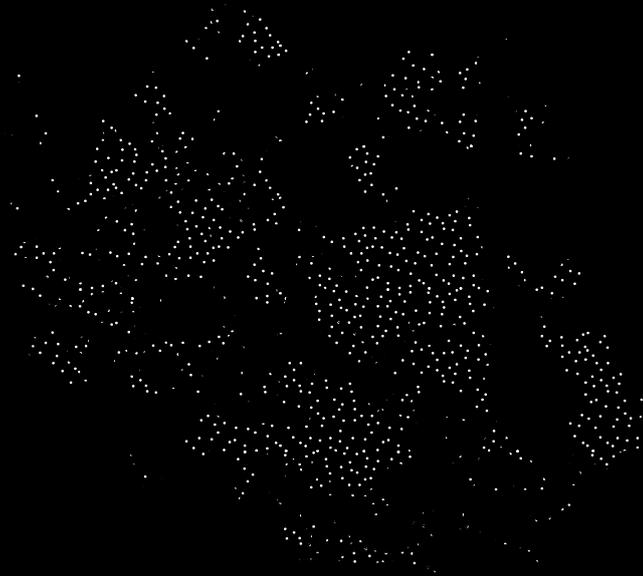


Terraforming

*Reclaiming post-mining territory as an unfinished
laboratory for an integrative transformation*

Research Report

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The Structure

The structure of this work is two-fold. The focus of the first part of the research – Territory: Upper Silesian Coal Basin – is the territorial relationship between the extensive and intensive systems of bituminous coal mining in the Polish part of Upper Silesian Coal Basin (USCB). The territorial research leads deductively to the site of the project intervention in the city of Bytom. The research of the local context and the site was organized in the second part of this work – Site: Bytom.

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“It is in vain to dream of a wildness distant from ourselves. There is none such. It is the bog in our brain and bowels, the primitive vigor of Nature in us, that inspires that dream. I shall never find in the wilds of Labrador any greater wildness than in some recess in Concord.”

Henry David Thoreau
in Journal (August 30, 1856)

Abstract.

We are at the end of the era of coal as a fossil fuel. If we plan to achieve climate neutrality by 2050, the options are limited. The coming end of coal mining rises questions regarding the aftermath of post-mining infrastructure and remediation of their ecological footprint, as mining operations are inherently bound to degradation and deterritorialization of natural systems. Among these systems waterscape belongs to the most affected ones as it is a major obstacle in the excavation of coal.

Since the industrial revolution, the waterscape was subject not only to mining operations, but to mining towns and their congregations in general. Historically, this degradative approach towards water was prevalent in Upper Silesian Coal Basin – the geological region known for the highest concentration of bituminous coal mines in Poland. Recently, as mining operations still proceed, so does the deterritorialization of the natural systems. Fast forward, the waterscape becomes a threat to human life, however, not only because of its excess, but also because of its foreseen shortage. Even though Upper Silesia is being depleted of their most valuable natural resource – water, little is done to remediate the post-mining territory when the water is still at hand.

Thus, this work addresses post-mining territories from the perspective of destructed ecologies. While exploring from the territorial perspective the relationship between the extensive and intensive systems of bituminous coal mining in Upper Silesian Coal Basin in Poland, the research investigates how the extensive mining operations lead to the degradation and deterritorialization of natural systems. As post-mining territories are usually burdened with the decommissioned infrastructure, often carrying unique history and deeply rooted emotional attachment, this research explores the role and operations on post-mining artefacts (systemic architectural intervention) in the process of remediation of not only the environment, but also society and minds.

While investigating the aforementioned extensive systems on the territorial scale, the research arrives deductively at its further architectural intervention site at a decommissioned coal mine in the city of Bytom. Here, from the local perspective the research explores the site-specific conditions among which water management operations of the decommissioned mine constitute an axis for the intervention aimed at the multiscale remediation of the post-mining territory.

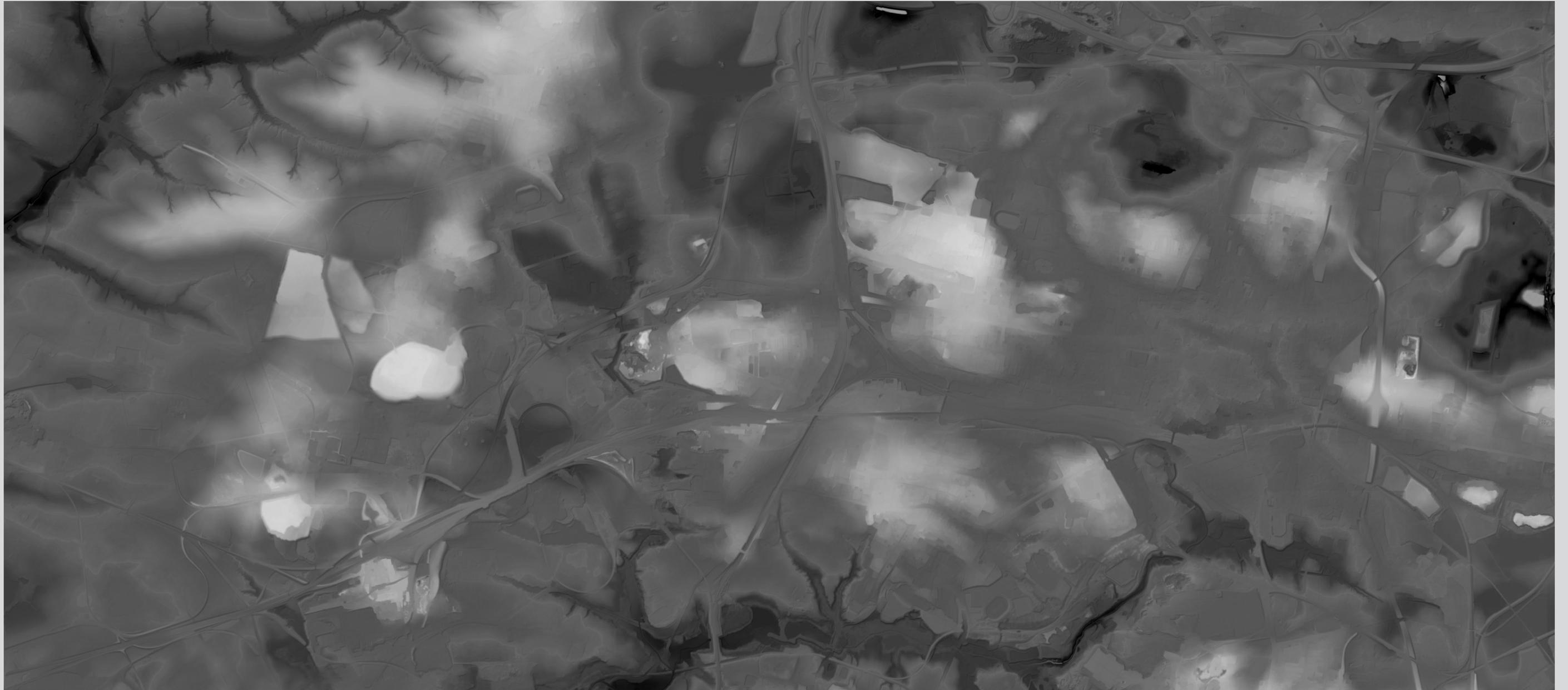
Key words: post-mining / territory / infrastructure / remediation / soil / water

Territory



Upper Silesian Conurbation (Katowice Urban Area)

2 March 2021
Source: NASA



Hypsometric Map, Bytom, Poland

Source: geoportals.gov.pl (2021)



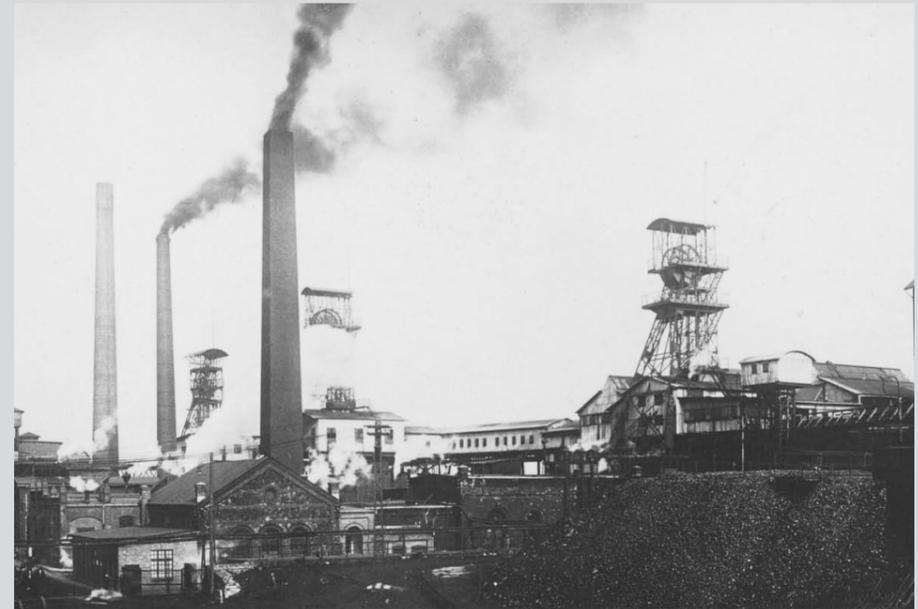
The situatuon of the industry around 'the white spots' on the map reveals that these are the areas of the highest altitude, and at the same time spared by the underground mining operations. It can be seen in this hypsometric map that the land subsidence hardly occurs in these (white) industrial areas.

Unsurprisingly, as mining operations avoided the industry (white), they did not hesitate to avoid drilling directly under the densely-populated urban settlements.



Spoil tip 'Szarłota' in Rydułtowy

Source: dziennikzachodni.pl



Bituminous Coal Mine in Upper Silesia

Old Photo. Beginning of the 20th century.
Source: SBC

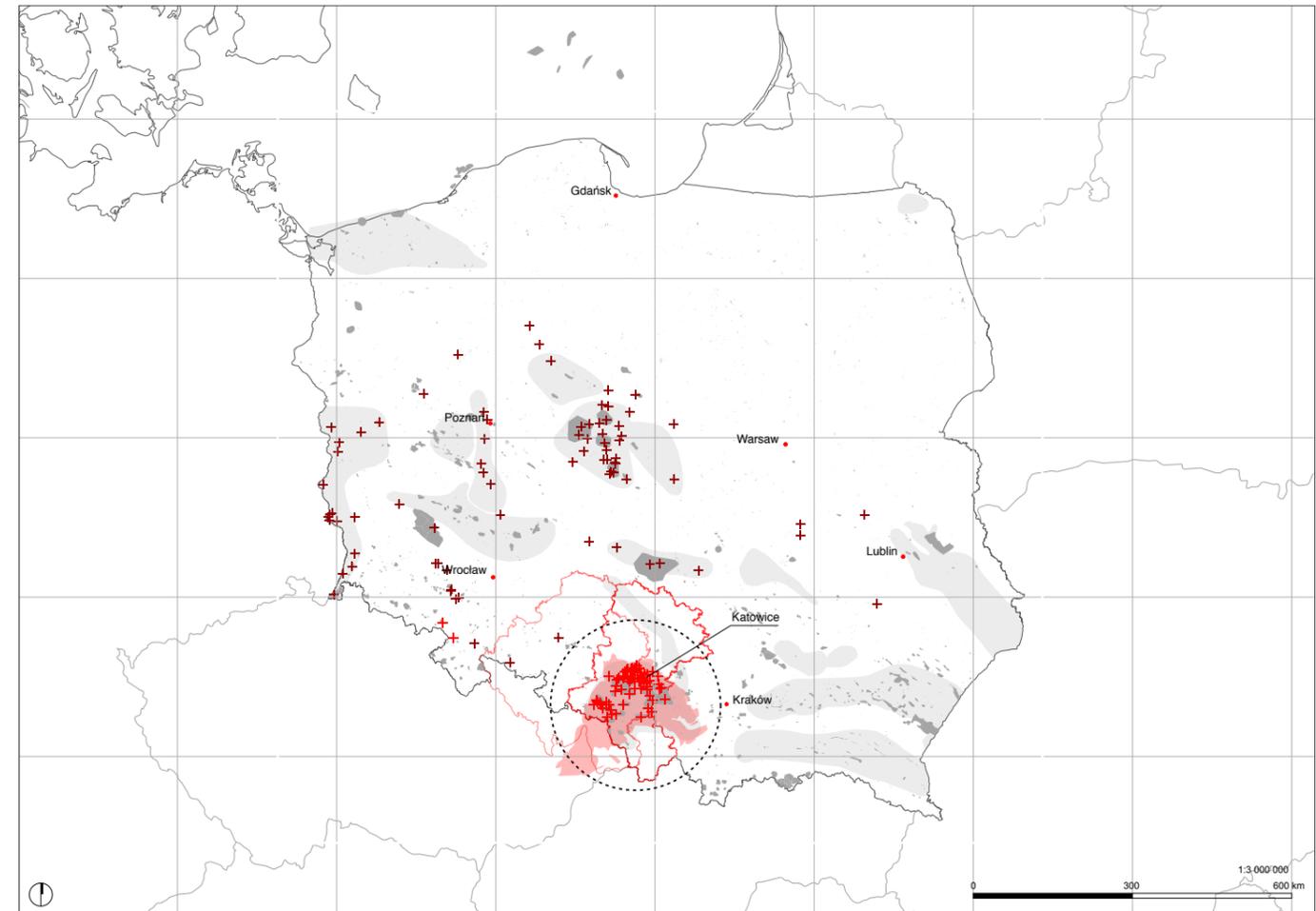
1. Territory: Upper Silesian Coal Basin

1.1. Introduction

Having history rich in heavy industry, Poland has an extensive heritage of bituminous coal mines. If up to this day the remaining mines have not been closed, they await their final closure by 2050. Since the transformation of mining industry in the early 1990s till the end of 2019, over 40 coal mines were decommissioned (Sokołowski et al. 2021, p.6-7). The progressive restructuring of mining industry triggers long-lasting systemic changes, which till this day have shaped not only socio-economic conditions, but also human's place within the degraded post-mining territory.

