and the agency’s duties were taken over by three organizations. The Federal Agency for Unification-derived Special Tasks<sup>4</sup> (hereinafter referred to as FAUST) succeeded the Treuhand among other tasks in the responsibility for administrating the exemption related federal funds. Though the FAUST still exists today most of its operative functions were delegated as of December 31, 2000 to a liquidator.

According to the FAUST, a total of 2.565 billion Euros were spent by the Treuhand/FAUST until the end of 2009 for brownfield remediation in eastern Germany. For the period from 2010 to 2014 another 132 million Euros were available.

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<sup>4</sup> German: Bundesanstalt für vereinigungsbedingte Sonderaufgaben (BvS)

## The Brownfield Situation in Saxony-Anhalt

In Saxony-Anhalt, the initial brownfield situation was mainly a result of four major industrial activities before 1990:

1. Large-scale mineral mining, surface and deep (brown coal, copper shale or potassium salt) with profound intrusion into the hydraulic systems of the region.
2. Concentration of finishing industry based on these natural resources, in particular energy production, brown coal refining, metallurgical industry, potash industry, and chemical industry, in connection with old waste and industrial deposits, frequently in hollow moulds.
3. Formation of industrial agglomerates such as Bitterfeld/Wolfen, Halle/Merseburg (including Leuna), Mansfelder Land, and Zeitz/Weißenfels.
4. Industrial agriculture and factory farming.

Industrial brownfield sites cover roughly 50% of all brownfield sites in Saxony-Anhalt and include among others chemical, metallurgical, petrol, plastics, food, mining, timber, paper, machine, and electronic industry sites. The inhomogeneous group of trade, services and utility services represent approximately 40% of all brownfield sites. The rest, roughly 10%, are agro-industry sites.

The definition of “brownfield” (German: Altlast) in the German legal context is based on the notion of “harmful change to soil” (§2 Abs. 6, German Soil Protection Act, German: Bundesbodenschutzgesetz). The definition includes former landfills (German: Altablagerungen) as well as abandoned sites (facilities, plants, etc.) where hazardous substances were handled, the latter ranging from industrial mega-sites to gas stations.

Currently 14,728 sites in Saxony-Anhalt are suspected of harmful change to soil. Apart from these cases, there are 5,046 cases of formerly suspected brownfields with a completed hazard assessment. As of May 2016, 251 brownfields are under the remediation measures, 82 brownfields under monitoring and assessing.<sup>5</sup>

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<sup>5</sup> Figures according to „Kennzahlen zur Altlastenstatistik“ November 2016, Landesamt für Umweltschutz Sachsen-Anhalt, <http://www.lau.sachsen-anhalt.de/boden-wasser-abfall/bodenschutz/altlasten/>.

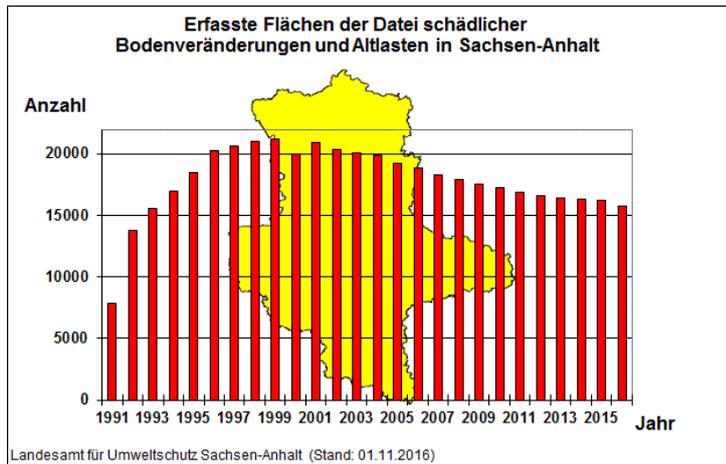


Figure 4: Registered areas of harmful soil changes and brownfields in Saxony-Anhalt 1991-2015

Source: Landesamt für Umweltschutz Sachsen-Anhalt, 2016

### Major Ecological Projects (MEP)

With seven Major Ecological Projects (MEP) Saxony-Anhalt features the highest concentration of brownfields among the new Länder. They cover an area of approximately 47.83 km<sup>2</sup>. In addition there are a number of larger non-MEP remediation projects that cover 10.79 km<sup>2</sup> as well as numerous exemption related brownfields mainly former brown coal mining sites and non-exemption related brownfields. According to the available land statistics for Saxony-Anhalt, it can be assumed that not more the 5.5% of the territory are covered with brownfields, potential brownfields or land suspected of harmful change to soil.

Of a total land of 20,446 km<sup>2</sup> the brownfields in Saxony-Anhalt extend to a maximum of 1,124 km<sup>2</sup>. That is a square of side of approximately 33.54 km and much larger than the German capital Berlin that extends to roughly 892 km<sup>2</sup>.

The contaminant situation of MEPs involves a highly differentiated variety of hazardous and harmful substances (contaminant cocktail) of dangerous contaminants which have extended vertically into the subsoil as well as horizontally over several kilometres via ground water aquifers.

The actual contaminant situation is often difficult to accurately assess because new sources may be discovered in the decontamination process. It is therefore in many cases not possible to predict the time needed to their completion. The decontamination of these sites often takes years and even decades because of their complex contaminant conditions, such as mixed and ultimately not quantifiable amounts of contaminants in the environmental matrices or because of hindered access to the hazard source due to, for instance, the coverage with construction.

In the course of the exemption for investors from liability for residual pollution, Saxony-Anhalt established seven Major Ecological Projects (MEP) - industrial brownfields and former industrial core zones containing particularly severe air, soil, and groundwater contamination:

- MEP Bitterfeld-Wolfen
- MEP Buna
- MEP Leuna
- MEP Zeitz
- MEP Mansfelder Land
- MEP Magdeburg-Rothensee
- MEP Erdgas-Erdöl Gommern

Besides the MEPs, there are many further brownfield remediation projects, requiring substantial financial resources as well. Among these large-scale projects are:

- Addinol
- MINOL petrol stations
- Paraffin plant Webau
- Schönebeck explosives facility

In Saxony-Anhalt, experts estimate the overall number of brownfields and former landfills of approximately 700.<sup>6</sup>

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<sup>6</sup> Figure according to Landesanstalt für Altlastenfreistellung Sachsen-Anhalt (LAF) / State Agency for Exemption from Contamination Liability in Saxony-Anhalt (SECL).

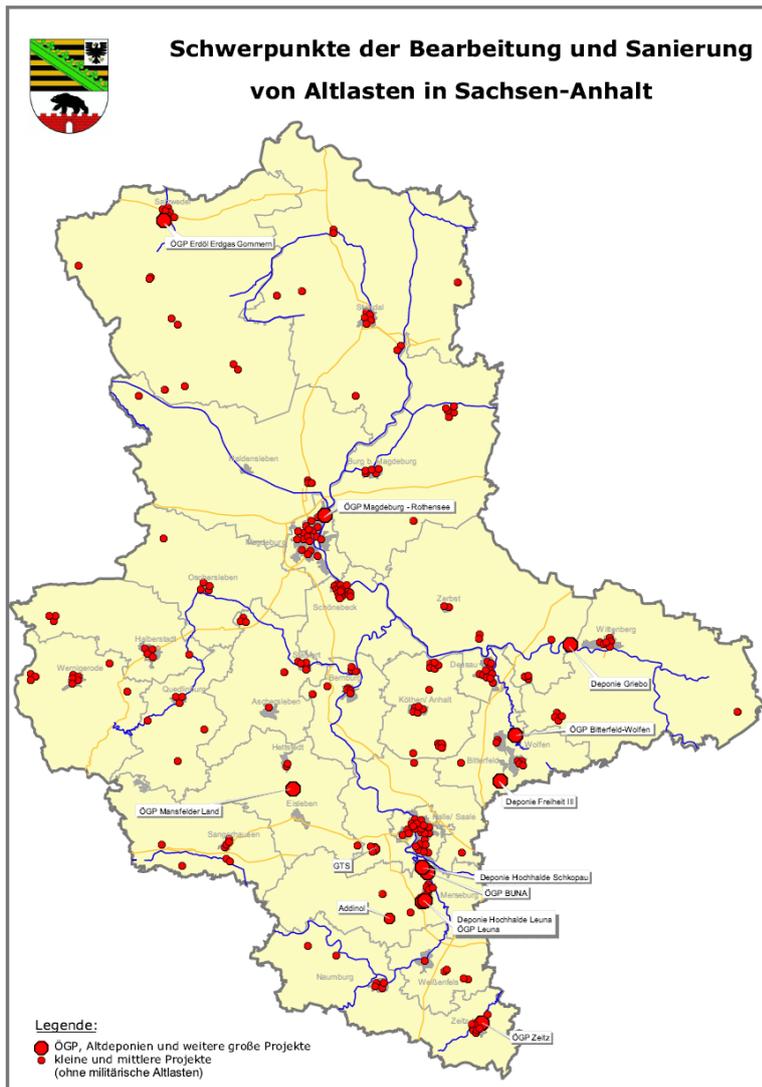


Figure 5: Main brownfield remediation areas in Saxony-Anhalt (without military contamination)  
 Source: Landesanstalt für Altlastenfreistellung Sachsen-Anhalt

### State Agency for Exemption from Contamination Liability in Saxony-Anhalt (SECL)<sup>7</sup>

The State Agency for Exemption from Contamination Liability in Saxony-Anhalt (SECL) is the principle point of contact for investors, property owners and municipalities in Saxony-Anhalt. SECL supports investors with regard to the acquisition of land by issuing the exemption from liability for residual pollution. Furthermore, SECL guides and supports the preparation and implementation of remediation measures throughout the entire project duration, even when it comes to refinancing and coordination with relevant authorities.

<sup>7</sup> German: Landesanstalt für Altlastenfreistellung (LAF)

By ensuring project completion on schedule and on budget, the efficient use of federal and Länder funds for eliminating barriers for investments at abandoned sites can be achieved.

According to experts<sup>8</sup>, current framework conditions and challenges for brown field revitalisation are:

- Existing old building fabric and related dismantling costs and additional expenditures for new buildings,
- Costs for the disposal of building fabric and excavated soil, elimination of infiltrated substances from various emission sources and contamination due to previous utilisation,
- Military / explosive contamination,
- Time (resp. delay due to revitalisation measures),
- Environmental protection matters, due to biotopes in abandoned buildings and brown field open spaces.

When considered from an economic point of view the negative factors can be balanced by

- Proceeds from land sales,
- Attractive location of the site / property (e.g. within a closed chemical site with access to traffic routes and media supply as well as site security service),
- High planning reliability (no new development plan required).

### **1.3 Overview of selected Brownfields in the Functional Urban Area Halle**

#### **1.3.1 Chemical Park Leuna**

Together with the both large chemical sites of Bitterfeld/Wolfen and Buna, the “Leunawerke” industrial complex formed the so-called “Chemical Triangle” of the former GDR. The history of this plant is the history of many revolutionary chemical inventions such as the ammonia synthesis at an industrial scale (1916), the hydrogenation from coal to fuel (since 1927), or the synthesis of caprolactam for producing nylon (1938). During the years of war, numerous production plants have been destroyed between 1943 and 1945. Especially by the effects of war but also by handling losses and disasters, massive pollutant entries mainly by fuels and by fuel additives of several thousand tons have been caused. The main areas of damage are to be found in the central, in the northern as well as the southern part of the Eastern Plant I and in the northern area of the Western Plant II. According to the highest hazardous risks, the main focus is on the area of the former *Old Refinery* in Plant I. The dismantling

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<sup>8</sup> In particular Eyk Hasselwander, Managing Director G.U.T. Gesellschaft für Umweltsanierungstechnologien mbH Merseburg, Germany.

of the old over ground plants and buildings has been done within a systematic clearance programme and is finished by now.

### Project approach

Today, there is a modern chemical park on Leuna site. Therefore, the remediation strategies are worked out and implemented in close coordination with the economic development of the site. For the “Ecological Major Project Leuna” (German: ÖGP) a remediation framework concept has been devised. Based on this there is a detailed plan of measures, costs and deadlines that serves as a “schedule” for the site restoration. Furthermore, it is continuously updated by the results of examination and renovation. At the first stage of implementing the remediation framework concept, the downstream of contaminated groundwater off the plant area has been stopped. By building a sealing wall, about 450 metres long, as a central element of hedging measures at Plant I/Central, the flood protection across the whole factory site has been completed up to the on-site preflooder “Saale” river in 2005. A steady and continuous groundwater monitoring controls these safety measures. At the same time, these safety measures are supported by the use of LNAPL skimmers at the factory site. A main approach is the development of a near-natural groundwater remediation technique for large-scale contaminated sites. The “Compartment Transfer” (CoTra) project by *The Helmholtz-Centre for Environmental Research (UFZ)* is based on the technically controlled contaminant transfer from anaerobic into aerobic conditions is performed via **constructed wetlands** and **aerobic trench systems** in order to foster natural degradation processes of the site's main contaminants; BTEX (benzene, toluene, ethylbenzene, and xylenes), MTBE (Methyl *tert*-butyl ether), and ammonium. A pilot project has been successfully tested in cooperation with *State Agency for Exemption from Contamination Liability in Saxony-Anhalt* (German: LAF), the *UFZ*, and *The Central German Asset Management Company* (German: MDVV) as sponsor.

Therefore, a full-scale eco-technology plant at the Leuna site based on the most efficient techniques has been realised. It works more efficient than the former conventional treatment plant on-site. By this comprehensive groundwater remediation combined with land clearing, further settlement projects in the area of the *Old Refinery* have been possible.

### Milestones

- 1998-2004 detailed investigation and surveying of remediation, developing the remediation framework concept
- 2003 the beginning of cooperation with *The Helmholtz-Centre for Environmental Research (UFZ)* on remediation research
- 2005 completing the chain of flood protection at the Eastern site's border by building the sealing wall at Plant I/Central

- 2006-2012 groundwater remediation in the area of the former *Old Refinery* in the course of land clearing
- 2011/2012 the successful development of a near-natural groundwater remediation technique for large-scale contaminated sites based on the transfer of contaminated groundwater from anaerobic into aerobic environments
- 2014 the realisation of a full-scale eco-technology plant (Compartment Transfer) to replace the conventional treatment plant on-site

#### Project size and costs

Since 2001, about 35 measures for groundwater - as well as soil remediation have been realised. Thereby, about 486,000 tons of contaminated soil has been disposed. About 350,000 m<sup>2</sup> of contaminated groundwater is purified per year, and thereby about 2,300 kg of contaminants have been removed. By phase-recovery, about 1,347,000 litres of chemical phases could be skimmed from the groundwater.

Within the project, measures with a volume of about 87.7 million Euro have been realised up to now.

#### Economic recovery / settlements

After 1990, larger parts and areas of the plant could be transferred into private ownership within a very short time, and numerous new businesses could be established. Today there are about 70 ha out of originally 1,300 ha of plant space left for new settlements. As there already are:

- TOTAL Deutschland GmbH
- ATOFINA Deutschland GmbH
- DOMO Caproleuna GmbH
- Linde Gas AG
- LEUNA-Harze GmbH
- STEAG AG
- MVV (TREA-Anlage)
- Kartogroup Deutschland GmbH
- Fraunhofer-Zentrum für Chemisch-Biotechnologische Prozesse CBP

With about 9,000 employees in more than 100 companies, Leuna site is one of the largest sites of the chemical industry in Germany today. *The InfraLeuna GmbH* is the owner as well as the operating company of the infrastructure facilities at the site and responsible for location development.

### 1.3.2 Dow ValuePark Schkopau

In 1936 was the start of building for the first synthetic rubber plant worldwide at Schkopau site. Under the name “Buna-Werke” the production began in 1937. The conventional process of producing synthetic rubber, in fact the polymerisation of butadiene and sodium (German: Natrium) has been the name giver. Besides Polyvinylchloride (PVC) and organic solvents have been produced. The chlorine needed for production has been gained in the chlor-alkali-electrolysis, in which mercury has been used on a large scale. After World War II the production profile has been constantly expanded. “Plastics and elastics from Schkopau” turned out to be the coining slogan for the production range in the GDR era. Therefore, further production plants for carbide, chlorine, vinyl chloride and PVC have been built. Decades of intensive industrial use, in part thereby careless handling with hazardous substances, the impacts of war and disasters have caused long-lasting and massive pollutant inputs in the floor and in the groundwater. The contaminant spectrum included hydro chloro-fluorocarbons (HCFC), aromatic hydrocarbons (BTEX) *and mercury. Especially HCFC and BTEX could spread from the unsaturated ground down to the aquifers lying beyond. The geological situation at the site is complex as contaminations can be proofed down to the new red stone layer. Partly, HCFC can be found as DNAPL at the bottom of the groundwater, which is a long-term, secondary contaminant source. In the direction of groundwater flow, about 500 m northeast of the site, there is the river Saale.*

#### Project approach

Already at the beginning of the 1990s a considerable environmental damage could be assumed. Therefore, for the future development of the site, the former Buna AG/Buna Sow Leuna Olefinverbund GmbH (BSL) got exemption from inherited liabilities. As supporting measure during the following privatisation and full reorganisation of the “Buna-Werke” by a major investor an extensive exploratory program for inherited liabilities has been implemented. By means of the exploratory results a frame concept had been developed, which has been the basis for the further containment measures, rehabilitation and monitoring of environmental damage at the site. According to hazard prevention successively soils contaminated with mercury and HCFC have been replaced. Thereby, the soil decontamination was completed. Then, a well gallery has been built to prevent the downstream of HCFC-contaminated groundwater towards the river *Saale*. Hereafter the safety measures have been improved by taking further wells into operation. At the same time an optimised groundwater downstream remediation has been started. Now there are four plants for groundwater decontamination with chlorinated hydrocarbon in operation at the site.

The measures of groundwater remediation and decontamination turned out to be effective in principle. Another task is to be seen in the involvement of local groundwater contamination in the current remediation and its constant optimisation. There are still knowledge gaps concerning the real extent of HCFC swelling potential as results from the present remediation process indicate the existence of *DNAPL pools*. *In order to help answer open questions innovative exploration strategies are required.*

#### Milestones

- 1993 exemption from inherited liabilities for the Buna AG/Buna Sow Leuna Olefinverbund GmbH (BSL) investors
- 1995 BSL transferred into private ownership of the The Dow Chemical Company
- 1995 - 1999 detailed investigation and surveying of remediation, developing the remediation framework concept
- 1999 - 2002 soil remediation
- 2002 - 2005 preliminary groundwater downstream remediation
- since 2005 optimised groundwater downstream remediation and groundwater decontamination with chlorinated hydrocarbon

#### Project size and costs

Within the project of soil remediation there have been replaced about 450,000 t of contaminated soil. Moreover, there have been about 7.2 billion m<sup>3</sup> groundwater exploited and decontaminated. Thereby about 153.2 t of HCFC and 13.9 t of BTEX have been removed so far from the ground. For the measure of exploration, security and remediation within the Ecological Major Project *Buna* 229 billion EUR have been spent up to 2015.

#### Economic recovery / settlements

In contrast to other large-scale chemical businesses of the former GDR, the “Buna-Werke” at Schkopau site has been sold almost completely to The Dow Chemical Company as a major investor. As part of the Dow Olefinverbund GmbH Schkopau site is a strong economic factor in the region today. Furthermore it is an attractive chemical site for further investors. The settlement strategy of Dow according to the concept of a *ValuePark* successfully attracted plastics processing industries and application-technical research businesses, as e.g.:

- BYK Kometra GmbH
- E.ON Kraftwerke GmbH, Kraftwerk Schkopau

- Fraunhofer-Gesellschaft: Fraunhofer-Center für Silizium-Photovoltaik/Modultechnologiezentrum Schkopau, Fraunhofer-Institut für Angewandte Polymerforschung/Pilotanlagenzentrum Schkopau
- Hoyer GmbH
- INEOS Vinyls Deutschland GmbH
- Manuli Stretch Deutschland GmbH
- mitz Merseburger Innovations- und Technologiezentrum GmbH
- Philippine GmbH & Co. Dämmstoffsysteme KG
- Styron Deutschland GmbH
- W.u.H. Fernholz GmbH & Co. KG.

## 2. Detailed assessment of Brownfield Halle Ammendorf

### 2.1 Spatial scope of brownfield site

Within the ReSites Project the project partner isw Institute and the associated partner City of Halle (Saale) have agreed to focus the work on the brownfield area in Ammendorf. This brownfield is located in the South and South Eastern part of the town. For practical reasons the following spatial scope has been defined alongside important streets and borders of land utilisation plans:

- Northern Border starting at Suburban Railway Bridge Rosengarten, Direction East alongside Kasseler Straße, Äußere Kasseler Straße/ Straße Osendorfer Damm until junction direction garden plot „Am Osendorfer Hain“
- Eastern Border alongside the walkway at the Halden Forest (Land Utilisation Plan border forest continuing until the city border), City border until Regensburger Straße/ City Exit
- Southern Border Regensburger Straße / City Exit until crossing Merseburger Straße
- Western Border Merseburger Straße between crossing Regensburger Straße until Suburban Railway Bridge Rosengarten including the area defined in the Master Plan „B-Plan Nr. 112 Industry- and Business Park Ammendorf“ as well as the area in the northern part reaching up to Industriestraße

This defined area has a surface of 407 ha. The largest North-South-Dimension amounts to 2700 m, in West-East direction approximately 1500 m due to its unregular form. The area includes a bit more than half of the city quarter Ammendorf and a quarter of the area of Radewell-Osendorf. The total area is composed of two priority areas with commercial – old-industrial background as well as bordering areas and areas located in between. These are the areas alongside the Eastern Part of the Merseburger Straße at both sides of the railway track Halle-Merseburg, where in the past the formerly very important local companies such as Waggonbau Ammendorf were located. On the other side, there are larger areas North of Regensburger Straße, where the commercial - industrial use started with the lignite mining. Today there are different after uses. Between the two industrial areas there is a larger living area called Heimstättensiedlung. Furthermore, there is the quarter Radewell/Osendorf, which was in the past an independent village characterised by mining activities. The definition of the area follows the idea to cover the spatial connections between the both commercial parts including the “interspace” with old-industrial locations and related situation. The development problems of the old mining area in the North East will not be considered.