Since its beginning, the restructuring of mining industry in Poland has been a complex phenomenon composed of multiple factors. On the demand side, these factors are: decline in the demand for coal, the reduction in the GDP energy consumption, unprofitability on the international coal market, tightening of environmental standards and the increase in emission allowance price. On the supply side, these are: deteriorating conditions of deposit exploitation and relatively high costs of access to the untouched coal beds (Sokołowski et al. 2021, p.6-7). All of these layers combined result in the systemic changes whose by-products can be seen as the extensive areas of 'terrain vague', as referred to de Sola Morales. These post-industrial terrains, profoundly affected by the extractivism of man, has long been challenged with rising pollution and deterritorialization of natural systems, among which soil and water belong to the most affected.

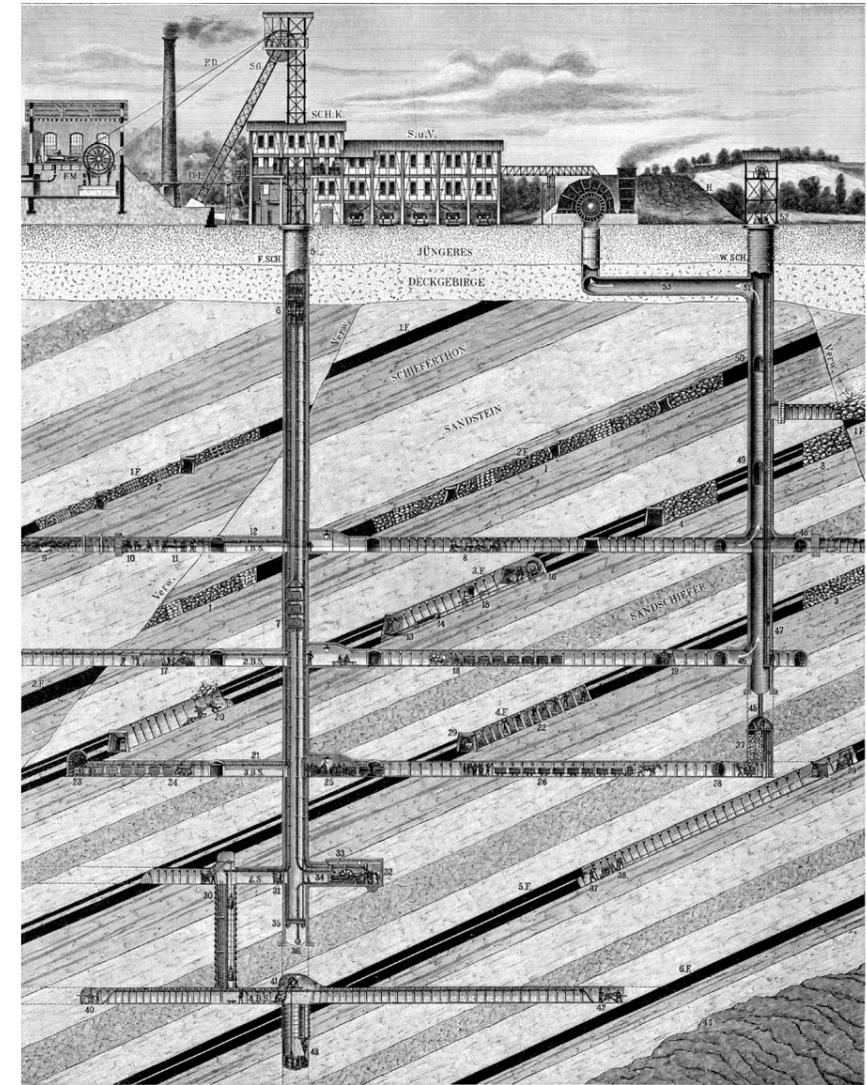
In Poland, the highest concentration of the post-mining territories is found in the south of the country, in the geological region of Upper Silesian Coal Basin, which to great extent overlaps with the geographical region of Upper Silesia, and is known for the oldest and largest mining areas in the country (Dulias 2016, p.3). As this region is facing an ongoing energy transformation, aimed at reaching energy neutrality by 2050, its transformation has resulted in the decommission of mining infrastructure and has long posed questions regarding the multiscale remediation of not only the environment, but society and local mindset.



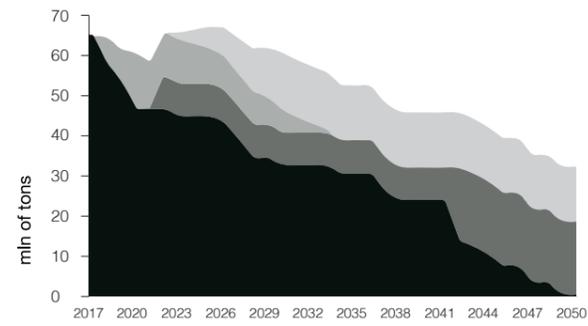
Mining Territories in Poland

Based on geoportals.gov.pl / OSM

- Focus of the Research
- Major City
- Geological Region: Upper Silesian Coal Basin
- Administrative Region: Silesian Voivodship
- Geographical Region: Upper Silesia
- Coal Mining Territories
- Mining Territories (all kinds)
- + Open-pit Lignite Mines
- + Underground Bituminous (Black) Coal Mines



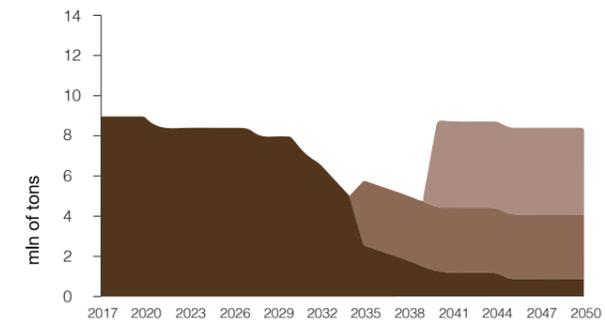
Section through the Bituminous Coal Mine
Old Drawing, Upper Silesia, Poland
Source: Silesian Library



Bituminous Coal
underground mining

Poland: Bituminous Coal Excavation Forecast
Source: Forum Energii

- Existing Mines
- New mines / extended lifespan
- Existing mines - restructuring
- New mines - Silesia



Lignite
open-pit mining

Poland: Lignite Excavation Forecast
Source: Forum Energii

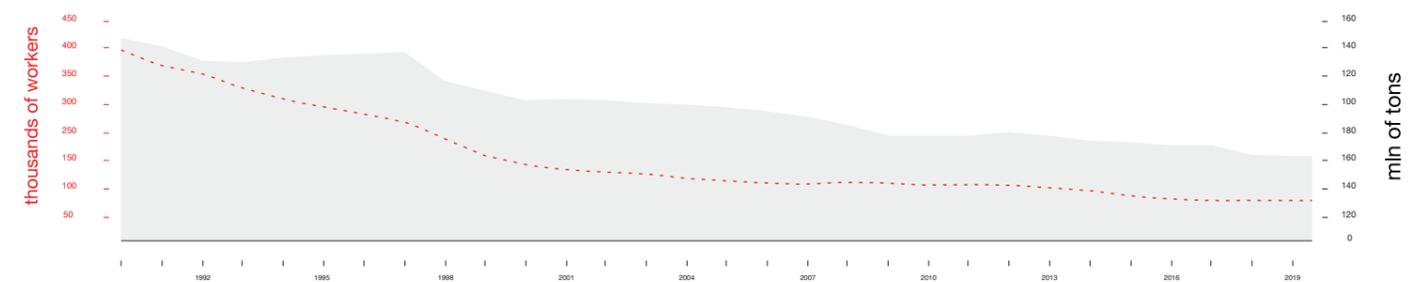
- Existing Mines
- New mines (KWB1)
- New mines (KWB2)

Energy Transition

Coal is a comparatively low-priced fuel whose combustion releases much more CO₂ than the combustion of natural gas or petroleum (Sijmons et al. 2014, p.121). As the taxation on CO₂ emissions in European Union increases dynamically, it causes great pressure on the acceleration of changes in Polish energy supply, thus, contributes to the reduction of employment in the mining sector. Compared to the current employment in this sector, as I write this paper in 2021, in 2031 the employment in the mining industry is currently estimated to be reduced by over 2/3. As the energy transformation in Poland advances since the early 1990, it is estimated that from now on it will accelerate even further triggering changes not only in mining-related industry but in the structure of society (Mazurkiewicz et al. 2021, p.5-6).

In Poland, particularly deep changes in this respect will affect the national center of bituminous coal mining – Silesian Voivodeship, which hosts the majority of the Upper Silesian Coal Basin – the geographical region, and the focus of the research. According to the latest WWF's report *Directions of the Territorial Plan of Just Transition and Development for Silesian Voivodeship* (Mazurkiewicz et al. 2021), replacing coal will further accelerate the development of renewable energy sources, energy storage technologies and other technologies that allow the operation of Polish power system (Mazurkiewicz et al. 2021, p.8).

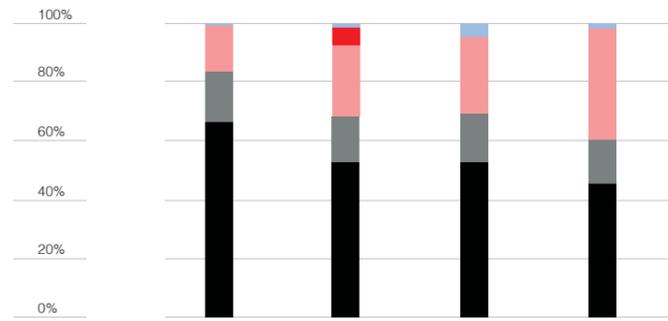
The energy transition is inherently bound to spatial changes, as Dirk Sijmons refers to this phenomenon in his *Landscape and Energy. Designing Transition* (2014, p.11). The introduction of new energy sources requires rethinking the use of space both in size and shape, and leads to remarkable redevelopment of landscape. This redevelopment, as Sijmons (2014, p.17) points out, has a profound influence on both the formal and informal agreements in the transformation-affected areas. The key spatial challenge lies not simply in the introduction of new facilities. Rather, it lies in the reorganization and redevelopment of the landscape ingredients (Sijmons 2014, p.17).



Poland: Employment in the Mining Sector

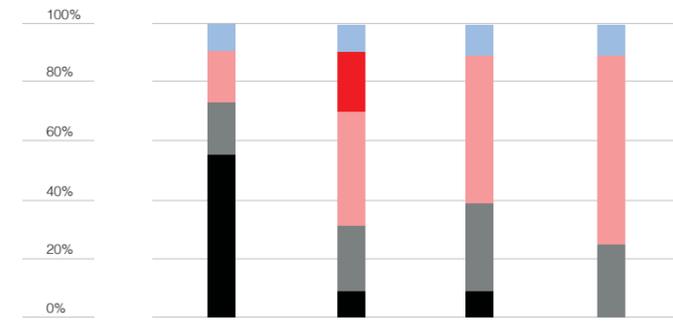
Source: Forum Energii

2030



Scenario 1: Coal
 Scenario 2: Sources diversified (incl. nuclear energy)
 Scenario 3: Sources diversified (excl. nuclear energy)
 Scenario 4: Renewable sources (excl. nuclear energy)

2050



Scenario 1: Coal
 Scenario 2: Sources diversified (incl. nuclear energy)
 Scenario 3: Sources diversified (excl. nuclear energy)
 Scenario 4: Renewable sources (excl. nuclear energy)

Poland: Energy Transition Scenarios

Source: Forum Energii

- Coal-based Power Plants
- Coal-based Cogeneration (CHP)
- Gas-based CHP, CCGT and GT
- Renewable Energy Sources
- Nuclear Plants
- Import

Degradation of Natural Systems

The extensive mining operations lead to the extensive disturbance of natural systems. Through the destruction of the balance in the bedrock, mining operations lead to three co-related forms of environmental changes—geomechanical, hydrological, and biological (Dulias 2016, p.7). As the geomechanical and the biological changes seem to be evident in urban fabric, and follow the examples, such as, streets subsidence, building deformations, seismic events, deforestation (in the case of the biological effects), the hydrological changes, on the other hand, are kept out of sight. Here, the degradation of brooks and rivers into the underground or pipe-based drainage is just one of a few examples of practices aimed at the deterritorialization of natural waterflows in Katowice Conurbation (e.g Bytomka brook in Bytom, Rawa river in Katowice).