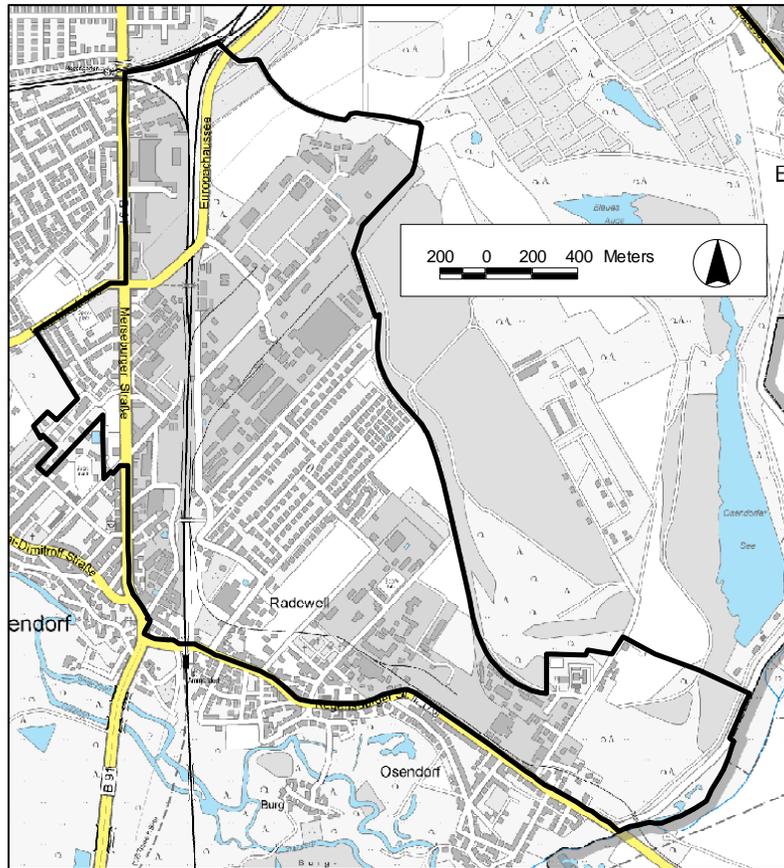


Figure 6: Definition of Brownfield Site Ammendorf  
 Source: City Halle (Saale), colours changed

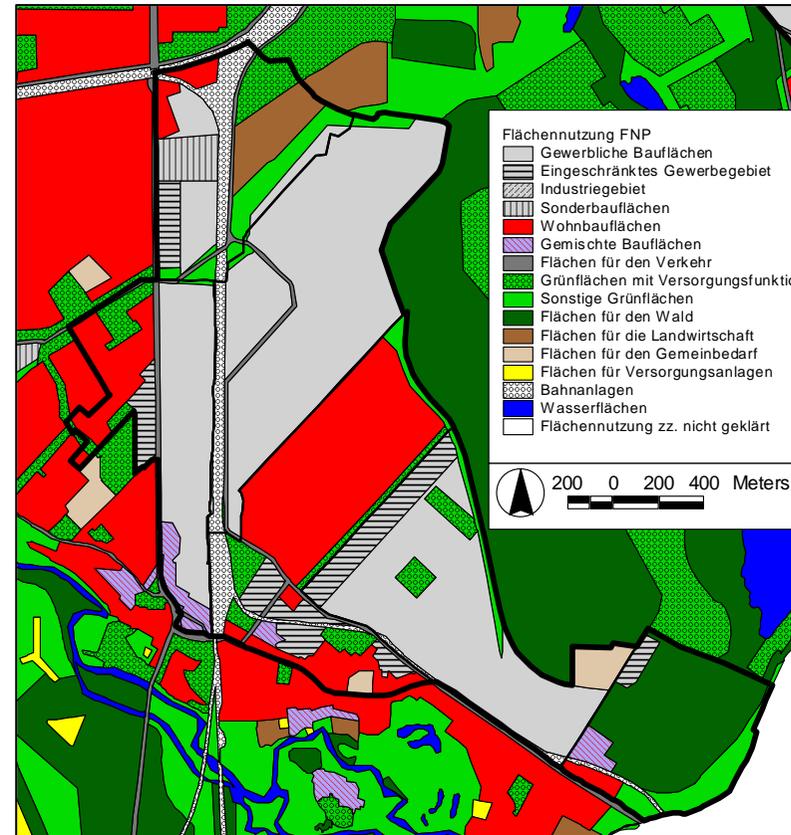


Figure 7: Area Ammendorf and bordering city area, Land Use Planning Categories  
 Source: City Halle (Saale), colours changed

Karte 3: Wirtschaft/Gewerbe - die Triebkräfte der Entwicklung von Stadt

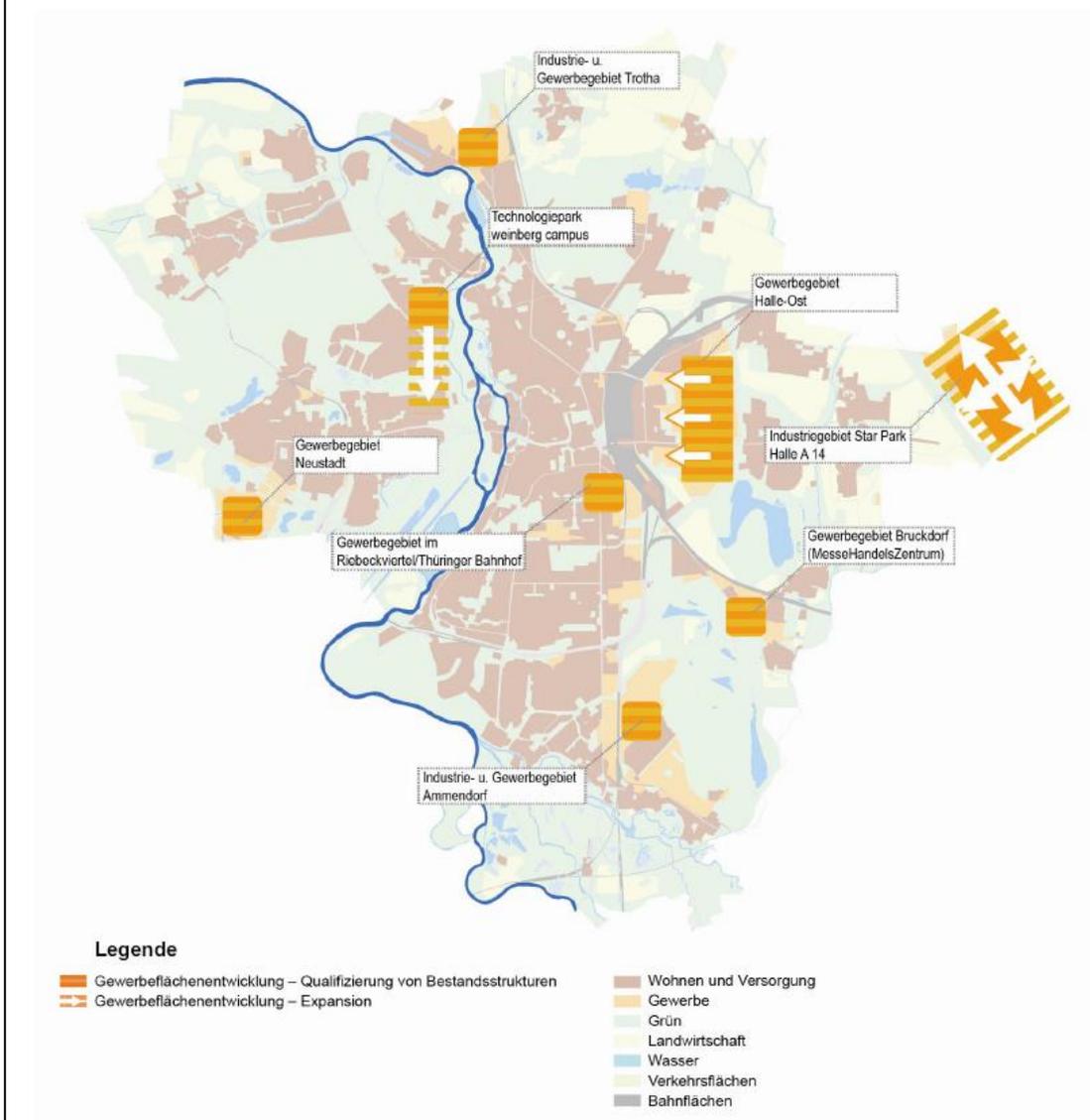


Figure 8: Locations for Economy and Industry in Spatial Concept Halle 2025 plus

Source: City Halle (Saale) 2010: 8

## **2.2 Historical Background**

Halle Ammendorf is a district in the southern part of Halle (Saale) with a long history. Ammendorf was known as an independent community, that was part of the Saalekreis und therefor of the Magdeburg monastery. Ammendorf was included in Halle as an urban district on the 1<sup>st</sup> July 1950.

The community Ammendorf as well as the urban district was an important industrial factor for the city of Halle and the region. During the 19th century the mining of lignite and the further utilisation were important sectors of the economy. The location was particularly attractive for the settlement of chemical companies and for the machine building industry. For example, the S-Lost (mustard gas) was manufactured by Orgacid GmbH. The company produced 26,000 t of the warfare agent and was considered to be one of Germany's largest poison gas factories. The best-known company, however, was the Waggonbau Ammendorf, which belonged to the Wagonfabrik Gottfried Lindner AG. Gottfried Lindner AG produced superstructures and bodies for trams, omnibuses, railway cars, trucks and passenger cars. After the end of the Second World War, the company was taken over and the plant moved into the state owned enterprises VEB Waggonbau Ammendorf. With the reunification and the transition to the free market economy, VEB Waggonbau Ammendorf was first merged into Deutsche Waggonbau AG and then sold to private investors. After the purchase of the Waggonbau Ammendorf by the Bombardier Group in 1998, the operation had to be closed in 2005. The company's real estate was bought up and the mechanical engineering and service company mbH (MSG Ammendorf) was established- It is historically the successor of the wagon building and with 200 employees a major employer of the city Halle. The Ammendorf area today has the typical characteristics of a mixed area with industrial use and housing. Due to the decline in industrial activities in the last 20 years, larger areas are not being used adequately and need strong support for further development.

## **2.3 Environmental status & critical aspects**

### **2.3.1 Air quality**

#### Regional climate

In terms of macroclimate, the area Halle is to be assigned to the transition area between the continental and maritime climate. Mainly, the annual weather pattern is affected by an active cyclonic activity that causes rather changeable weather. Therefore, precipitations occur at all seasons; a maximum can be observed in the summer months.

In terms of regional climate, the city Halle lies in the transition area of the inland climate with low precipitation of the Harz foreland to the west and the area with a bit higher precipitation of the Leipzig Basin to the east. The main wind direction is dominant from the west to south-

west. The average annual air temperature is 9.1 °C; the average annual precipitation is 498 mm. In February, precipitation is at its minimum with 27 mm. In June, the highest annual precipitation can be expected (average 61 mm).

Generally, the climatic conditions in the area of Halle can be described to be poor in precipitation, mild in winter, and warm in summer.