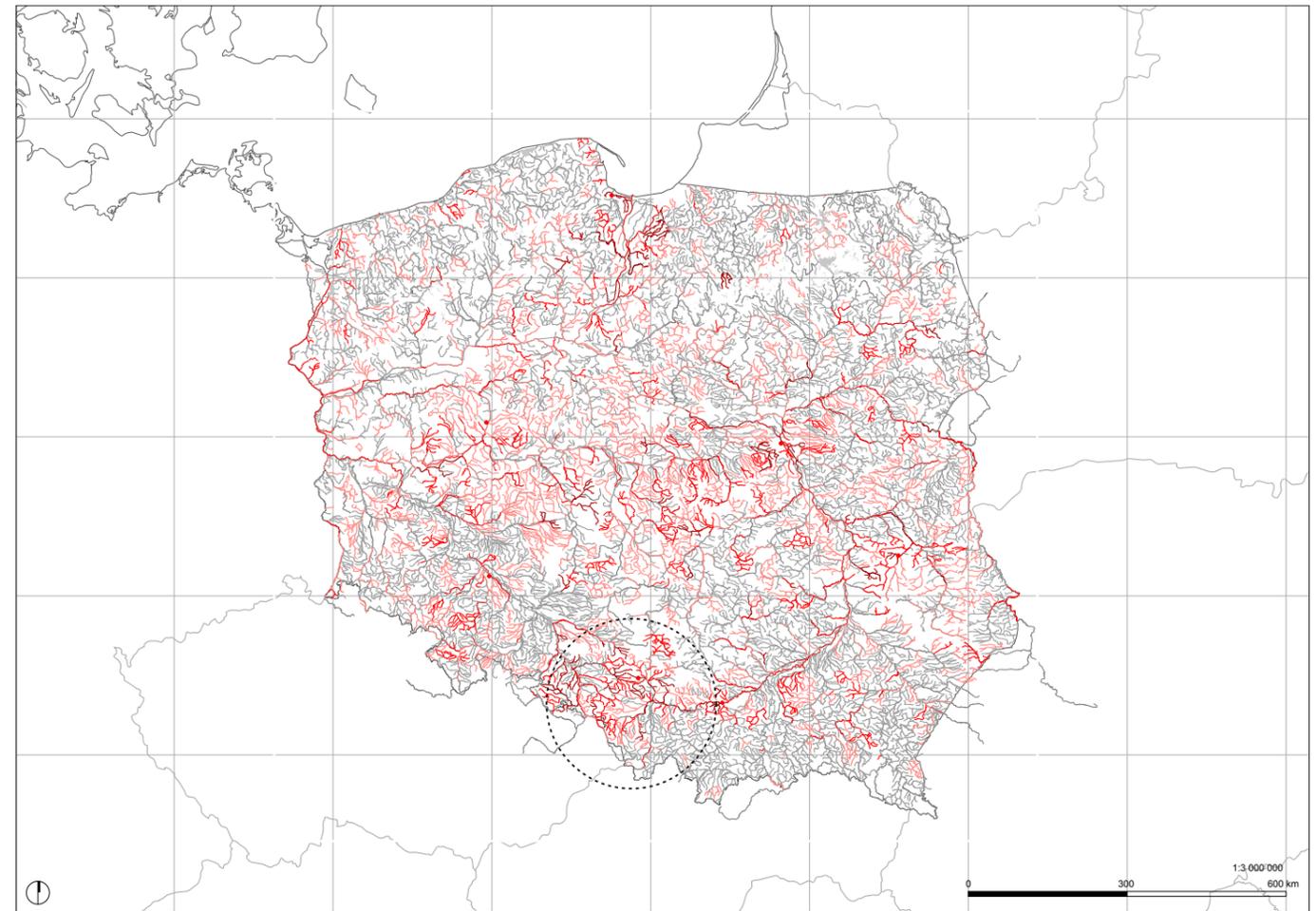
However, the hydrological changes does not concern the terrestrial conditions exclusively. The underground hydrological changes are even more extensive as they influence the groundwater conditions through the discharge of underground (saline) waters – the result of dewatering of the underground mines (Gzyl et al. 2017, p.463). The necessity of dewatering of the underground mines is dependent on the occurrence of the aquifers, which pose a threat to both miners and their mining operations. As a result, the degradation of the aquifers entails systemic side effects, which in Silesian Voievodship concern both the excess and deficiency of water. This, in turn, influences living conditions in the former mining towns (by e.g. floods), as the derailed water system can be hardly predicted.



[1]



[2]

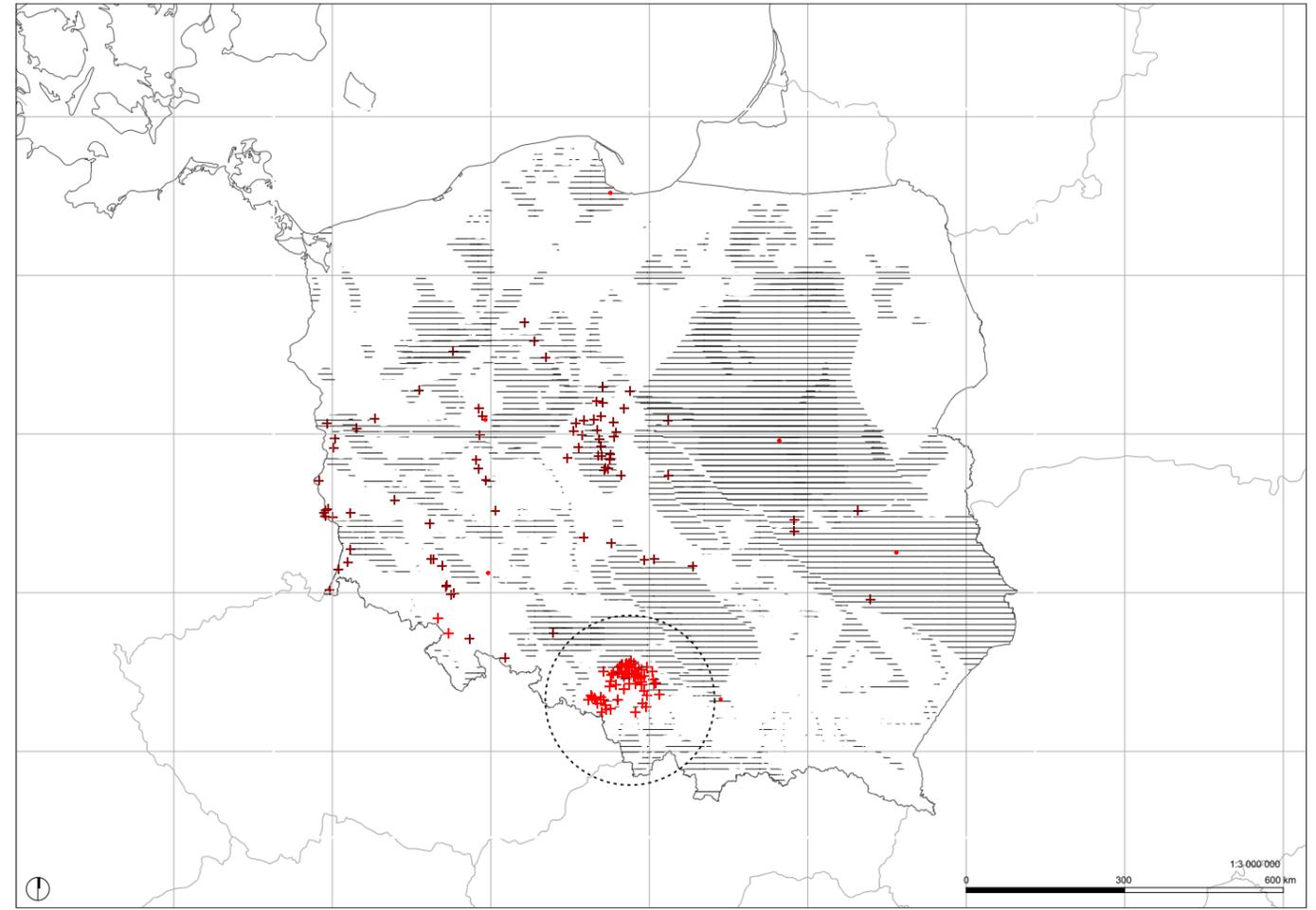


Ecological Condition of Rivers in Poland

Based on OSM / JWPC data

- Focus of the Research
- Major City

- Ecological Condition of River:
- *Bad*
 - *Poor*
 - *Moderate*
 - *Better than Moderate*



Groundwaters in Poland

Based on OSM / JWPC data

- Focus of the Research
- Major City
- ▨ Range of the Groundwaters
- + Open-pit Lignite Mines
- + Underground Bituminous (Black) Coal Mines

1. Territory: Upper Silesian Coal Basin

1.5. Focus Point

The approach

The approach to the redevelopment of the post-industrial terrains can be influenced by multiple theories which assign different position of human to the revitalized space. This position may vary from ecocentric to anthropocentric. While in the past the industrial infrastructure accelerated the degradation of ecosystems, in recent days it passively hosts, among others, museums, music venues, or memorials of anthropocentric past. Recently, as the anthropocentric approach is prevalent, it results in the ‘disneylandization’ of former mines, which amplifies the dualistic divergence human vs. nature. The lack of the proper consideration of the ecocentric approach results in the fact that not enough attention is paid to introduce the ecocentric interventions aimed at joint remediation of post-mining landscape, infrastructure and human habits. Though the necessity of these interventions might be obvious, there is not enough emphasis on the fact that they are conditioned by the state of the waterscape, which is constantly deteriorated by active mining operations.

Post-mining infrastructure

The restructuring of mining leads to the prolonged process of decommissioning. If a coal mine reaches its ‘expiry date’, its decommission follows multiple steps aimed at reducing, securing and abolishing both the terrestrial and subterrestrial infrastructure. In some cases, however, the terrestrial artefacts of peculiar historical values are preserved. In others, while preserved, they are transformed into the regional water management stations. Regardless of conditions underlying the preservation, this process is usually poorly planned and inherent with prolonged decay of the post-mining artefacts.

The rapid process of the demolition of the terrestrial post-mining artefacts in Upper Silesian Coal Basin results in a pitiful loss of artefacts of peculiar historical and emotional values. At the same time, little is done to consider the multiple redevelopment operations that could be projected onto the post-mining artefacts. Some of these operations could lead to their new remediation-based functionality, hence, their preservation under the altered function. Some, on the other hand, to the recovery of the material from the necessarily demolished infrastructure.

Compared to Germany’s major coal mining region, Ruhr valley, Poland lacks a regional program for structural changes in terms of ecological, social and cultural spheres of post-mining territories. In macro scale, the existing remediation interventions to post-mining territories are point-based, and do not constitute a systemic strategy of a regional impact. In micro scale, these interventions (if exist) do not go beyond one field of influence, thus, they are not integrative nor multiscale. They do not integrate the necessary maintenance operations (e.g. water management station) with the on-site remediation of environment (through for example phytoremediation) and social sphere (through the contextual programming of space). Little is done to integrate, little is done to remediate.

1.4. Research Question

How to approach integrative transformation through active reprogramming of soil and post-mining infrastructure in the light of the alternative form of economy?

Sub-questions:

Region: *What is the relationship between the extensive systems underlying underground mining activities?*

Ensemble: *Under what conditions and with what effect do the extensive systems underlying mining activities materialize in the form of the post-mining artefacts?*

Artefact: *How to approach values and the relationship between the artefacts co-creating mining infrastructure?*

1. Territory: Upper Silesian Coal Basin

1.5. Theoretical Reflection

My theoretical reflection begins with the attempts to define the notion of 'landscape', as the transformation of landscape is a large-scale spatial consequence of mining operations. Contemporary landscape thinkers such as James Corner frame this notion as a cross-disciplinary spatial medium following multiple explanations, perceived as active rather than passive space. While considering Corner's multiple attempts to clarify the recent perception of landscape, one may conclude that proper understanding of this notion follows the recognition of its plurality. In his essay 'Recovering Landscape as a Critical Cultural Practice' James Corner argues that landscape is 'an idea that is neither universally shared nor manifested in the same way across cultures and times; its meaning and value together with its physical and formal characteristics, are not fixed' (Corner 1999a, p.5).

Apart from the plurality of meanings, the discourse presented in 'Recovering landscape' is opposed to the modernist recognition of landscape as an Arcadian, untouched wilderness. In his essay, Corner proves that landscape has long been stigmatized as an idyllic counterpart to the built environment. This image, constructed by media on nostalgia, has been present in culture ever since the end of IIWW (Corner 1999, p.8). While on one hand it rightly summons to protect the natural environment from the destructive power of man, on the second it deepens dualistic divergence between culture and nature. In literature, absurdity of this division has long been studied, among others, by Donna Haraway, an author of 'A Cyborg Manifesto' who in response to the dualistic perception coined the transcendent term of 'nature- culture'. Similar conclusions were presented by Gregory Bateson, an English anthropologist, linguist, and cyberneticist, who in 1972 his 'Steps to Ecology of Mind' derived the human-nature divergence from Darwin's falsely posed 'unit of survival' – species vs. species (Bateson 1972, p.491).

As environmental atrophy was finally proved in the late 1970s, the concept of the landscape became a battlefield for advocates of diverse and contradictory ecologies. Followers of inter alia resourcism, deep ecology, or ecofeminism began to argue over the right approach towards nature (Corner 1999, p.14). Among them, Bateson stood out as a figure who laid the foundation for a progressive model of ecologies linking three scales of mind, society, and environment. His model was later advanced in hands of Felix Guattari, French poststructuralist theorist known for his collaboration with Gilles Deleuze. Once again, in Guattari's philosophy of 'ecosophy' it is possible to find a kind request to mankind to halt and reorient the detachment of culture from nature. In this matter, Guattari states that 'now more than ever, nature cannot be separated from culture; to comprehend the interactions between ecosystems, the mecosphere and the social and individual Universes of reference, we must learn to think 'transversally' (Guattari 1989, p.43). Thus, Guattari's transversal understanding of ecologies leads me to his multiscalar model of three ecologies interlinking the scales of mind, society, and environment.

As Three Ecologies depict a way of multiscalar understanding of reality, they do not focus on processes occurring in space. In this matter Guattari's individual work guides me towards his collaboration with Gilles Deleuze, and their 1991 book 'What Is Philosophy?' where they develop a philosophical approach of 'geophilosophy' by emphasizing the concept of space as such over the subject-oriented phenomenological space.

According to their 'geophilosophy' thoughts are not present on the line subject – object, rather 'thinking takes place in the relationship of territory and the earth'. Their position is akin to Husserl's who appeals for ground for thoughts. However, Deleuze and Guattari depart from his position on the stability and permanence of earth. Rather, they notice that earth constantly undergoes processes of deterritorialization and reterritorialization that underlay thinking processes (Deleuze and Guattari 1994, p.84). In what follows they perceive earth and territory as two pieces of the same indiscernible equations – deterritorialization (from territory to earth) and reterritorialization (from earth to territory) (Deleuze and Guattari 1994, p.86). This understanding channels my perception of mining operations as complex process of a multiscalar impact (affecting the scales of mind, society, and environment) that undergoes constant territorialization and deterritorialization as the same applies to the conditions that trigger these processes.

1. Territory: Upper Silesian Coal Basin

1.6. Methodological Reflection

Project's research framework is based on the theory of Ecosophy by Felix Guattari. This philosophy lies a foundation for the key lens, which I use both to organize and categorize methods according to the scales of mind, society and environment. These scales are projected onto the triangulation of the corresponding categories of methods. Thus, the methodology of the research is based on this triad: mind follows ethnographic, society follows demographic/economic and environment follows cartographic/ecological techniques of research.

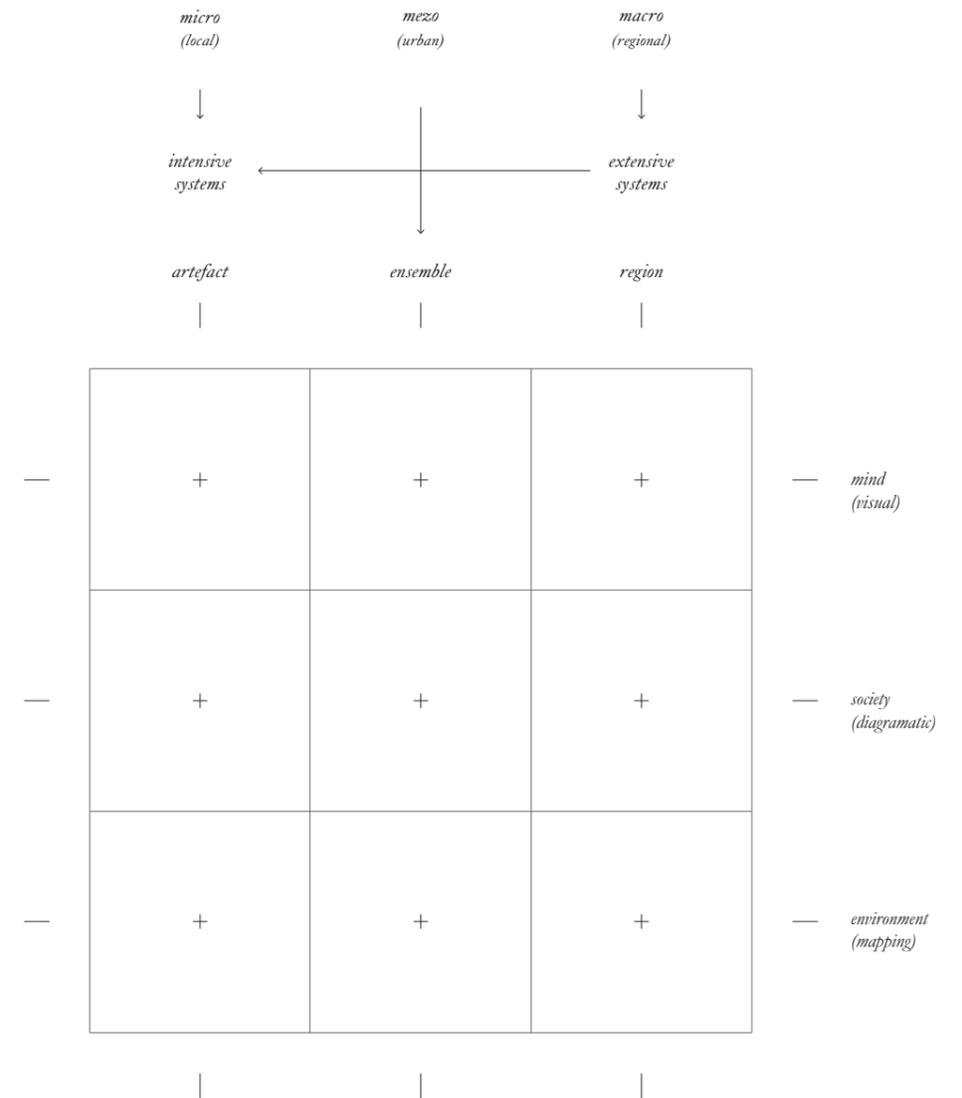
Further, the mentioned three categories are interlinked with the macro, meso, and micro-scales, which enable reflecting upon a multiscale approach to architecture at the intersection of these scales. Consequently, my approach considers both deductive and inductive methods, which aim to characterize on one side the "extensive systems" and on the other "the intensive ones".

Among the mentioned categories, I give the techniques of mapping (cartographic methods) a special attention as I use it to coordinate, organize, process, and illustrate the key spatial, geological, economical and morphological findings. Through correlations of quantitative and qualitative data, I use it to draw topological and typological links to depict not only the present state but also the state of "becoming." Further, mapping serves as an analytical tool, which allows for, inter alia, layering, addition, subtraction, exclusion and zooming. Apart from mapping, other research methods include the interview of the ethnographic methods, and secondary data analysis of the demographic methods.

The field study encompasses a range of direct methods which fall under the categories of ethnographic and demographic methods. These include, inter alia, site survey, direct observation, qualitative interviews, participant observation, and the analysis of documents and other information relevant for research.

1.7. Framework: „Cartographies of Research” .

As in the project, there is a strong link to geography, the most significant research method, cartographies, is drawn from deleuzoguatterian philosophy and guattarian three ecologies interlinking the scales of mind, society and environment. This use of scales is based on the necessity of a multi-scalar approach where the project defines its intervention strategy on a multi-disciplinary ground. As the research considers a multiscale approach to reading architecture, I connect the scales of mind, society, and environment with the spatial scales of micro, mezzo, macro. As a result of this connection, I arrive at the key diagram titled 'Cartographies of Research', which helps to navigate the research.



Cartographies of Research

1. Territory: Upper Silesian Coal Basin

1.8. Multiscalar Analysis

1.8.1 Region

Subquestion 1:

What is the relationship between the extensive systems underlying underground mining activities?

The Growing Demand.

The history of Upper Silesia reveals that within a century, this dense-in-forestry peripheral region became one of Europe's largest industrial centers (Długoborski in Pietrzak-Pawłowska 1970, pp.110-112). Despite the terrestrial traces of coal, repeatedly encountered by the locals, the exploration and demand for this precious material had long been negligible. Thus, for centuries, coal resources situated beneath the Upper Silesian topsoil remained barely touched. This was due to the fact that until the late 18th century the main energy resource was found in widely available timber, which supplied in the omnipresent woods, was used both as the energy and construction material (Frużyński 2012a, p. 31). This changed in the latter part of the 18th century when the timber demand of the expanding industry exceeded the shrinking supply. Thus, timber prices spiked, and the emerging heavy industry was forced to consider another potential energy resource (Długoborski in Pietrzak-Pawłowska 1970, pp.110-112). Once the timber was close to be depleted, human was forced to excavate coal to meet the still increasing energy demand.

This demand coincided with the end of the Seven Years' War (1756-1763), which left the region in a very poor condition. Administered by the Prussian state, in 1767 both Upper and Lower Silesias were discovered to be the regions strategic for the mineral resources and reconstruction of the Prussian state from the war damage (Frużyński 2012a, p. 34). To achieve that, the local metal ore industry required the structural transformations and the priority of capitalist-type enterprise (Długoborski in Pietrzak-Pawłowska 1970, pp.313). In 1769 a pioneering law was introduced to foster coal exploration by unifying the legal regulations and subordinating the existing mines to the authorities. As it was in the state interest to maximize the excavation of black coal, the new law granted anyone the right to undertake mining activities. Further, a state privilege was published, and guaranteed personal exemption from serfdom, military service, and taxes for miners (Frużyński 2012a, p. 35-36). Thus, it was the first time in the area when the personal freedom was entangled with extractivism. It was also the first time (1769) extractivism was systematized into a legitimate regular enterprise (Frużyński 2012b, p.17).

Soon, seeking for coal beds became a prosperous, yet hazardous profession burdened with a significant risk. The parallel increase of industrialization, coal demand, and forming of coal-driven human assemblages resulted in the increasing number of workers scattered across the fields of Upper Silesia. It was no later than 1778 when the 'Aid for Coal Mining' was established providing the funds for the construction of infrastructure (e.g. roads, tunnels), mining towns, and mining schools (Frużyński 2012a, p. 37). Hence, the search for the invisible commodity became a driving force in the urbanization of the previously rural areas.



Panorama over a Silesian town, 18th century

Source: : igrek.amzp.pl (author unknown)

Emerging Identity

'Silesia like a fairy tale: people immersed in the rituals of work and struggle, pragmatic and romantic, proud and natural; black country of coal shafts and heaps where the principal values of family, homeland and meaning of life were perfectly preserved'

(G. Stachówna in Kadłubek & Kunce 2007, p. 208)

The emergence of first mining towns resulted from the formation of human assemblages driven by the junction of extractivism and the early capitalist enterprises. These assemblages depended on the periodicity of labor and underlaid by the same repetitive socially-inclusive activities led to the formation of a local tradition around the mining infrastructure. This, recently unquestionable, tradition arose thanks to the successive generations that worked and died around the mines reinforcing the image of mine's sacrum among the fields of the Upper Silesian landscape.

Soon, mines with their skyscraping shafts and ground scraping galleries became the new mechanic cathedrals of Upper Silesia, if referred to in Le Corbusier's *When Cathedrals Were White*. Mine served as a parent company, a life-giving and life-taking force, an attractor on a regional labor map, the provider of a stable life, steady income, and high social status. As a labor center, the mine stood as the central point and a landmark within the urban settlements. Furthermore, the mine served as a cityscaping mechanism - a trigger for construction (e.g worker's housing estates, schools, leisure, social facilities) and deconstruction (e.g. in the face of mining damage) of urban fabric (Frużyński 2012b, pp. 10-11).

If regarded through Lewis Mumford's lense of the megamachine, mine stood as a mechanic system organizing labor and urban life as its extensive influence spread far beyond its material location. The organization of labor tied to the specific mining artefacts and activities laid the foundation for the rituals, superstitions (e.g prohibition of swearing during the underground operations), and fairy tales (e.g about a ghost the guardian of the underground treasures).



[1]



[2]



[3]

1.8. Multiscalar Analysis

1.8.2 Ensemble

Subquestion 2:

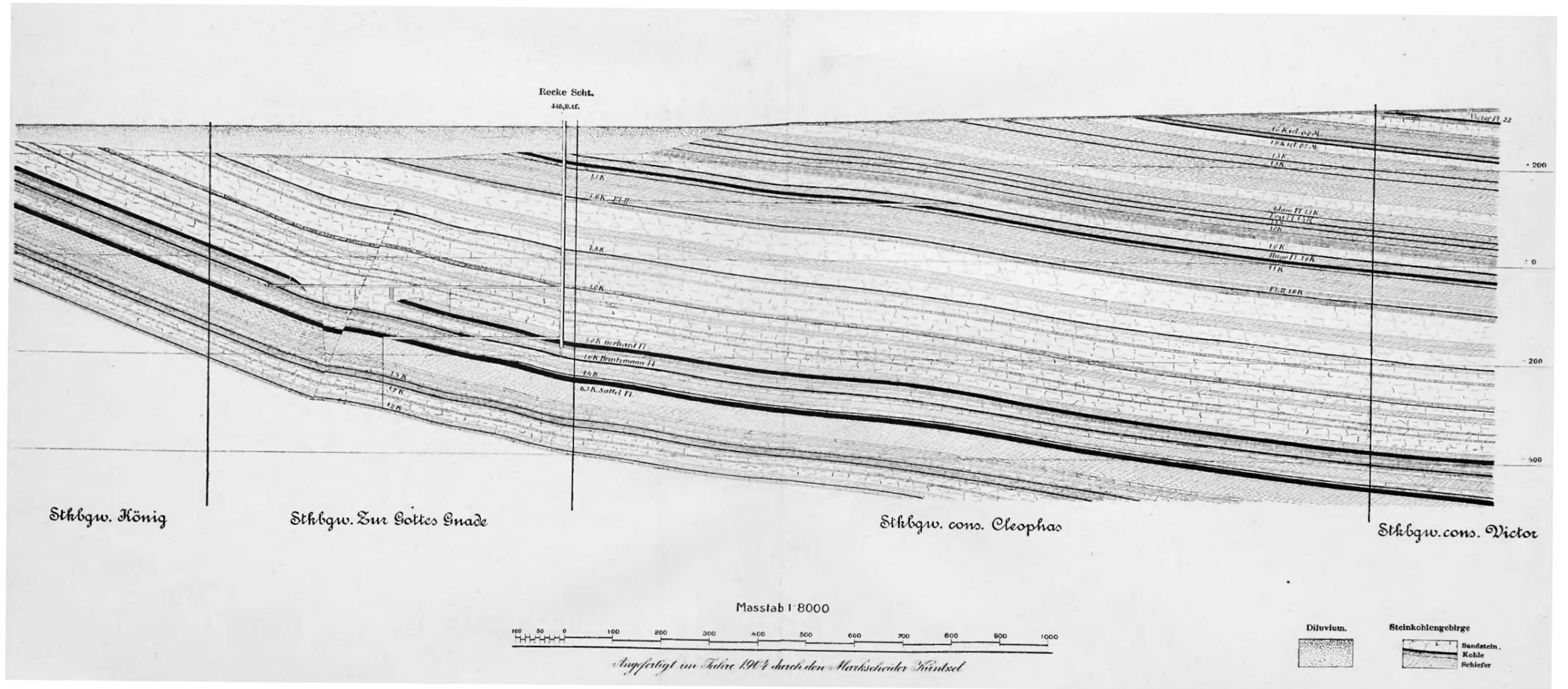
Under what conditions and with what effect do the extensive systems underlying mining activities materialize in the form of the post-mining artefacts?