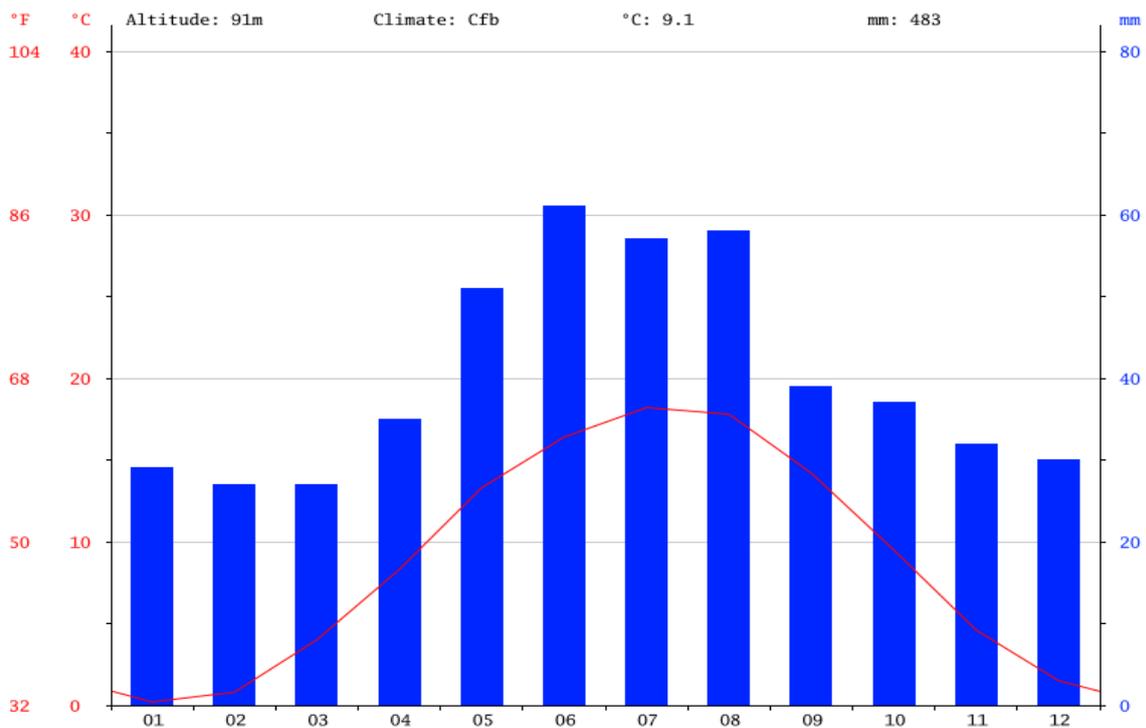


Figure: Climate diagram of the city Halle (Saale)

Source: <https://de.climate-data.org/location/6343/>, 25.01.2017

### Local climate

The local climate of the area is characterized by the high percentage of sealed surfaces at the existing industrial sites. The investigation of the urban climate (city Halle 1992) describes the industrial and commercial complex – with the company Waggonbau Ammendorf – as top priority for climatic rehabilitation measures.

The ground in this area of the city is slightly inclined eastwards, so that no cold air flows from these surfaces into the exploration area. Between Silberhöhe and Ammendorf, there is a cold-air passage in the southwest-northeast direction in the open space near Brauhaus Street / Industrie Street. This cold air flows past the exploration area and is not effective here.

All the higher is the significance of the groves for the microclimate of the exploration area. They filter the dust, counteract the heating up of the surfaces and provide for higher air humidity. However, in this effect they are not enough for the whole area.

## Air pollution

Climate phenomena depending on the relief can influence the air quality significantly. Thus, during windless, high-pressure weather conditions atmospheric inversions can be formed that cause stable air stratification with poor air exchange. Due to insufficient ventilation this causes an enrichment of emitted air pollutants in the lower air layer and this is the reason for climatic and air-hygienic loads. The generation of fresh air and the formation of cold air are the preconditions for the exchange of heat and air between loaded estate areas and undeveloped landscapes. In wind-exposed positions, mainly woods and larger areas of grove serve for the formation of fresh air generation areas.

There were no up-to-date measurements available for the exploration area referring air pollutant emissions. However, on the basis of the traffic volume in Merseburger Street it can be assumed that increased traffic-related inputs of pollutants can be expected in the adjacent area of the road. Currently, the inputs of pollutants from the existing commercial utilization cannot be identified more precisely. Because the currently operated production plants have been replaced or newly established during the last years, we assume that they, in compliance with the general state of the art, do not generate emissions exceeding the limit value.

The evaluation of the daily average of fine dust  $PM_{10}$  (limit value  $50 \mu\text{g}/\text{m}^3$ ) in the area of Merseburger Street has been tending to decrease since 2011. Since 2012, the measured values ( $PM_{10}$ : 23 to  $12 \mu\text{g}/\text{m}^3$ ) have been clearly below the limit value of  $50 \mu\text{g}/\text{m}^3$ .

In the exploration area, the annual average values for ozone are also clearly below the threshold ( $110 \mu\text{g}/\text{m}^3$ ).

### **2.3.2 Superficial water and groundwater quality**

In the southwest area of the city Halle, there are two multi-aquifer formations that consist of several separated, different aquifers.

The lower formation includes the solid rock complex (Lower Trias). Here, the well permeable sandstone forms a confined aquifer. The groundwater flows in the southeast direction.

The upper formation consists of Tertiary and Quaternary unconsolidated sediments. The Tertiary aquifer is only formed in the eastern part of Ammendorf and is strongly influenced by mining activities. The groundwater also flows south-eastwards towards the river Weiße Elster.

The Quaternary aquifer consists of 2 to 6 m thick, widespread Saalian Glacial gravel sands that are to be seen as main aquifer. In wide parts of the exploration area, the Saalian Glacial gravel sands directly lay on the Bunter sandstone. A hydraulic connection to the solid rock aquifer below (Bunter sandstone) is mostly strongly restricted by a 1 to 5 m thick weathered layer. Usually, this also mainly prevents the penetration of pollutants towards the solid rock aquifer. The outflow of the Quaternary aquifer is directed from the central part of the exploration area to the southwest towards the river Weiße Elster and to the southeast towards Osendorf.

Above the Saalian Glacial gravel sands, thick Glacial till horizons of up to 15 m are formed to the north of Ammendorf that have the effect of an aquiclude, or an aquitard. To the south, the thickness of the Glacial till decreases, so that, nearly in the central part (to the north of the bridge - Eisenbahn Street), the water conducting gravel sands are in place near surface and with this, they are widely unprotected against penetrating pollutants.

In the exploration area, the depth to water table is between 5 and 10 m. Only at the north and south boundary, the groundwater rises to approx. 2.5 m below surface.

Surface waters are not present in the exploration area. Approximately 2 km to the south, there is the course of the river Weiße Elster that flows in the Saale within the area of Beesen-Ammendorf. As stagnant surface waters, the former worked out open cuts „Osendorfer See“ and „Blaues Auge“ are to be mentioned that are in a distance of approx. 2 km to the east or northeast.

The recharge rate of groundwater for the exploration area is to be seen as low. That is because of the high degree of sealing.

The district Ammendorf and its environment belong to the oldest and most intensively used industrial sites within the city Halle. Since the middle of the 19th century, numerous big factories with different ranges of products (chemical industry, machine building, etc.) have been built. A large number and partly high quantities of environmentally and especially water-hazardous substances were handled over a long time.

Partly, these substances were stored temporarily or permanently. Many reports on the exploration of the contaminated sites are available. Some of these sites have been developed and/or saved. Partly, rehabilitation works are still running or are planned.

### **2.3.3 Soil quality**

The geological ground of the area consists of types of rock belonging to the Middle Bunter that have been superimposed by the glacial occurrences. With this, glacial till was deposited above the formations of Bunter sandstone in the northern exploration area and basal gravel and lower terrace gravels of the Saale main terrace were deposited in the southern part. The boundary line between glacial till on the one side and basal gravel and terrace gravels on the other side runs in the north-south direction at the same height of the crossing of

Schacht Street/Merseburger Street. Overall in the industrial site of Ammendorf, partly a sandy loess clay sheet is superposed.

The process of soil formation caused Brown Chernozems that, however, have been restored or sealed in the largest shares of the area due to cultural purposes.

Generally, the degree of sealing of the in-situ soils decreases in the easterly direction. The highest portion of sealing with partially > 80 % can be recorded in the area to the west of Eisenbahn Street, as well as in the central area. The soils consist of natural and technogenic substrates. The area in the north between railway line, former Ammendorfer Plastwerk and the former ORGACID GmbH is not sealed by anthropogenic measures and therefore, it features middle to very high biotic habitat potential.

Because the soils in the exploration area consist of cohesive or strongly anthropogenically superimposed layers of broad expanse that partly have a very high degree of sealing, precipitation water can only penetrate in a restricted way. Notwithstanding the above, in the whole exploration area two areas can be sustained. To the north of the geological boundary, at the level of the crossing Schacht Street/Merseburger Street, seepage is tendentially more difficult. South of it, it is tendentially easier.

#### Abandoned mines/ old mining activities (historic mining)

Even today, the effects of the former mining industry operated in Halle are noticeable in many sites in the city area and caused significant changes in the landscape. Mainly, the open cuts in the city area are witnesses of intensive mining activities for brown coal extraction. Over time, these open cuts, left from the historic mining, filled with groundwater and precipitation water. In the peripheral area of the city, approx. 2 km to the east or to the northeast, there are the water-filled, former open cuts „Osendorfer See“ and „Blaues Auge“.

In the area Ammendorf, brown coal mining was also carried out in underground mining. In the north-east area of the industrial area Ammendorf, shafts as well as underground galleries and excavations have been opened within an area of approx. 2 km in the north-south direction and in the east-west direction of 1 km, in a depth of max. 50 m. The underground cavities including the drain ways of more than 1 km have been filled with water-impermeable materials to prevent the risk of day falls. Nevertheless, on the basis of the known cavities and the stowed refilling material it can be assumed that residual cavities of the former brown coal mining are still left.

### 2.3.4 Natural heritage (potential impact on)

#### Areas of conservation and protected objects

The European nature reserve project "Natura 2000" combines the Fauna-Flora Habitat directive or FFH directive (FFH areas) with the Birds Directive (SPA areas). There are no FFH or SPA areas within the exploration area.

There are large-size FFH- and SPA areas, as well as Areas of Outstanding Natural Beauty and Nature conservation Areas in the south along the river Weiße Elster.

Along the eastern boundary of the industrial area Ammendorf, there is an elongated area with legally protected biotopes as per § 22 NatSchG of the Land Saxony Anhalt, outside the exploration area on the margin of former open cast mine Bruckdorf.

#### Types of biotope

The area to the east of Merseburger Street is characterized by nearly completely sealed or cleared clearance areas without plant cover. There are small parts of surfaces open, ruderalized surfaces and open house gardenstructures along Schacht Street. Ruderal vegetation can often be found at deep-reaching superimposed sites (e.g. uncultivated farm land, devastated overcultivated soils) and can be considered to be transition areas of different types of biotope in which a mostly undisturbed succession can take place.

The tree stock is confined to the above mentioned open ground areas and the road sides, and mainly consists of older leaf trees. These are mainly various species of maple and small-leaved lindens. All in all, the biotope value is very low.

The Merseburger Street is lined with an incomplete row of small-leaved lindens with a trunk circumference of 100 to 120 cm.

To the west of the Merseburger Street, mainly there are clearance areas that, in the boundary area to the Sommerbad, pass into ruderalized meadows. The occasional tree stock mainly consists of small-leaved lindens. For the clearance areas, the biotope value is low, for the ruderal areas, it is of medium to high value.

The area of the mining settlement between Brücken Street and Adolf-Reinhardt Street is characterized by a differing house and allotment structure with a high percentage of small woods of medium and high value. In the south, partly agriculturally used areas adjoin.

In the area of the site Radewell, biotope complexes of the settlement and industrial areas are dominant.

On the east, the forested heap „von der Heydt“ directly adjoins the exploration area.

## Landscape appearance

The exploration area is divided in two large partial areas by the route of the Eisenbahn Street and the railway track.

Merseburger Street as the western boundary of the industrial area is like a tree-lined road which is mainly lined by small-leaved lindens; the tree rows are interrupted in several parts of the road. The structures along Merseburger Street are divided in small parts and fully interpenetrated by greenery.

The area to the east of Merseburger Street up to the railway system is strongly characterized by industry and is interrupted by individual clearance areas.

In the southern part, the topology of eastern Eisenbahn Street is characterized by a single-family house structure as well as domestic gardens and allotments. To the north, there is a zone with large derelict lands.

In the northeast area of the exploration area, there are public, freely accessible open spaces in form of large uncultivated farmland.

The whole industrial and urban area is not suitable for recreation purposes.

### **2.3.5 Land consumption in urban areas**

The urban planning is based on a general orientation towards the existing structure of building and utilization. Interventions take place, when the mixture of dwelling and industry, for instance, requires the prevention of emission conflicts in compliance with the current interpretation of the law, and when a long-term change of the building structure is sought for the benefit of the building development in special residential areas.

Main target is it to secure the existence and the further development of the existing commercial site. Structuring of the commercial areas is done on the basis of area-related noise levels and takes the requirements of the emission protection into account.

Special residential areas are identified with the objective to preserve the residential use in mixed areas and to further develop it. The building structure based on building design and dimension is fixed in a way that, for long-term planning, a newly organized structure of two-storey, road-side buildings can be developed in the south and north, and of three-storey linear buildings in the middle. On the one hand, the newly specified structure allows the development of residential buildings as multi-storey buildings as well as private measures in terraced houses and groups of houses and on the other hand, smaller commercial buildings are also possible in this structure. The existing large-scale residential and commercial buildings will be further protected by the provision made to safeguard existing standards; however for further developments they shall not be the scale basis.

In the commercial areas to the east of Merseburger Street, it is conceivable that the former building structure will be dissolved. Here, the specification of dimensions for the land-use

zoning shall be guided by the requirements of future commercial occupancy. The allowed building height for new buildings shall not exceed the heights of the currently existing halls to ensure that the arising new buildings will be adapted to the overall architectural impression.

To achieve a better space formation along Merseburger Street in future, the minimum height for buildings is partly specified there.

## 2.4 Socio-economic status

### 2.4.1 Population (potential impact on)

Many companies describe demographic change as major problem for securing skilled workers. The number of decreasing young professionals is generally being mentioned in connection to this. The following table provides a comparison of the development of population cohorts 0-5, 5-10, 10-15, 15-20 and 20-25 years for the young generation that will enter the labor market within the next years and cohorts 55-60 and 60-65 years for the older generation, who will retire. This shows a quite differentiated picture. First of all, it can be noticed that the reduction of the young population was stopped. The age group of 0 to 15 years remained relatively constant and even increased slightly. Within the groups of 15 to 20 years a greater reduction was noticed compared to 2008 and 2009, but remained fairly stable between the years 2010 and 2013. A significant reduction was noticed within the age group of 20 to 25 years. While the numbers remained somewhat stable in Halle, this group decreased significantly within the surrounding administrative districts. In comparison to the age cohorts 15 to 20 the appeal of the University City Halle is reflected and the age group of 20 to 25 years has increased by approximately 10.000. A certain internal migration from the surrounding areas to Halle must be surely taken into consideration. Nevertheless, it can be noticed that many young people still leave the region to either study or work.

Looking at the older generation, the age group 55 to 60 years remains relatively constant around 30.000. However, the group of 60 to 65 years has increased from approximately 24.000 to 29.000. Putting the younger generation in relation to the older generation, it becomes clear, that double of employees leave the labour market than young people are available to follow. Because of that a big gap arises, which makes it harder for companies to adequately fill vacant positions in the future.

Looking at the migration movement within the Halle area shows an interesting picture as well. Over the years more people moved away than moved to the region. In recent years, this out-migration decreased slowly and a positive migration balance can be noted (2005: -2567, 2014 +1293). While the out-migration decreased, the immigration increased. This statistic demonstrates, that this region has become quite appealing. This is due to the positive economic development as well as the higher quality of life.

	2008	2009	2010	2011	2012	2013
<b>0 bis 5</b>						
Halle	9.796	9.980	10.148	10.233	10.086	10.074
Saalekreis	7.385	7.404	7.467	7.509	7.305	7.222
<b>FUA Halle</b>	<b>17.181</b>	<b>17.384</b>	<b>17.615</b>	<b>17.742</b>	<b>17.391</b>	<b>17.296</b>
<b>5 bis 10</b>						
Halle	8.476	8.678	8.773	8.850	8.882	9.146
Saalekreis	7.405	7.455	7.388	7.291	7.210	7.387
<b>FUA Halle</b>	<b>15.881</b>	<b>16.133</b>	<b>16.161</b>	<b>16.141</b>	<b>16.092</b>	<b>16.533</b>
<b>10 bis 15</b>						
Halle	6.726	7.112	7.557	7.856	7.931	8.159
Saalekreis	6.538	6.791	7.081	7.209	7.261	7.280
<b>FUA Halle</b>	<b>13.264</b>	<b>13.903</b>	<b>14.638</b>	<b>15.065</b>	<b>15.192</b>	<b>15.439</b>
<b>15 bis 20</b>						
Halle	10.062	8.816	7.616	7.607	7.704	8.188
Saalekreis	8.919	7.429	6.219	6.035	5.899	6.180
<b>FUA Halle</b>	<b>18.981</b>	<b>16.245</b>	<b>13.835</b>	<b>13.642</b>	<b>13.603</b>	<b>14.368</b>
<b>20 bis 25</b>						
Halle	18.488	18.616	19.494	19.428	18.975	17.683
Saalekreis	12.446	12.136	11.637	10.334	8.718	7.395
<b>FUA Halle</b>	<b>30.934</b>	<b>30.752</b>	<b>31.131</b>	<b>29.762</b>	<b>27.693</b>	<b>25.078</b>
<b>55 bis 60</b>						
Halle	16.685	16.654	16.416	16.132	15.256	14.711
Saalekreis	16.368	16.639	16.908	16.851	16.317	16.018
<b>FUA Halle</b>	<b>33.053</b>	<b>33.293</b>	<b>33.324</b>	<b>32.983</b>	<b>31.573</b>	<b>30.729</b>
<b>60 bis 65</b>						
Halle	13.455	13.110	13.939	14.786	14.857	15.371
Saalekreis	10.965	11.217	12.399	13.798	14.542	15.416
<b>FUA Halle</b>	<b>24.420</b>	<b>24.327</b>	<b>26.338</b>	<b>28.584</b>	<b>29.399</b>	<b>30.787</b>

Table 2: Population of the FUA Halle by age cohorts from 2008 to 2013

Source: Statistical bureau Saxony-Anhalt (2015), designed by isw

In upcoming years the total population will continue to decrease due to the high death rate, but a countermovement via a slight growth of the young generation and a migration surplus can be noted as well. In particular, the attractiveness of the universities in Halle and Merseburg bring many young people into the region. The challenge is to utilize this group for the regional labor market.

	2008	2009	2010	2011	2012	2013	2014
<b>Immigration</b>							
Halle	9.550	10.428	10.773	11.450	11.412	11.650	11.600
Saalekreis	5.592	5.389	5.374	5.687	5.470	5.669	5.677
<b>FUA Halle</b>	<b>15.142</b>	<b>15.817</b>	<b>16.147</b>	<b>17.137</b>	<b>16.882</b>	<b>17.319</b>	<b>17.277</b>
<b>Out-migration</b>							
Halle	10.165	10.459	9.391	9.992	9.761	10.583	10.119
Saalekreis	7.544	6.867	6.566	6.643	6.055	6.158	5.865
<b>FUA Halle</b>	<b>17.709</b>	<b>17.326</b>	<b>15.957</b>	<b>16.635</b>	<b>15.816</b>	<b>16.741</b>	<b>15.984</b>
<b>Balance</b>							
Halle	-615	-31	1.382	1.458	1.651	1.067	1.481
Saalekreis	-1.952	-1.478	-1.192	-956	-585	-489	-188
<b>FUA Halle</b>	<b>-2.567</b>	<b>-1.509</b>	<b>190</b>	<b>502</b>	<b>1.066</b>	<b>578</b>	<b>1.293</b>

Table 3: Migration movements in der FUA Halle 2008-2014

Source: Statistical bureau Saxony-Anhalt (2015), designed by isw

	Total	Gymnasium		Extended Secondary School		General Secondary School		Lower Secondary School	
Halle	1.526	557	36,50%	219	14,40%	368	24,10%	149	9,80%
Saalekreis	1.156	279	24,10%	239	20,70%	399	34,50%	98	8,50%
<b>FUA Halle</b>	<b>2.682</b>	<b>836</b>	<b>30,30%</b>	<b>458</b>	<b>17,55%</b>	<b>767</b>	<b>29,30%</b>	<b>247</b>	<b>9,15%</b>

Table 4: School graduates of the secondary schools in the FUA Halle, 2014

Source: Statistical bureau Saxony-Anhalt (2015), designed by isw

Table 4 shows the current number of school graduates and the distribution to the various secondary schools. 2682 young people graduated school in 2014. Between one fourth and one third of that year chose matriculation (Abitur), approximately 24% and 34,5% have a general secondary school (Realschule) certificate and 9,8% and 8,5% finished lower secondary school (Hauptschule).

## Demographic development

The city experienced a difficult population development in the past 25 years. With the re-unification the „old“ Halle was merged with the chemical workers-Trabant city Neustadt and the population rose to 310.00 inhabitants. In subsequent years Halle had to struggle with out-migration, high unemployment and demographic change just like other East German cities. Halle had to cope with a population reduction of nearly 80.000 inhabitants from 310.000 to 232.000 since the re-unification. As of 2009 the population numbers increased again slowly. In the following diagram the percentage development of the population in the city Halle can be observed.

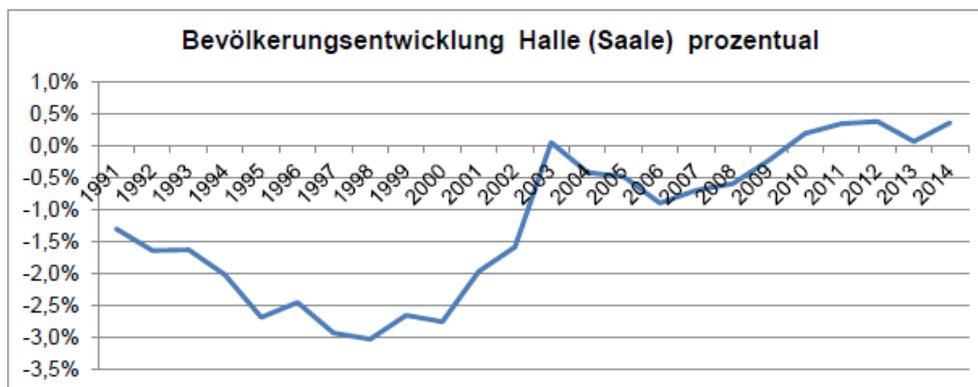


Figure 9: Population development Halle (Saale) since 1991

Source: Economic development concept of the city Halle, p. 16

The last small-space forecast (status 2007) of the city Halle (Saale) assumed an development runs contrary to the forecast and a slight population growth was displayed in the past years, a new evaluation concerning the future demographic development became necessary. Behind this background, the company “Analyse & Konzepte” realized a population and household forecast for the city Halle by order of the city council, which depicts the possible development of the population and households from 2014 till 2030. The following overview illustrates the results of the forecast.

### Development number of inhabitants

As a result of the population forecast, the number of inhabitants in Halle will not develop linear but slightly sinuous. Therefore, a population growth of about 405 to 233.110 inhabitants can be estimated by 2017. Subsequently, due to shrinking net immigration in particular, the population will slowly but surely decrease to 231.162 inhabitants until 2030.

### Development of deaths and births

In Halle (Saale) more inhabitants of Halle will die than be born on balance during the entire forecast duration – which to a significantly large extent has been the case in nearly all East German cities for many years now.

## Development of migration

The current immigration from West Germany will lead to greater out-migration to West Germany within the coming years. The proportions will remain negative opposed to West Germany and positive opposed to East Germany. The migration of surrounding areas will continue to remain positive.