The Critical Bet.

The topsoil, visible with a naked eye, carries the traces of the underground world. As these traces, black and flammable, have always been encountered in the region, they were long omitted as timber met the energy requirements alone. However, once this fragile equation became no longer valid, the emerging heavy industry raised their eyes towards the traces of the forgotten black commodity encountered among the Upper Silesian fields. These topsoil traces of strata served as the approximation of the conditions for the construction of the architectural artefacts – the exploration shafts – small vertical tunnels used for the underground exploration of coal deposits. These objects prioritized the section as the method of investigation. Here, sampling strata was the main objective to find the most promising location for the establishment of the mining infrastructure.

Once the industrial revolution expanded in Upper Silesia, the Upper Silesian territory became covered with the temporary exploration shafts. From the architectural perspective, what is recently visible, is just the effect of the former exploration, what is not, is the territorial scale of the exploration which led to the establishment of mines in their locations. Here, it is relevant to note that the choice of these locations was merely based on the most promising premises of the existence of the coal beds. Further, to certain extent, mine's location was based on the approximation if we consider the high insecurity of the underground conditions or the lack of knowledge in the underlying rock formation. Thus, from the very beginning of its existence, the mine was burdened with a risk that evolved in time with the expansion of the mine.





Geological Section
 Coal Beds Exploration in Silesia, 1904.
 Source: igrek.amzp.pl

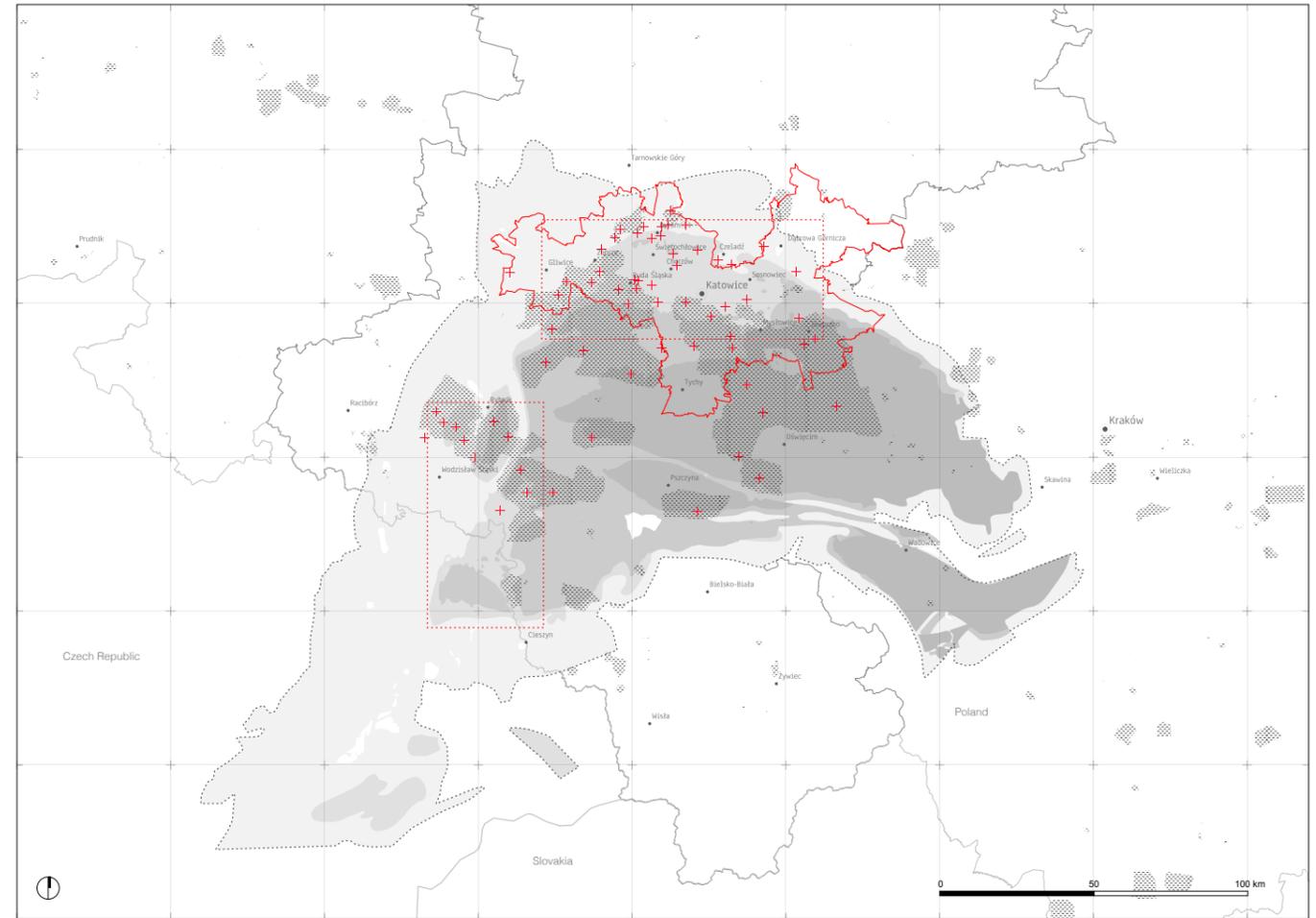


Transects
Coal Beds Exploration in Silesia. 1902.
Source: igrek.amzp.pl



Katowice Conurbation

(above)
Source: onet

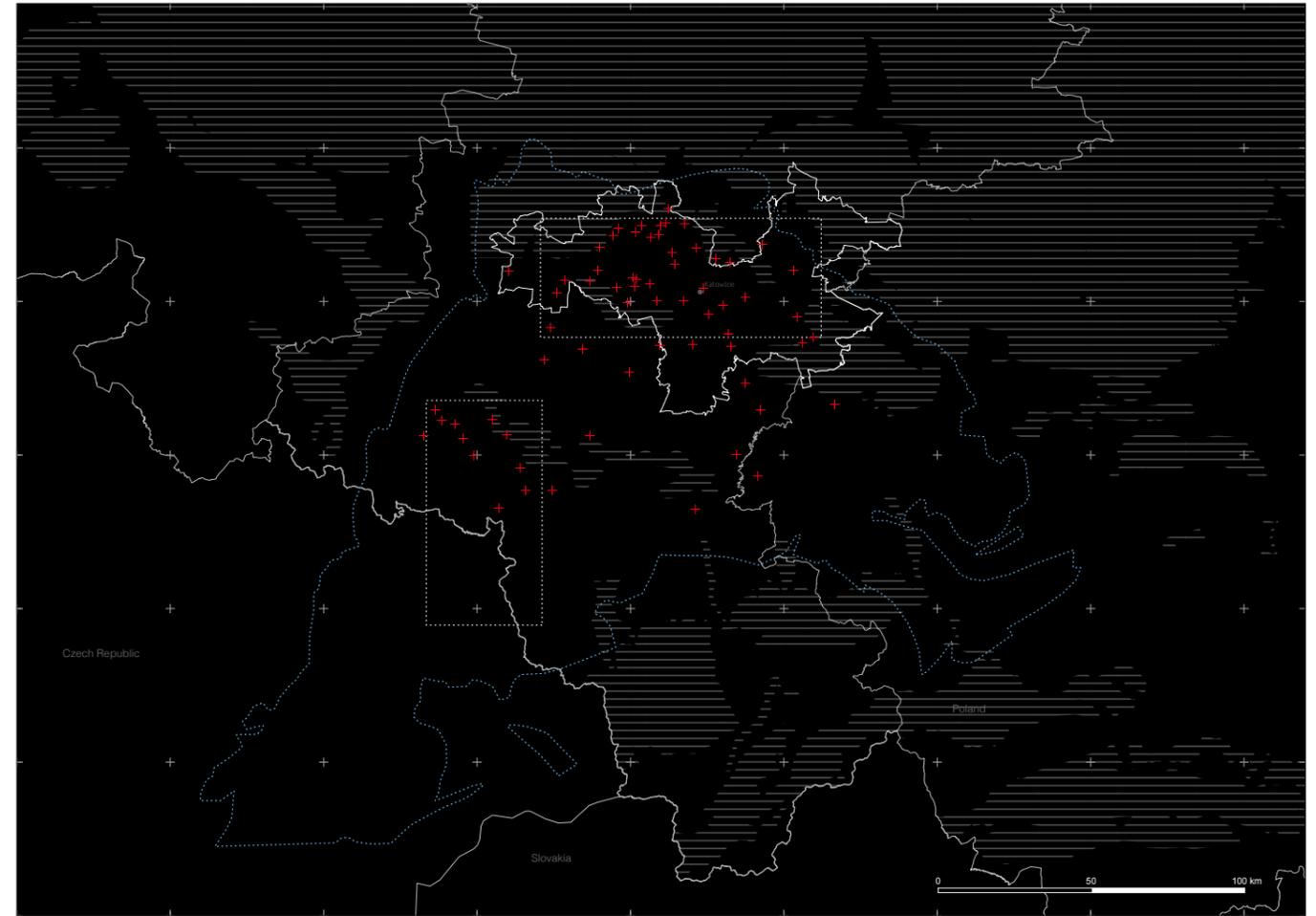


Geological Series and the Distribution of Urban Settlements

Based on geoportal.gov.pl / OSM data

- Katowice Conurbation
- - Upper Silesian Agglomeration
- - - Geological Region: Upper Silesian Coal Basin
- Major City

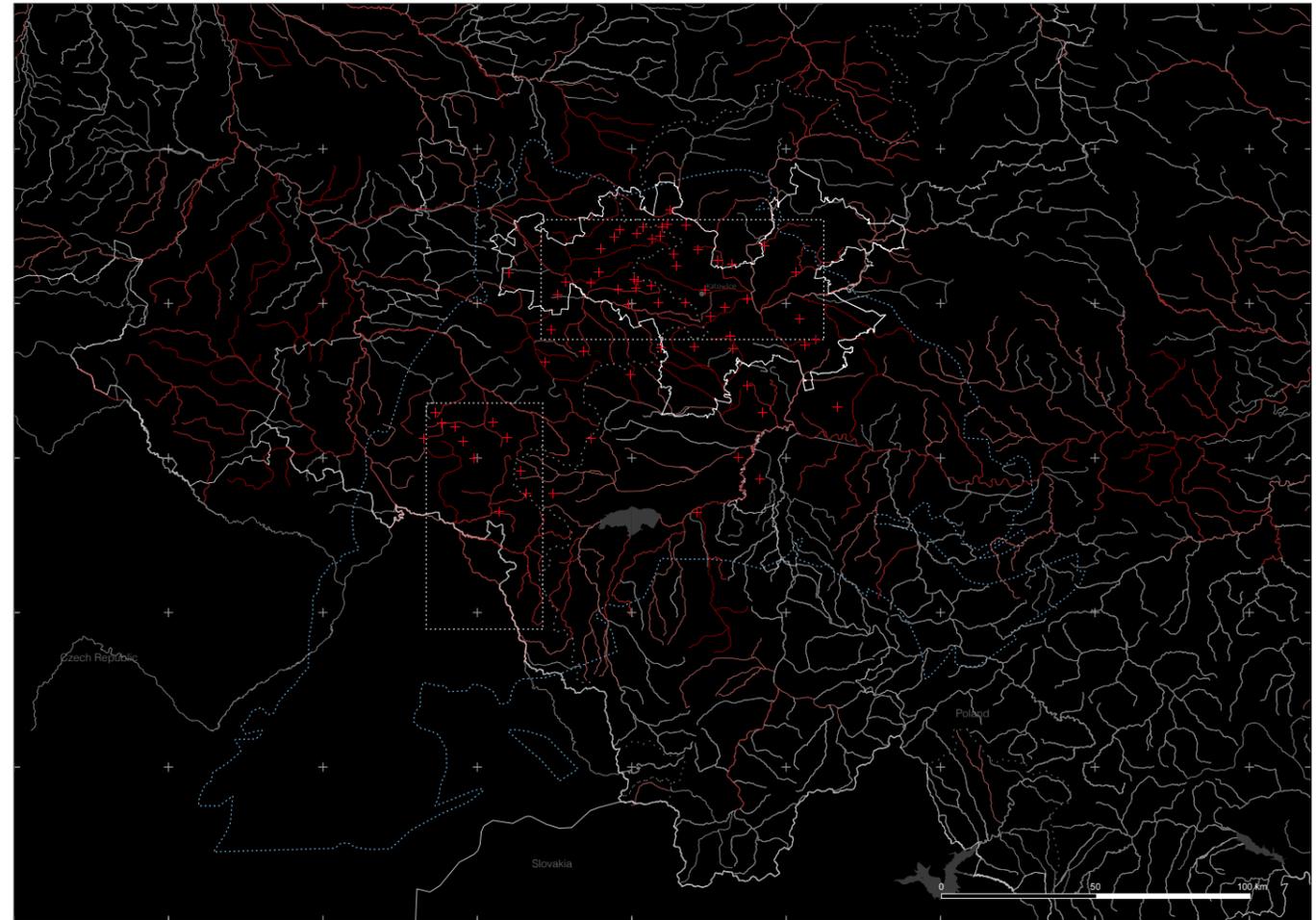
- Geological Series:
- Cracow Sandstone
- Mudstone
- Upper Silesian Sandstones
- Paralic
- + Open-pit Lignite Mine
- + - Underground Bituminous (Black) Coal Mine
- ||| Coal Mining Territories