## Development average age

The average age of 44,1 years (2030) of Halles' inhabitants will remain nearly constant opposed to 44,3 years in 2013.

In total a positive demographic forecast is presented, which however demonstrates a lower growth in comparison to the competitors. The forecasted development in the administrative districts of Saxony-Anhalt remains problematic. In the core area of the metropolitan region Leipzig-Halle a growth can be observed, which is of greater benefit to the Leipzig area.

## 2.4.2 Employment situation

### Regional labor market

The economic transformation process after the re-unification lead to high unemployment numbers in Saxony-Anhalt. For years, the state carried the red lantern and an unemployment rate of over 20% illustrated the great social and societal problems. In the past years a significant improvement could be achieved in this area as well. If one compares the absolute figures of the unemployed from 2008 and 2015, those decreased by one fourth in Halle and by about one third in the administrative district Saalekreis. The unemployment rate is now 8,8% in the Saalekreis and fell between 5 and 7 percent within the past seven years. In 2014 the employment rate was 77,5% in Halle and 80,4% in the Saalekreis.

This positive development on the labor market is mainly due to two reasons. For one, as demonstrated above, new jobs were created due to economic growth. At the same time the demographic change and the migration caused a shrinking of the population. The battle against unemployment remains furthermore an important task of economic policy. The great share of long-term unemployed persons and in comparison, high school-dropout rates remains a continuous challenge.

Gesamt	2008	2009	2010	2011	2012	2013	2014	2015	Delta
Halle	17.444	15.967	15.070	13.002	13.688	13.598	13.594	13.033	- 25,30%
Saalekreis	13.352	13.520	12.612	10.871	9.997	9.815	9.413	8.880	- 33,50%
FUA Halle	30.796	29.487	27.682	23.873	23.685	23.413	23.007	21.913	
Unemployment Rate %									
Halle	16,6	14	13,5	11,7	12,3	11,9	11,8	11,3	-5,3
Saalekreis	13,5	12,7	12	10,3	9,5	9,5	9,2	8,8	-4,7
FUA Halle	15,05	13,35	12,75	11	10,9	10,7	10,5	10,05	

Table 5: Unemployment numbers and unemployment rated in the FUA Halle, 2008-2015

Source: Statistical bureau Saxony-Anhalt (2015), designed by isw

The development on the regional labor market in the region Halle shows a quite positive picture. Since 2008 employment subject to social insurance contribution increased continuously.

	2008	2009	2010	2011	2012	2013	2014	Delta
Halle	89.714	90.521	91.626	92.092	91.352	90.653	91.635	2,10%
Saalekreis	62.914	62.349	63.101	65.036	65.625	66.277	67.616	7,50%
FUA Halle	152.628	152.870	154.727	157.128	156.977	156.930	159.251	

Table 6: Employees subject to social insurance contribution in the FUA Halle

Source: Statistical bureau Saxony-Anhalt (2015), designed by isw

While between 2008 and 2014 the increase was moderate in Halle, the Saalekreis experienced a significant growth of over 7%. The number of employees, subject to social insurance contribution in the manufacturing trade show a differentiated picture of the economic structure and development. In Halle and the Saalekreis this employment sector hardly grew between 2008 and 2014.

The manufacturing trade is of lower importance for the city Halle in comparison to the surrounding administrative districts. For instance, the number of employees subject to social insurance contribution is three times greater in the Saalekreis.

	2008	2009	2010	2011	2012	2013	2014	Delta
Halle	6.419	6.291	6.382	6.537	6.513	6.220	6.454	0,50%
Saalekreis	17.585	17.825	17.530	17.872	17.936	17.785	17.759	1,00%
FUA Halle	24.004	24.116	23.912	24.409	24.449	24.005	24.213	

Table 7: Employees subject to social insurance contribution in the manufacturing trade without construction industry, FUA Halle

Source: Statistical bureau Saxony-Anhalt (2015), designed by isw

Thereby, the Saalekreis takes on an outstanding position as industry location in the region Halle. The development of the manufacturing trade probably stagnates due to the lacking availability of settlement area in the city Halle.

### 2.4.3 Economic development

Meanwhile the trade and service sector is in terms of the number of companies and number of employees by far the strongest sector in the city Halle (Saale). The following overview shows the distribution of employees subject to social insurance contribution onto the sectors of the manufacturing industry, agriculture and forestry, fishing industry and services.

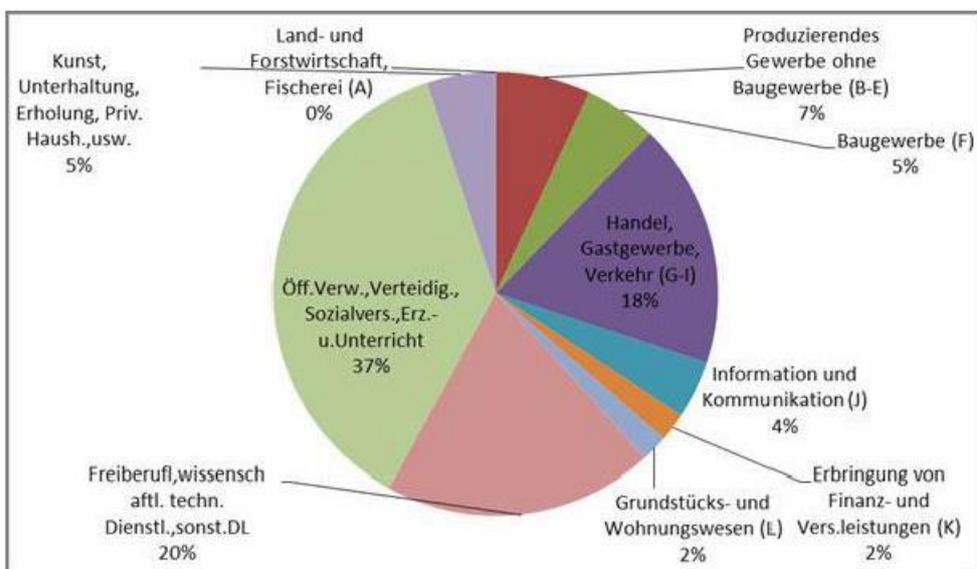


Figure 10: Overview of employees subject to social insurance contribution by sectors, June 2013

Source: Wirtschaftsförderungskonzept der Stadt Halle

<i>Number of Employees by Sectors</i>	
<i>Agriculture and Forestry, Fishery (A) 0%</i>	<i>40</i>
<i>Manufacturing Industry, excl. Construction Industry (B-E) 7%</i>	<i>6220</i>
<i>Construction Industry (F) 5%</i>	<i>4768</i>
<i>Trade, Catering, Traffic (G-I) 18%</i>	<i>16260</i>
<i>Information and Communication (J) 4%</i>	<i>3820</i>
<i>Provision of Finance and Insurance Services (K) 2%</i>	<i>1874</i>
<i>Real Estate and Housing Sector (L) 2%</i>	<i>1745</i>
<i>Freelance, Scientific Technical Services, Other Services 20%</i>	<i>17833</i>
<i>Public Administration, Defense, Social Insurance, Education and Teaching 37%</i>	<i>33543</i>
<i>Art, Entertainment, Recreation, Private Households, etc. 5%</i>	<i>4549</i>
<i>Total</i>	<i>90652</i>

*Table 8: Overview of employees subject to social insurance contribution by sectors, June 2013*

*Source: Economic development concept of the city Halle*

Besides the traditional, but transformation-related in size and depth strongly shrunk industries, more new companies from the technology and services sector start to shape the economic structure of the city and the region.

- Innovation and technology (TGZ/ Bio-Zentrum),
- Information, communication and media (MMZ),
- Mechanical engineering,
- Service sector, e.g. call-center and administration,
- Construction industry,
- Food industry.

#### **2.4.4 Productive activities**

While looking at important economic key figures of the FUA Halle, the strong position of the Saalekreis as industrial location becomes apparent once again. Nearly one fourth of the revenue of the manufacturing trade in Saxony-Anhalt is generated here. This is particularly caused by the capital-intensive and lucrative chemical industry. The numbers of the city Halle illustrate the very low industrial density. According to the revenue earned, the mechanical engineering industry is the most important sector of the manufacturing trade in the city

Halle. Subsequently follow the food industry and the chemical industry. However, the low number of companies and their small size must be considered.

	<b>Companies</b>	<b>Employees</b>	<b>Revenue [t€]</b>	<b>%</b>
<b>Saalekreis</b>	<b>176</b>	<b>13.670</b>	<b>11.295.425</b>	<b>100%</b>
<i>Extraction of Stones and Earth, Other Mining</i>	9	141	21.369	0,20%
<i>Manufacture of Food Products</i>	11	1.066	130.307	1,20%
<i>Manufacture of Chemical Products</i>	30	4.245	2.959.513	26,20%
<i>Manufacture of Rubber and Plastic Products</i>	14	781	385.418	3,40%
<i>Manufacture of Non-Metallic Mineral Products, Processing of Stones and Earth</i>	17	447	224.092	2,00%
<i>Repair and Installation of Machinery and Equipment</i>	41	3.166	362.450	3,20%

Table 9: Process industry in the Saalekreis

Source: Statistical Bureau Saxony-Anhalt (2015), calculated and presented by isw

<b>Sectors</b>	<b>represented in</b>	<b>Companies</b>	<b>Employees</b>	<b>Revenue [t€]</b>
<b>Functional Urban Area Halle</b>		156	12.685	4.577.587
Manufacture of Food Products	HAL + SK	15	1.635	269.696
Manufacture of Chemical Products	HAL + SK	36	4.596	3.039.510
Metals Production and Processing				
Manufacture of Rubber and Plastic Products	SK	14	781	385.418
Repair and Installation of Machinery and Equipment	HAL + SK	50	3.764	410.332

Manufacture of Non-Metallic Mineral Products, Processing of Stones and Earth	SK	17	447	224.092
Mechanical Engineering	HAL	6	988	174.313
Manufacture of Metal Products	HAL	9	333	52.857
Manufacture of Products of Wood, Cork, and Wicker (except Furniture)				
Manufacture of Data Processing Equipment, electronic				
Extraction of Stones and Earth, Other Mining	SK	9	141	21.369

Table 10: Process industry in the FUA Halle (sum)

Source: Statistical Bureau Saxony-Anhalt (2015), calculated and presented by AHP

The revenue figures underline once more, that particularly the chemical industry and the food industry dominate within the region Halle. In third place based on revenue follows the metal work industry incl. mechanical engineering and mechanical repair/ installation, which however also have the most employees in total.

During the course of the aimed at industry focus for the city Halle (Saale), the following structuring is being undertaken.

Industries with particularly high development and innovation potential are being viewed as development industries. Those industries have a great potential through the comprehensive research network with universities/ institutes. In the city Halle (Saale) these have good pre-conditions through the framework conditions in the technology park Weinberg Campus and MMZ. However, high coordination and funding needs exist in these sectors. Companies from this sector have already a strong network and internationality.

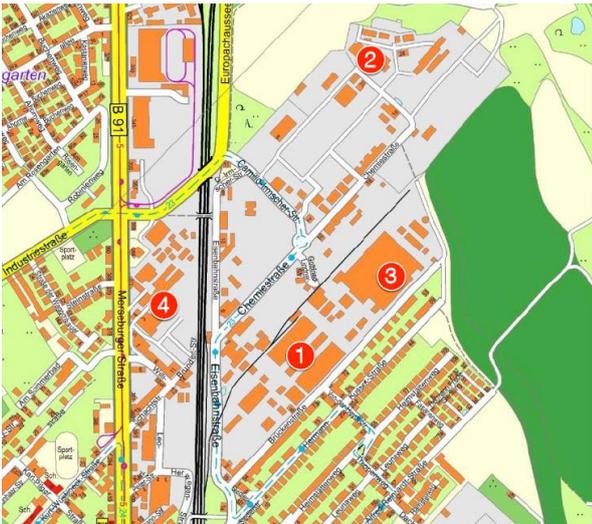
Key industries are those industries with high concentration of companies or high number of employees respectively. Those are classical industries, but with a special significance in the city Halle. For the continuous development, a great potential is seen for extensions and in particular a special support for securing manpower, e.g. necessary for company relocations and company successions.

Development Industries
Bio-Technology and Life Science
Media Technology, IT
Material Technology and Engineering
Key Industries
Mechanical and Plant Engineering
Trade and Services
Logistic
Food Industry/ Nutrition Industry
Construction Industry

Table 11: Overview industry focus Halle (Saale)

Source: Economic development concept of the city Halle, p. 57

At the location in Ammendorf there is an active industrial development ongoing. The four important companies in the Northern part are investing in their business and currently employ 630 people. For instance INDU LIGHT has invested 1 Mio Euro in 2016 to extend production for a new product.



1. MSG Maschinenbau und Service GmbH Ammendorf
2. Elektro-Thermit GmbH & Co. KG
3. S.M.A. Metalltechnik GmbH & Co. KG
4. INDU LIGHT Produktion & Vertrieb GmbH

Figure 11: Located Industries in Ammendorf / North

Source: City Halle (Saale)

Also in the southern part in Radewell companies have a stable development and plans for extensions. The chamber of Handicraft is currently investing 25 Mio Euro to construct a new training centre, which should be completed in 2020.



1. Tief- und Spezialbau Halle GmbH
2. TSR Recycling GmbH & Co. KG
3. Fehr Umwelt Ost GmbH
4. Handwerkskammer Halle / Bildungs- und Technologiezentrum
5. Metallbau Hofmann GmbH

Figure 12: Located Industries in Ammendorf / South

Source: City Halle (Saale)

## 2.5 Infrastructure, Logistics, Legal Constraints

In the Land Development Plan 112 a detailed analysis of the single infrastructure has been undertaken. The supply with medias and waste disposal can be ensured for the planned buildings.

The supply of the area with energy and drinking water will be ensured from the Merserburger Straße. The inner supply network of the factory area Werk 1 has to be newly build in case

of parcelling and new development. Existing so far privately owned pipes can only be taken over by the public utility in a very limited way.

The local electricity provider (EVH) operates a boiler house at the street “Am Sommerbad”, where the legal planning framework has to be ensured. Furthermore, the existing high pressure gas pipeline to the boiler house has to be considered.

The waste water treatment of the area is managed via the pipelines in a mixed system located in the Schachtstraße, Karl-Peter-Straße, Kurt-Wüsteneck-Straße and Merseburger Straße. Further two waste water pipelines are located at the former factory area of Bombardier, from which one pipelines leads to the Horst-Heilmann-Straße.

The water discharge system for the industrial area is not sufficiently secured according to present standards. New rainwater retention basins have to be built on the area and it is necessary to extend the exiting public mixed water network.

A limitation of the rain water drain to 10 litres per second is necessary.

### **2.5.1 Waste water treatment**

The area is in general equipped with a mixe waste water system. But at present the channel network is not sufficient to meet the demands of current and future planned sealing of the land. It is necessary to reduce the waste water drain (waste water and rain water) for new building activities to 10 litre per second and hectare with the help of retention basins, holdup channel and similar measures.

The waste water channels have to be renewed in the planned public streets with appropriate dimensions.

Additionally the provision of sufficient water discharge capacity in the public area is necessary, which extends to areas outside the Land Development Plan. This is valid for the following partial measures.

- Replacement and new construction channel Kurt-Wüsteneck-Straße from DN 400 / 450 to DN 800
- New Construction of parallel channel DN 500 – DN 600 in Merseburger Straße
- Replacement and new construction channel Schachtstraße from DN 300 to DN 400 – DN 450

### **Drinking Water**

The supply with drinking water is in general ensured with the existing pipelines from the public streets. The drinking water pipeline in the street “Am Sommerbad” is not in the property of the local public utility (HWA). The HWA would be ready to take over this pipeline for free, in order to secure the public drinking water supply also in this street.

In case of new constructions of the supply network, the pipelines of the former company owned water grid can only be taken over in a very limited way. In principle, a new construction of the water pipelines is necessary in the planned public streets.

### 2.5.2 Waste treatment

The Ammendorf Site is covered by the waste treatment services offered by the public utilities of Halle.

### 2.5.3 Power and Energy Supply

The area has good access with electricity and gas supplied by the local public utility (EVH). A supply with distance heating is currently not offered by the EVH. The planning framework of the boiling house “Am Sommerbad” is implemented by the EVH.

In Ammendorf normal phone connections is provided by Deutsche Telekom AG. A permanent problem is the provision of good internet connections. During the regional stakeholder meeting in December 2016 local inhabitants and representatives from companies complained about slow internet connections. The city administration presented a map, that shows the missing capacities in the area. Currently they are implementing a survey with companies to identify the needs. On this basis extension of the broadband network should be progressed in cooperation with the telecommunication companies also using public funding.

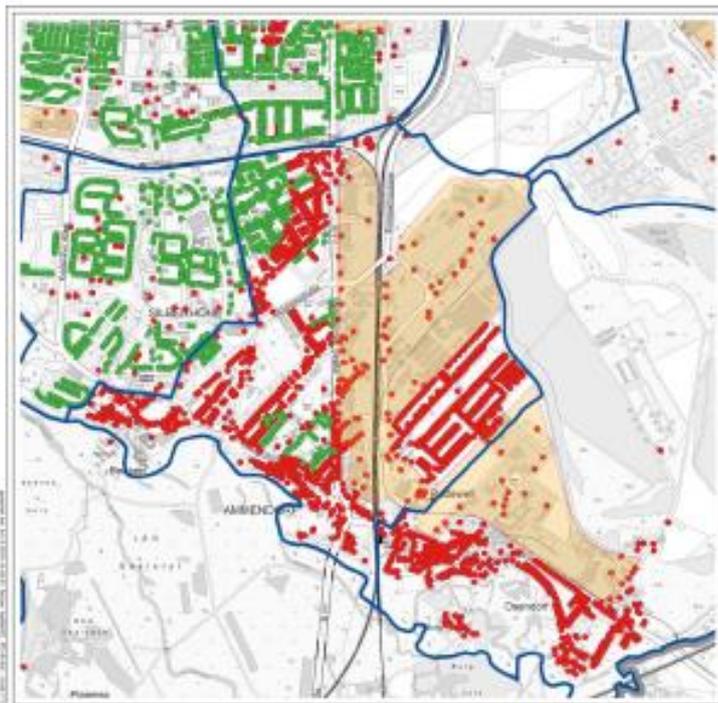


Figure 13: Overview broadband access in Ammendorf.

Source: City Halle (Saale)

A microwave link of Vattenfall AG, which leads to the power plant in Schkopau requires a height limit for buildings of 10 m.

#### **2.5.4 Transport Connections (roads, railway, airports, ports and harbours)**

The Merseburger Straße fulfils main transport access functions in the Western part of the area, the Regensburger Straße in the South Eastern part. Due to the construction and partial completion of the Main Access Road the so called “Eastern tangent” the Northern transport connection of the commercial areas in Ammendorf have already improved. Still there is a problem to complete the internal connection. Another aspect is the public use of roads, which are actually not dedicated as roads (e.g. in the area of the former Plast Factory). Further challenge is the de facto continuation of the Main Access Road as commercial road East from the rail track. This road could offer a second local bypass for Radewell in the Northern part. The planning of this “commercial road Ammendorf/Radewell” (B-Plan Nr. 139) is well progressed but could not be implemented so far due to other priorities.

During the regional stakeholder meeting in December 2016, many inhabitants complained about the high transit traffic of lorries using the Regensburger Straße, which leads to noise pollution for the nearby houses. The city administration reported figures of 10.000 cars passing this road every day and 900 lorries. In order to reduce the impact on the inhabitants the city has tested a night ban for lorries for the Regensburger Straße and a speed limit of 30 km/h. Currently the administration is applying for a constant lorry night ban with the regional transport authority and hopes to get an approval soon. The city administration gave an outlook to the new local transport concept in 2017. The slowdown of traffic in Radewell will have a high priority and the construction of the commercial road should be implemented afterwards.

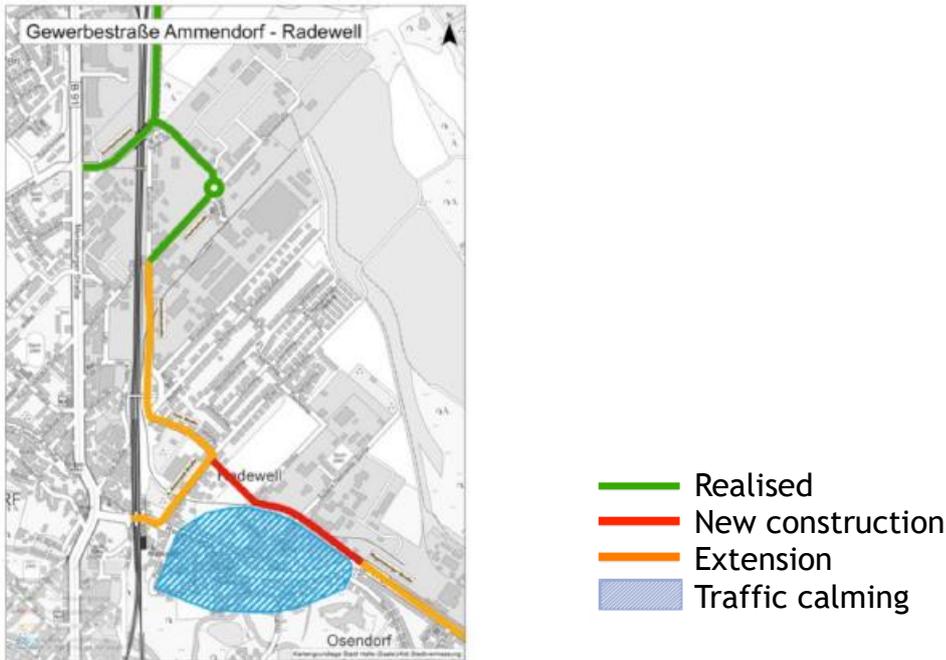


Figure 14: Planning of Commercial Road Ammendorf Radewell

Source: City Halle (Saale)

The road connections to the regional transport net is provided by the national road B91, which provides access to the highway 38 via the regional road L172 (crossroad South from Schkopau). The remote location of the area could be compensated with this access.

In the framework of the renovation of the local tram network the Southern part of Merseburger Straße will be renovated in the next years. Four driving lines should be provided for the road. The planning process will be implemented in 2017/2018 and the constructions are foreseen for 2018/2019.

Main starting point for the usability for all neighbours and potential settlers is the optimisation of the internal site development. The rail track Halle-Merseburg constitutes a crucial barrier in this respect. On this track a number of freight transports will be operated and since recently the fast train Erfurt-Berlin uses this track.

## Public Transport

The planning area is connected to Tram lines 3 and 5 via the Merseburger Straße. Furthermore, the bus line 24 (Südstadt – Döllnitz) from Kurt-Wüsteneck-Straße to Regensburger Straße. Bus stops are located at Kurt-Wüsteneck-Straße close to former factory gate Werk 1 (bus stop Waggonbau).

The tram is driving north from the Schachtstraße in its own rail track. This needs to be considered for the new development of the crossroad and tram stop Am Sommerbad.