Distribution of the Urban Settlements / Groundwaters

Based on geoportal.gov.pl / OSM / JWPC data

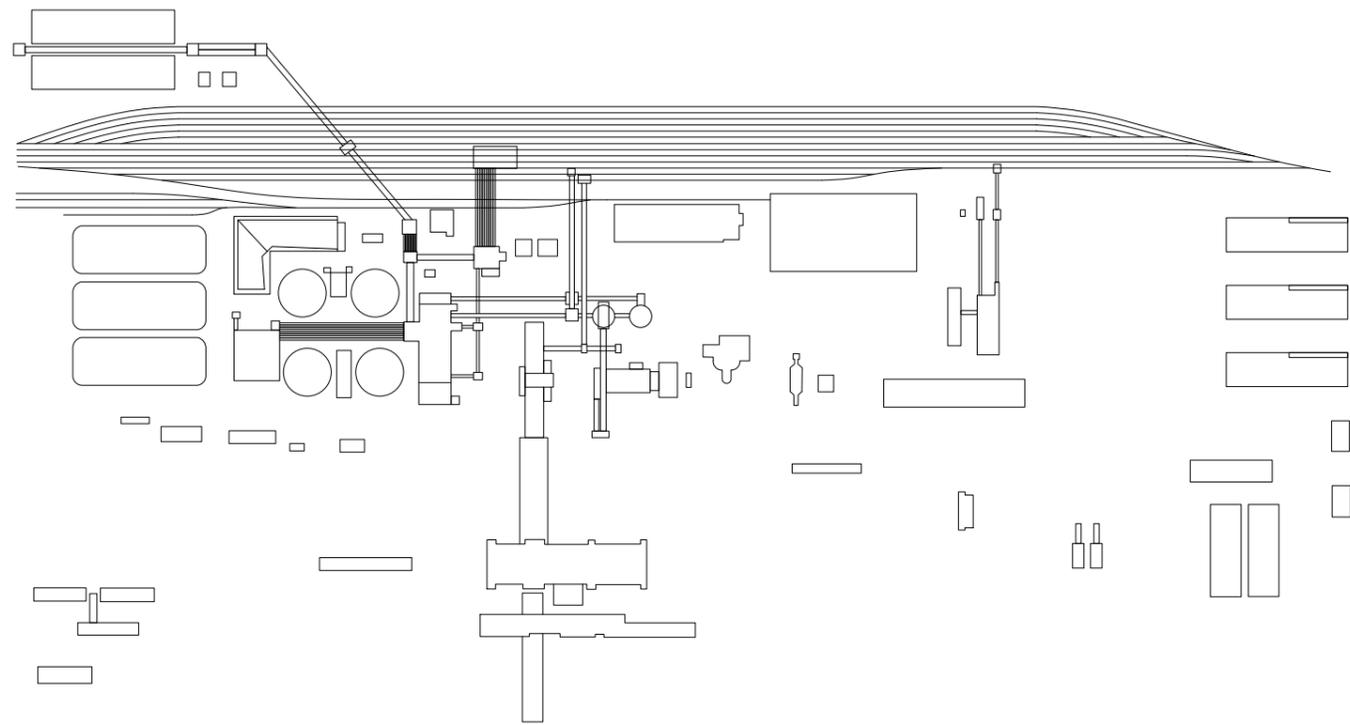
- + Katowice Conurbation
- Upper Silesian Agglomeration
- - - Geological Region: Upper Silesian Coal Basin
- ▨ Groundwaters
- + Open-pit Lignite Mine
- + Underground Bituminous (Black) Coal Mine
- International Border
- - - Concentration of Urban Settlements and Mining Operations



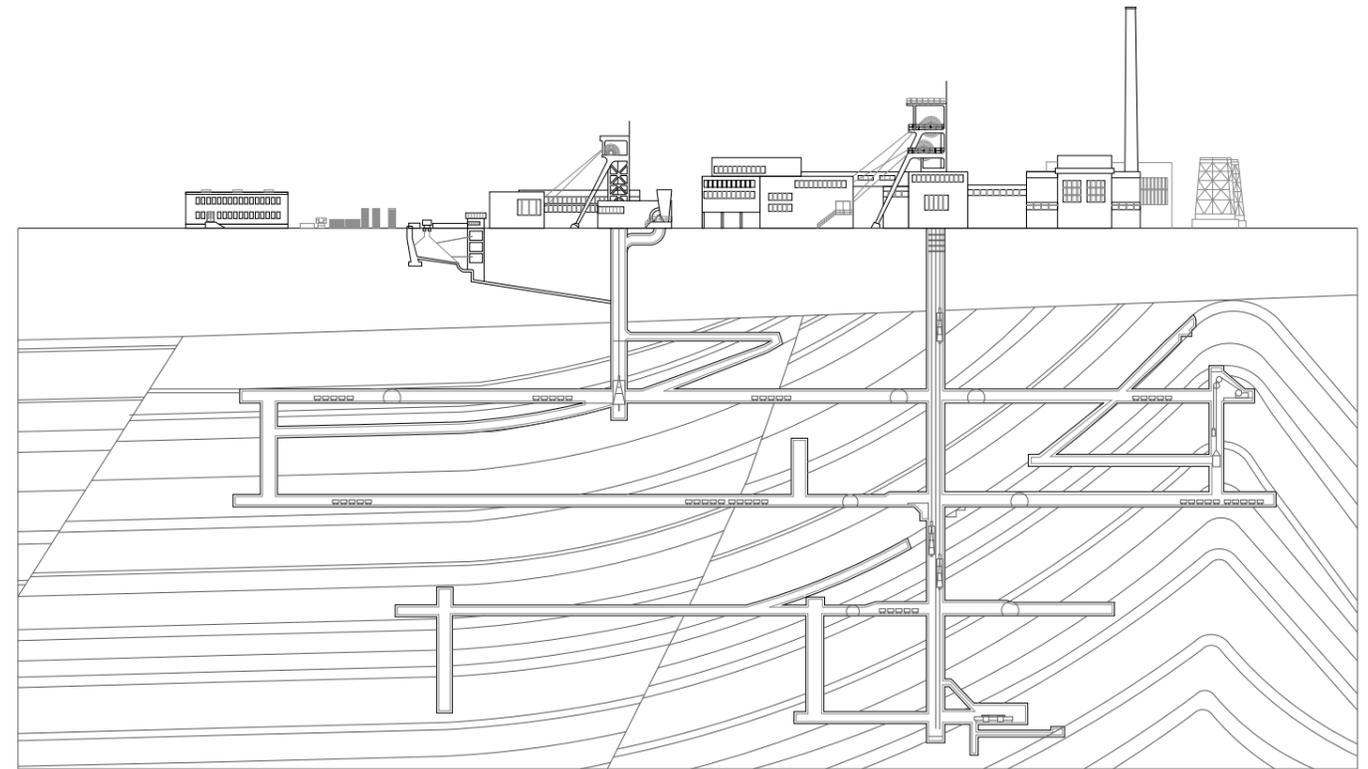
Distribution of the Urban Settlements / Surface Waters

Based on geoportal.gov.pl / OSM / JWPC data

—	Katowice Conurbation
—	Upper Silesian Agglomeration
—	Geological Region: Upper Silesian Coal Basin
≡	Groundwaters
+	Open-pit Lignite Mine
+	Underground Bituminous (Black) Coal Mine
—	International Border
—	Concentration of Urban Settlements and Mining Operations
Ecological Condition of River:	
—	<i>Bad</i>
—	<i>Poor</i>
—	<i>Moderate</i>
—	<i>Better than Moderate</i>



Plan of an Underground Coal Mine
 author's drawing based on kwkmcinec.pl



Section through the underground coal mine
 author's drawing based on (Frużyniski 2012a)

1.8. Multiscalar Analysis

1.8.3 Artefact

Subquestion 3:

How to approach values and the relationship between the artefacts co-creating mining infrastructure?

Old miners used to say that the whole concept of a mine can be summarized as the great production line aimed at moving coal from the bottom to the top. Anything that stood on this line was to render this process more efficient.

Despite its accuracy, this comparison overlooks the plurality of meanings embedded in the word *mine*. In the region *mine* stands for much more than the precise assemblage of the consecutive architectural artefacts designed for the efficient excavation of coal. It stands for the regional history, culture, folklore, and beliefs (Frużyński 2012b, p. 9-10). What is more, in the past the *mine* stood as the landmark of stability, prosperity, and technological advancement organizing labor and communities. Generations lived, worked, and died in the shadow of the *mine* elevating this *megamachine* to the level of the temple of production. As a landscaping landmark, the *mine* has stood as inherent part of the Upper Silesian landscape enriching its gentle hills with the skyscraping shafts and groundscraping railway network.

Apart from their industrial and social functions, mining artefacts carry a profound ecological footprint. As in this research, I emphasized the intersection between mining and degraded water systems, the artefact of a water pump becomes a primary object of my interest. This is because the existence of mine is highly dependent on the security provided by the water management technology capable of discharging the inflow of groundwaters. Thus, the existence of mine is dependent on the degradation and deterritorialization of the groundwaters in the very first place.



[1]

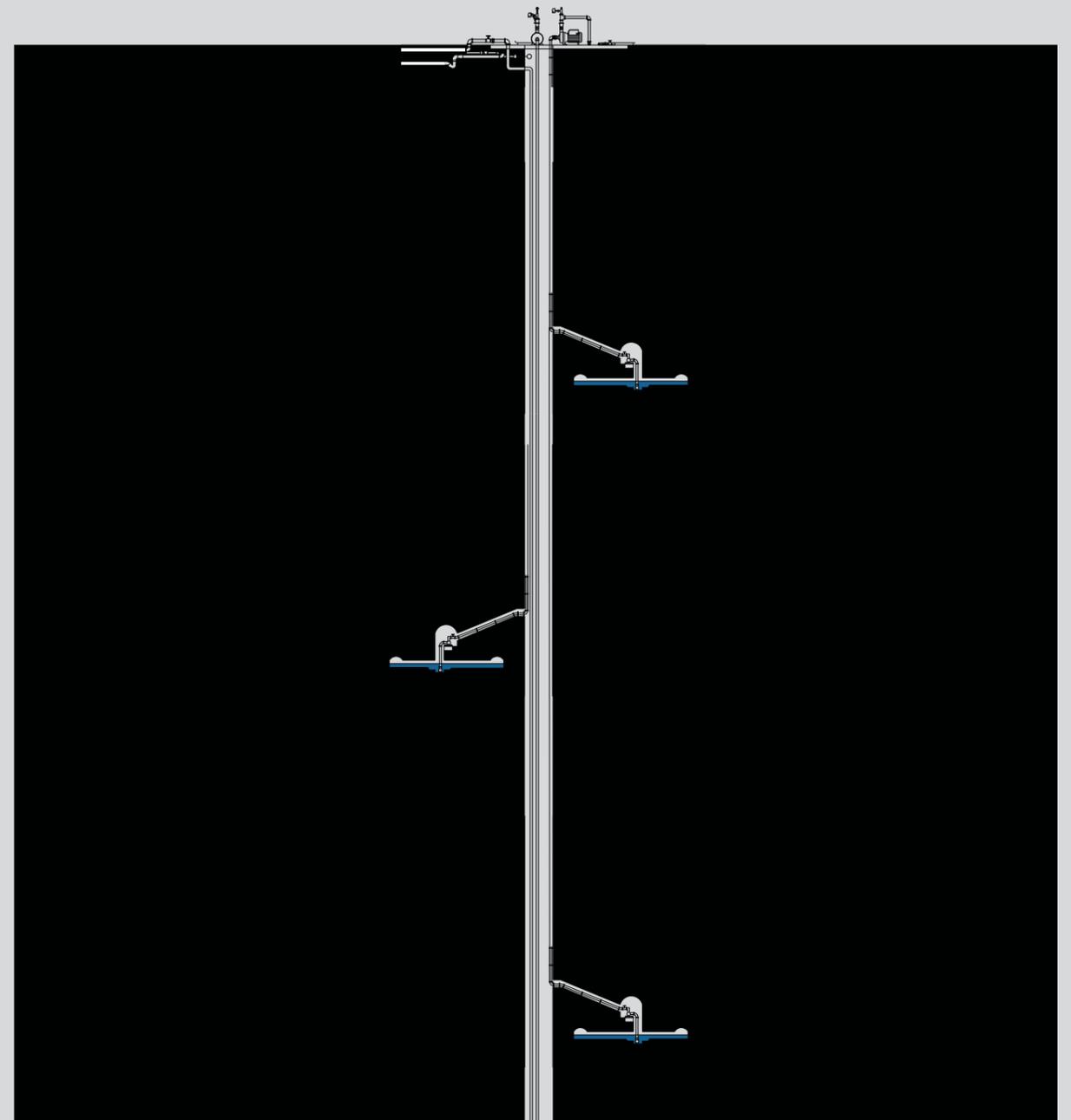
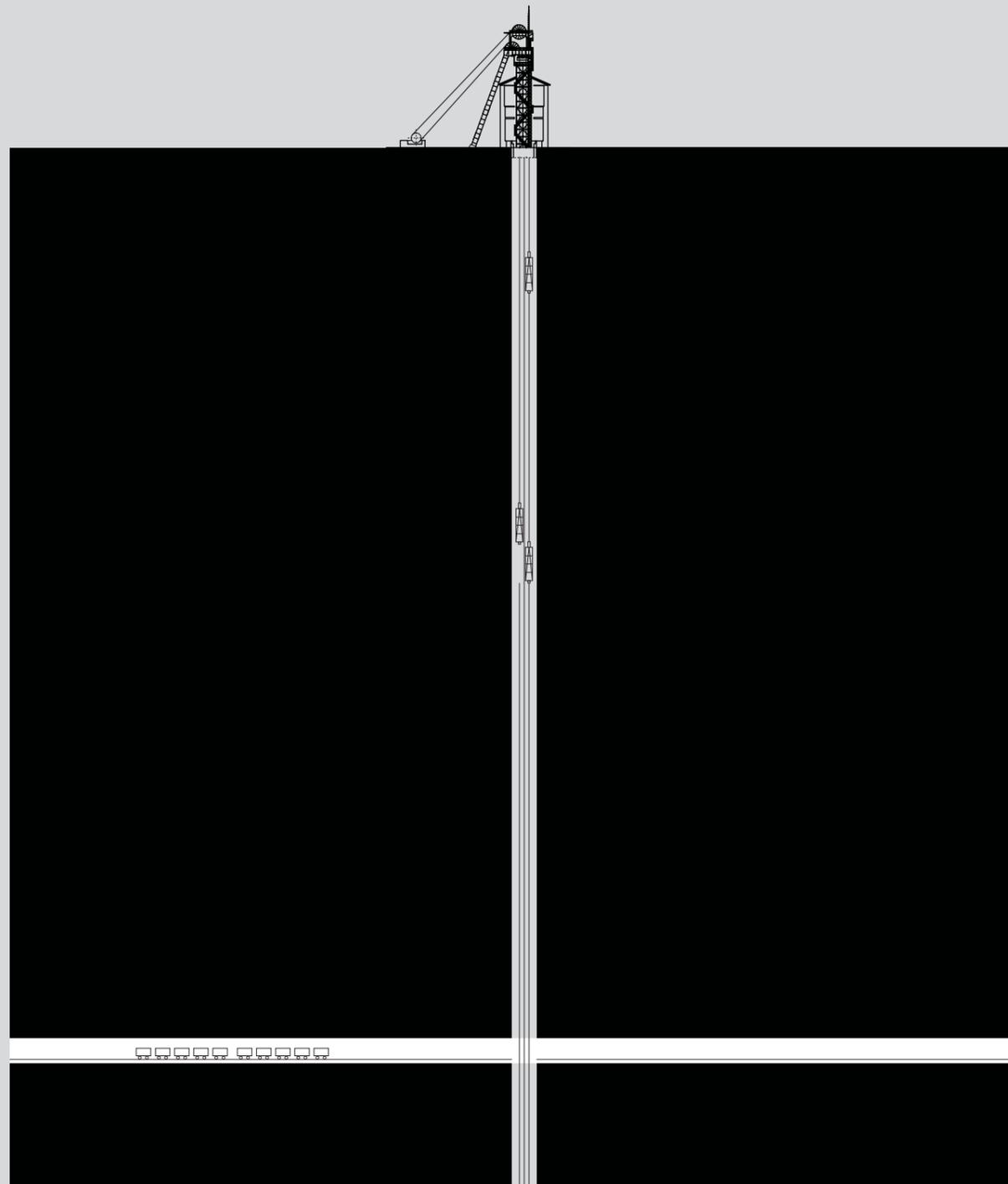


[2]

[1] Cehaus (*pol. cechownia*) - miners' gathering chamber

[2] Bathhouse (view over the hanging clothes)

source: Frużyński 2020a





**TEREN ZAMKNIĘTY
WSTĘP WZBRONIŁY**
Spółka Restrukturyzacji Kopalń S.A.
ZAKŁAD
"CENTRALNY ZAKŁAD ODDZIARNIENIA KOPALNI"
41-253 Czeladź ul. Kościuszki 9
RUCH | rej. "NIWKA-MODRZEJÓW"
ul. in. DTPROWYTORA 265-27-00, 265-15-35 NPK, 500

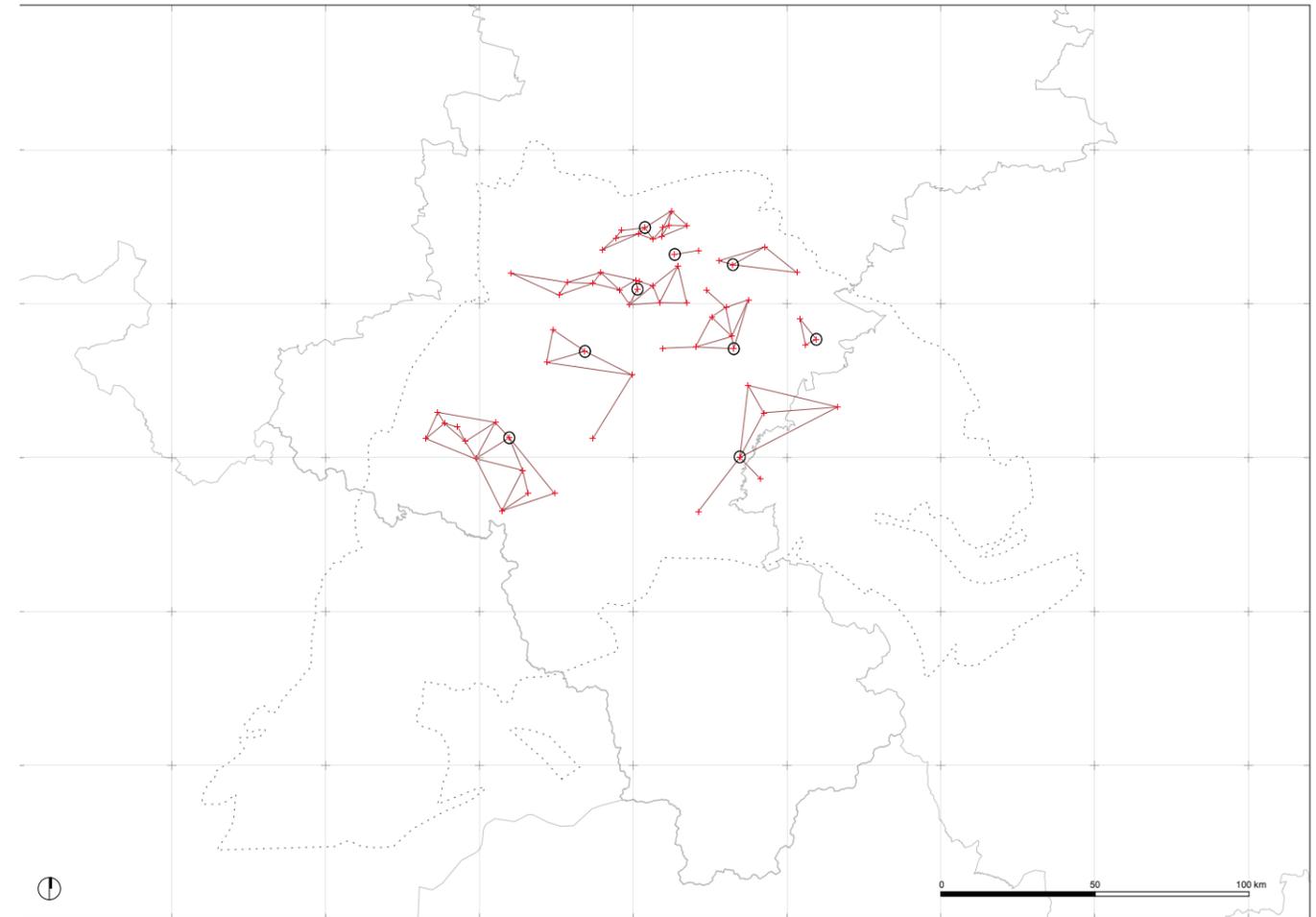
Mine's Water Management Station

Source: SRK

'From Mining Coal to Mining Water'

Recently, as more and more bituminous coal mines are decommissioned many of them undergo a major transition, namely from 'mining coal to mining water'. This is because the underground aquifers constitute an underground system of connected vessels. Thus, the balance and stabilization of the level of groundwaters does not depend on the separate mines, but on the mining system as a whole. This renders the process of decommissioning highly challenging as still operating mines rely on the territorial water management system established in the previous century. Hence, first of all, the decommission of certain mines follows their transition into the water management station before their operations are fully terminated. While looking into the architecture of the mine, this transition involves redevelopment operations on the existing mining artefacts (e.g decommission, deconstruction, preservation, adaptation). In each case, the architecture of the mine is reduced and adjusted to the new water-related functionality.

The choice of mines transformed into the water management stations is based on the specific hydrogeological conditions, such as the direction of the underground flow, its volume, and the depth of the groundwaters (Czapnik & Konsek 2020, pp. 99). In the recent years, based on the hydrogeological analysis, a model for dewatering of mines was proposed to systematize the discharge of the groundwaters (Czapnik & Konsek 2020, pp. 99). This model points out 9 subregions in the Upper Silesian Coal Basin (macro scale), and is followed by the 9 mining sites (micro scale) strategic for the territorial water management system. As this model considers planning and operations necessary to establish the groundwaters dewatering system, it does not consider the systemic effect of the discharge and its environmental consequences (e.g degradation and deterritorialization of ground and surface waters in the region). In addition, the discharged groundwaters contain a high concentration of dissolved salts (e.g. 2,1 g/dm³ for 'KWK Centrum'), and their physicochemical properties are significantly different from surface waters. Hence, their discharge, even though controlled, is causing environmental pollution stretched long in time after the last ton of coal left the mining plant.



Territorial Water Management System

The system of the interconnected vessels

Based on geoportal.gov.pl / OSM data / (Czapnik & Konsek 2020, p.99)

- Geological Region: Upper Silesian Coal Basin
- + Underground Bituminous Coal Mine
- ⊕ Underground Bituminous Coal Mine (Regional Water Management Station)
(Regional Groundwaters Management Station)
- International Border



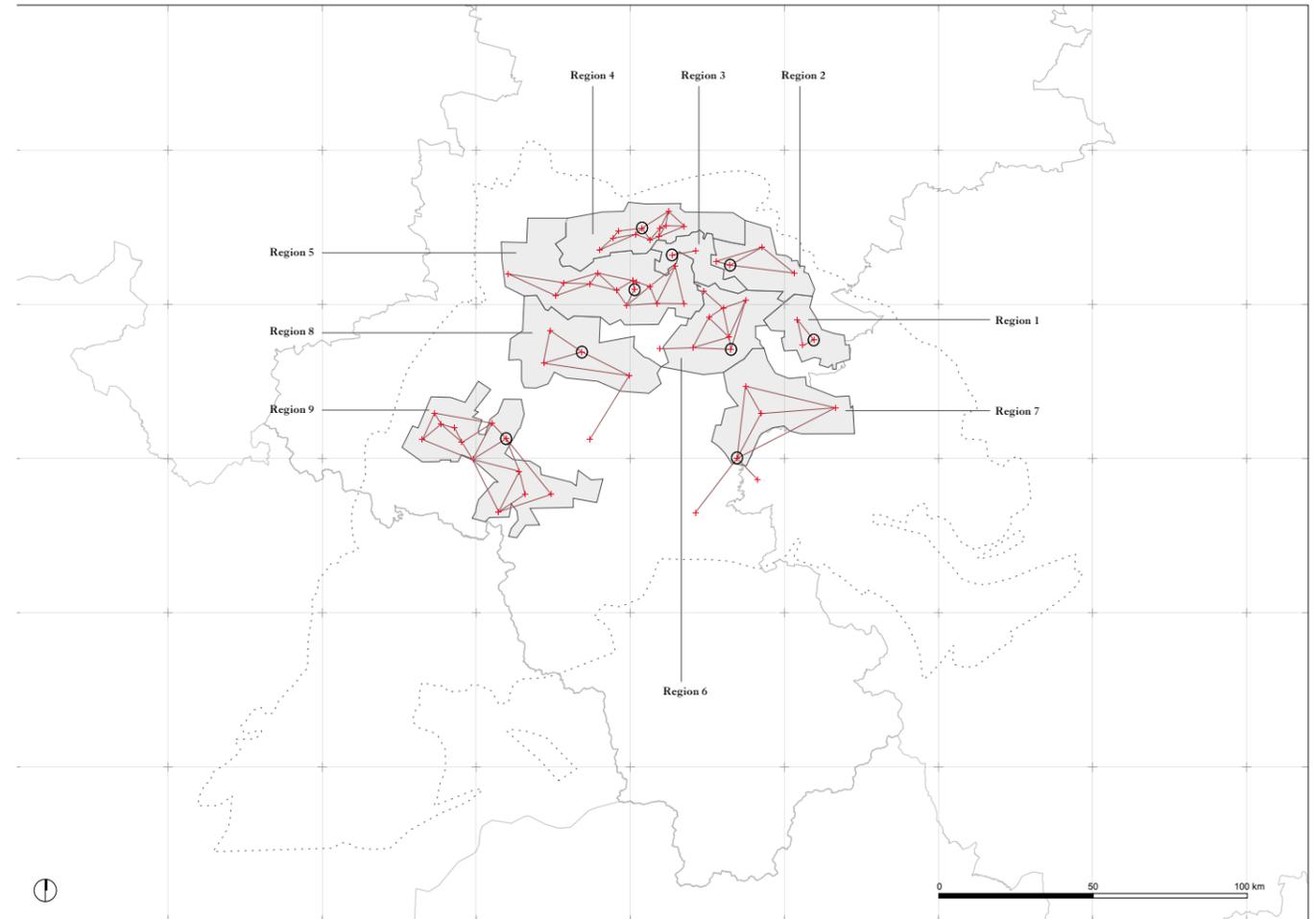
9 Strategic Post-Mining Sites

(above)
Photos: google maps

Territorial Water Management System

System of the interconnected vessels
Based on geoportal.gov.pl / OSM data / (Czapnik & Konsek 2020, p.99)

- Geological Region: Upper Silesian Coal Basin
- + Underground Bituminous Coal Mine
- ⊕ Underground Bituminous Coal Mine / Pioneer Site (Regional Groundwaters Management Station)
- International Border