## Bicycle and walkways

Alongside the Merseburger Straße a continuous bicycle path is existing. A bicycle and walkway connection to Merseburger Straße is existing via Friedrichstraße from the nearby housing area and the Sommerbad. Furthermore, the extension of bicycle and walkway connection from Hohe Straße to Heilmannstraße has to be improved, to ensure better connection between Radewell to Merseburger Straße.

During the regional stakeholder meeting in December 2016 the city administration presented ongoing work for the extension of bicycle pathways “Elsterradweg” which also touches Ammendorf. The aim is to have a separate asphalt bicycle path with a minimum width of 2,5 m. The city will use public funding for the financing of the construction



Figure 15: Development and Construction of Elster Bicycle Pathway

Source: City Halle Saale

## 2.5.5 Legislation (environmental, urban, public works, etc.) and planning instruments

Major legislation for brownfield remediation has been described in above chapters, which is focused on the activities of the agency for brownfield remediation in Saxony-Anhalt. The integrated urban development plan of the city of Halle is the basic strategic planning instrument for further development of the Ammendorf. Site. The old B-Plan (land development plan) for part of the Ammendorf site from 2003 is the starting point for the operational planning of activities on this specific area. The surrounding area needs more detailed work on land planning.

## 2.5.6 Ownership

The largest share of properties on the site belong to private owners. Main share belongs to Bombardier Transportation AG. The traffic area for public use is in municipal property. The road "Am Sommerbad" is in private property. The Schachtstraße also belongs to the municipality also in the publicly not accessible part inside the factory area.

The former railyard Ammendorf is in the property of the public transport utility HAVAG.

The following map shows the available settlement areas, which are currently offered on the market. Private owners and city administration cooperate to attract potential investors.



Figure 16: Overview of available settlement areas in Ammendorf

Source: City Halle (Saale)

The planning area gives a relatively unstructured impression, because different construction forms are mixed and there is not consistent spatial development. Additionally, construction gaps, brownfields and empty houses have a negative impact on the outer appearance. The road area alongside the Merseburger Straße does not have a clear construction boarder, which is a bit compensated by the trees.

### 3. Conclusions

The analysis of the area has led to the identification of 59 ha for potential development, whereas 338 ha are no potential areas. The potential area has a share of 14% which is relatively low but differs between the different parts.

The potential areas belong in similar sizes to the categories 1 (undeveloped area) and 2 (slightly developed area) (each approximately 27 ha). Due to unclear information in the partial area F-05, 10ha could not be assessed.

From the 338 ha of non potential areas, 112 ha are currently used for industrial and commercial activities (category 5), which constitutes a share of 28% and stresses the high importance of the site as business location.

A larger share of the area belongs to category 8 (other area not useful for industrial settlements) (ca. 221 ha). They are dominated by housing and forests.

The results of the analysis of the area show that larger development potential for industrial and commercial activities is available especially in the partial areas F-03 and F-05 under consideration of the emission problems. Especially in F-05 the used commercial area seems to be underused. A specific characteristic for the Area F is that there is no highly fragmented parcelling of the land, which normally constitute a main characteristic for brownfield sites. Further analysis has to be implemented in the area of environmental pollution caused from former industrial activities for the respective site.

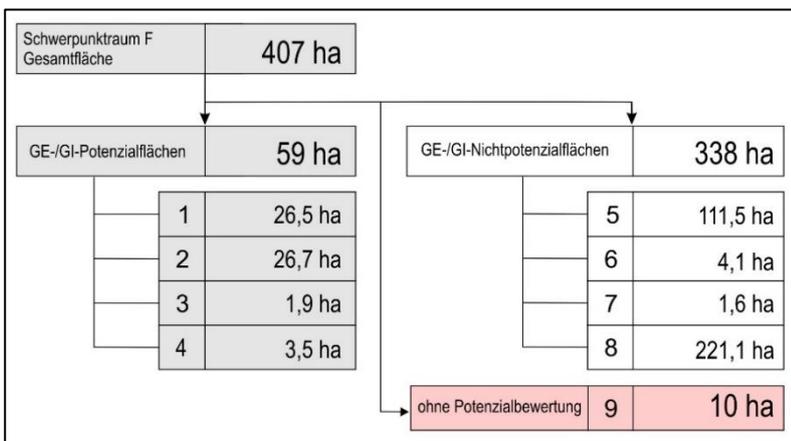


Figure 17: Overview of potential categories for industrial and commercial settlements

Quelle: isw Institute

Partial Area	<b>XS</b> 1.000 to <5.000 m <sup>2</sup>	<b>S</b> 5.000 m <sup>2</sup> to <1 ha	<b>M</b> 1 to <5 ha	<b>L</b> 5 to <10 ha	<b>Sum</b>
F-01	1	1	1		3
F-02	3	5	5		13
F-03	3	2	6	1	12
F-04	1		2		3
F-05		2	2	1	5
F-06					-
<b>H total</b>	<b>8</b>	<b>10</b>	<b>16</b>	<b>2</b>	<b>36</b>

Table 12: Number of Potential Development Areas in Ammendorf in partial areas and size categories

Source: isw Institute

The analysis of Ammendorf Areas has led to the identification of 36 potential areas for industrial and commercial settlements. The major share of area belongs to category M, followed by category S and XS. There are only two areas within category L, larger areas are not available. Important question has to be discussed how several smaller areas can be merged in one larger area for a single settlement. Especially the area north of the Waggonbau location has several potential areas, that have a good shape, size and structure for future industrial or commercial use. A decisive question for future users is the improvement of the internal road network as well as the realisation of the business road for optimised access to the nearby main roads (B-Plan 139)

The following maps show the position and size of potential areas. It is obvious that the northern partial area F-01 shows characteristics of a mixed areas. The areas already identified in the land use plan in partial area F-02 differ from the areas in partial area F-03 especially in the size. These smaller potential areas could be merged to larger entities, which is a clear development advantage for brownfield sites. Regarding the partially heavily used areas in the partial area F-05 needs further analysis how to create additional potential for industrial or commercial settlements.

The assessment of protection requirements for the planning area shows that there are no special needs regarding animals and habitat due to already existing housing and industrial usage. Existing single trees and green vegetation fields have a high local importance due to missing free room quality of the area and they should be sustained. The free room quality of the area requires in general a suitable improvement in connection to the planned use.

The previous impacts of the location regarding subjects of protection such as soil, water, climate and air are high to very high. Especially future noise pollution of planned use should be considered and respective protection measures have to be taken.

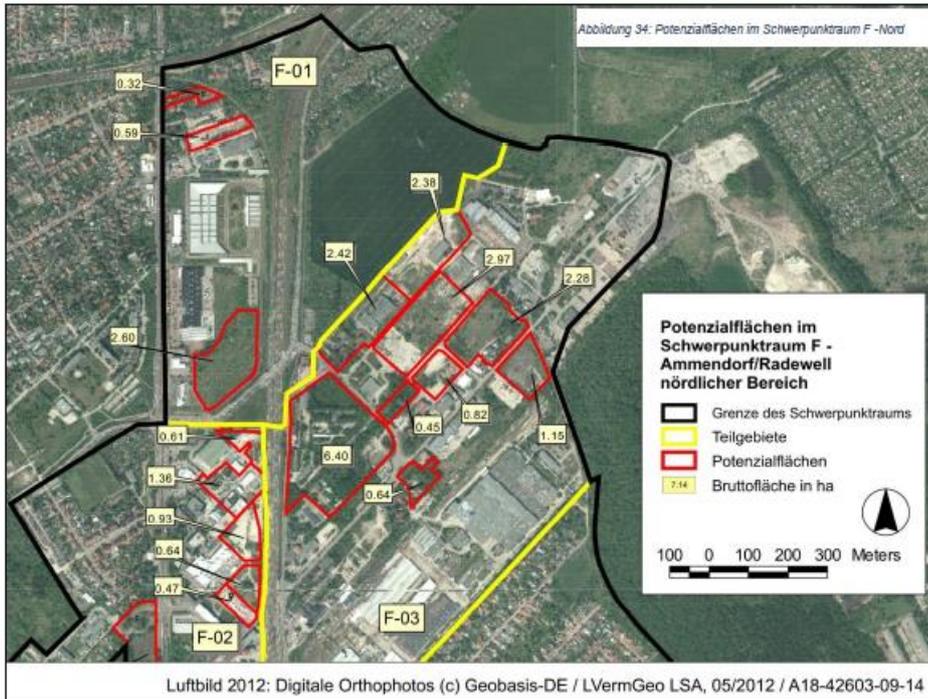


Figure 18: Potential Areas in Ammendorf Northern Part

Source: isw Institute

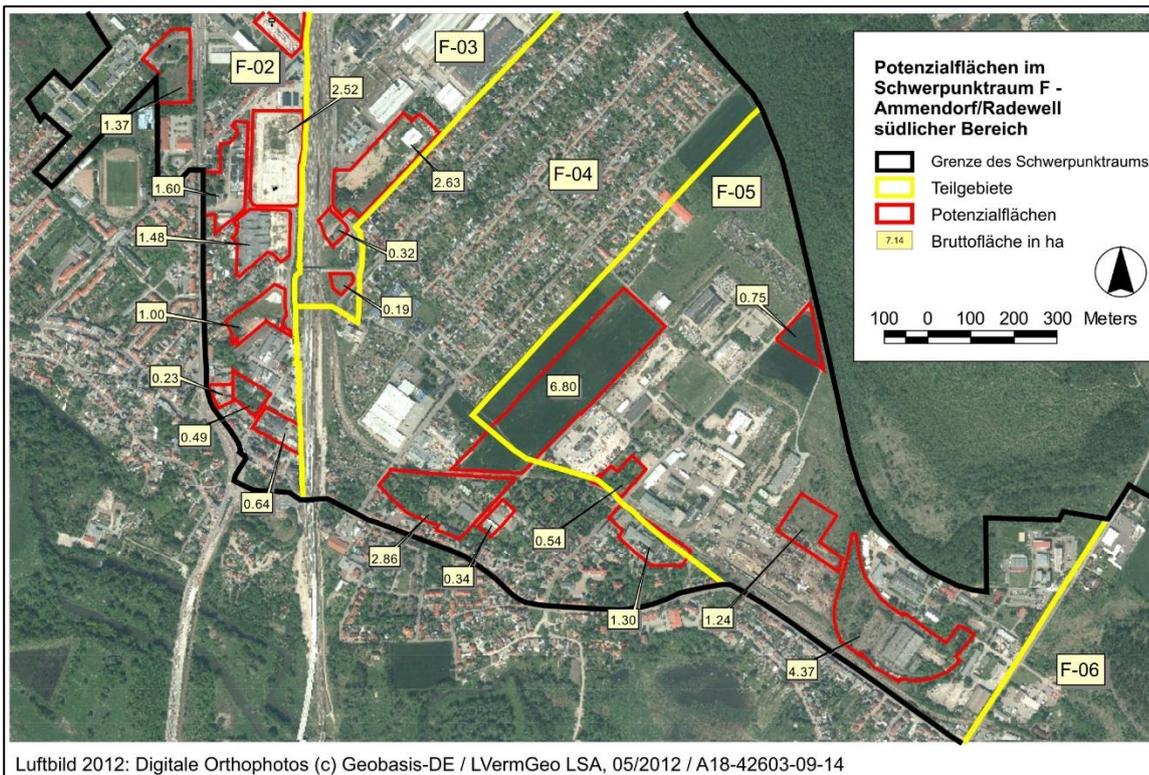


Figure 19: Potential Areas in Ammendorf Southern Part

Source: isw Institute