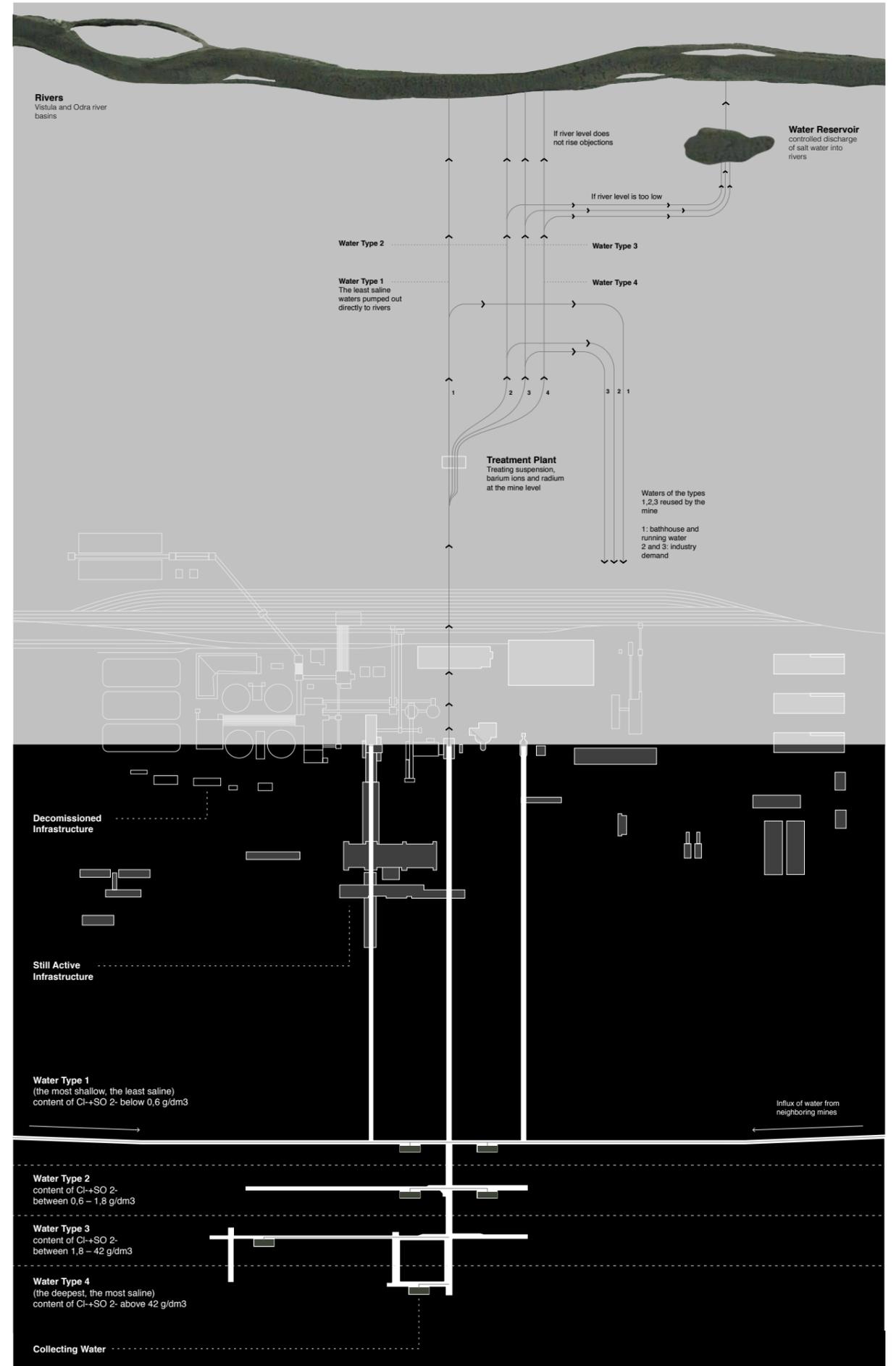




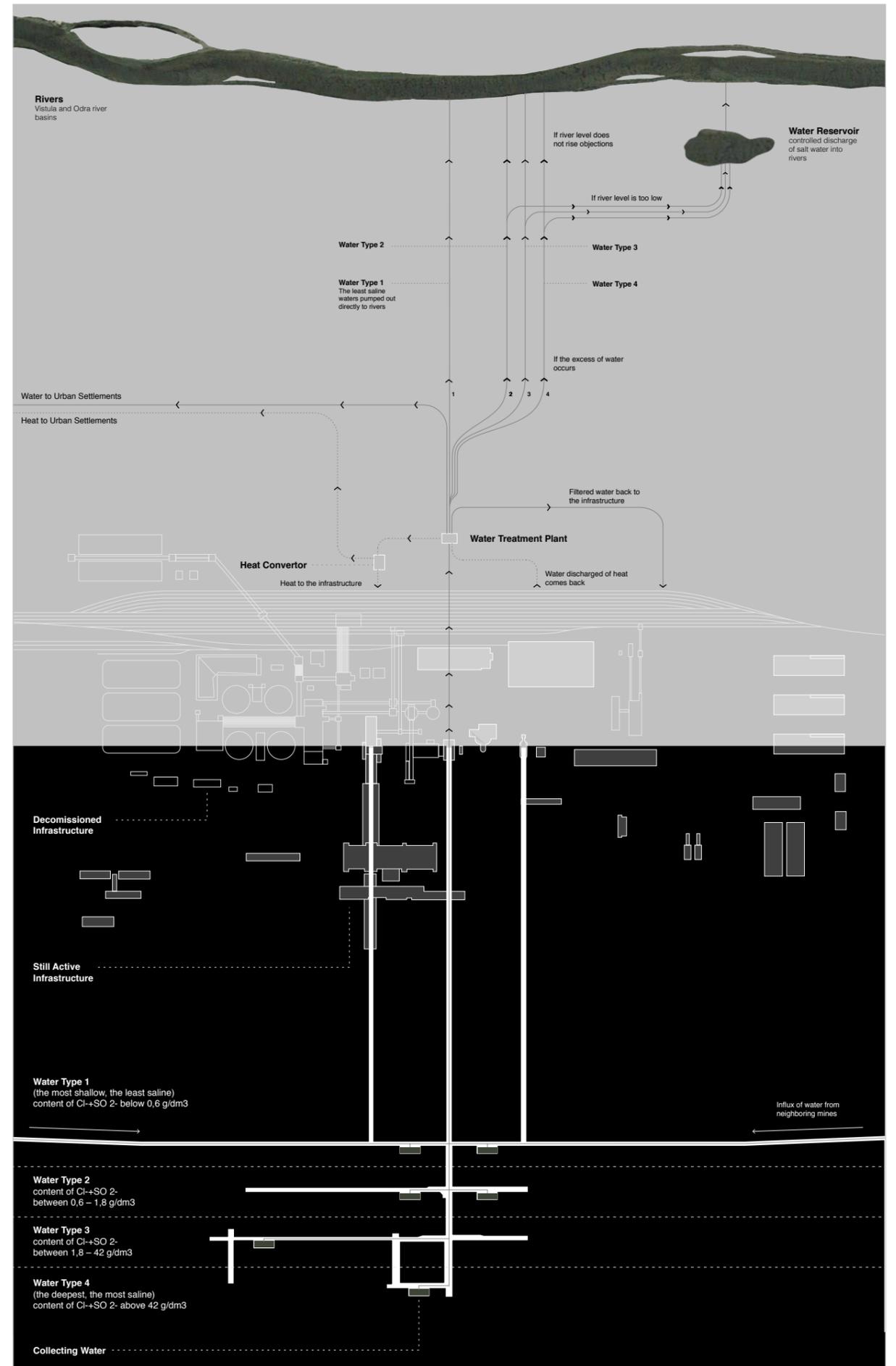
Groundwaters Management System
 Accumulation of groundwaters in the underground gallery
 Source: SRK



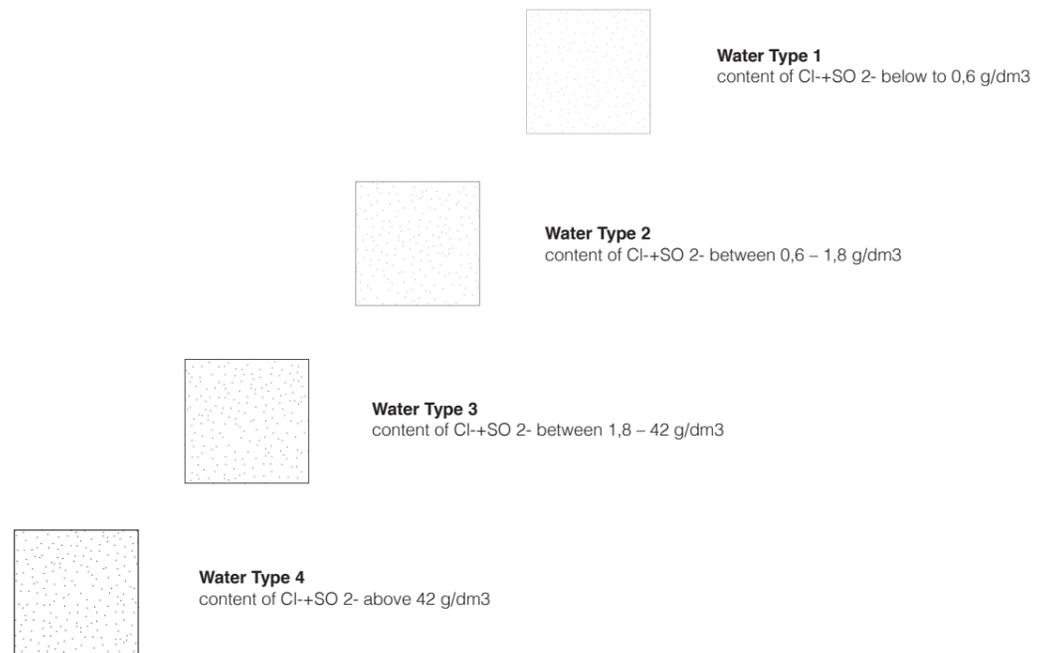
Expected Decommission Deadlines - Upper Silesian Coal Mines
 Based on the OSM data



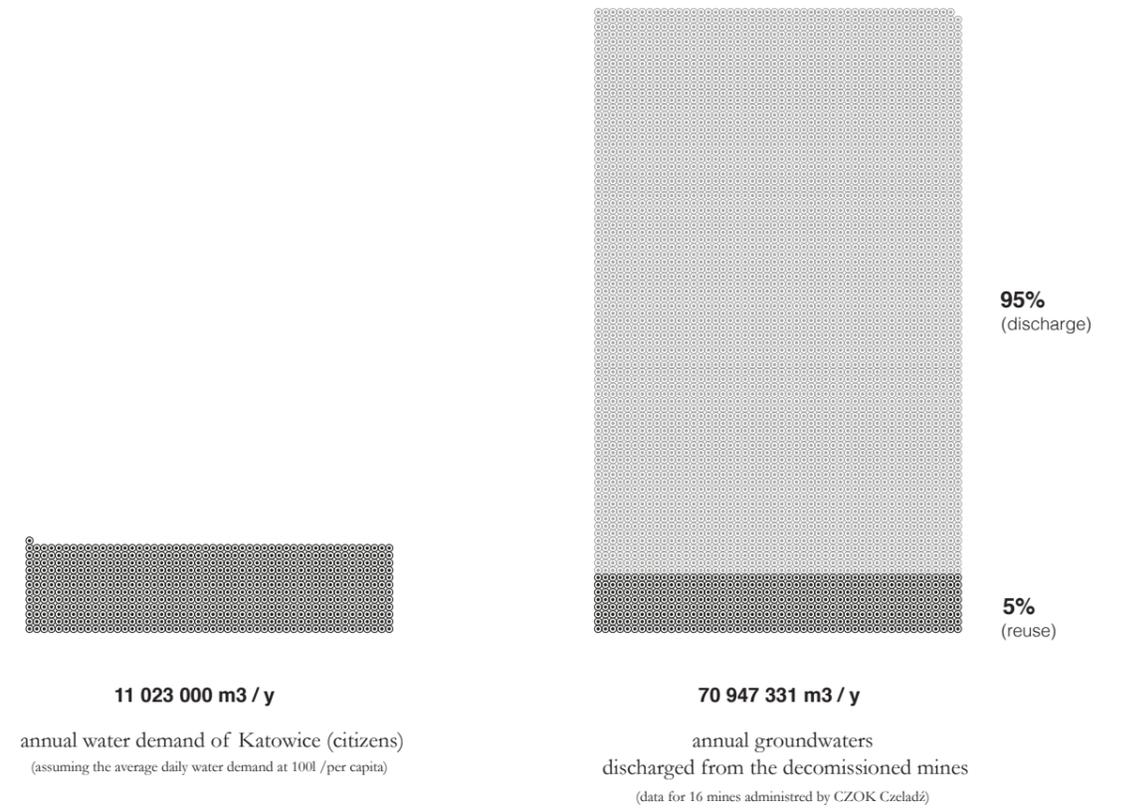
Distribution of the Discharged Groundwaters
author's drawing based on the SRK data



Distribution of the Discharged Groundwaters (Redevelopment of the Flow)
author's drawing based on the SRK data



Properties of the Discharged Groundwaters
Source: SRK



Based on the SWIP data

1.9. Precedents

The precedents of the interventions aimed at the remediation of post-mining territories can be found, inter alia, in Germany's Ruhr valley among the projects comprising "The Internationale Bauausstellung Emscher Park" (the regional program for structural changes of post-mining territories). Among these projects, those of peculiar interest for my research are: "Duisburg-Nord Landscape Park" designed by Latz+Partner, and "Zeche Zollverein Coal Mine Industrial Complex" by designed OMA. These are the examples par excellence of former industrial sites that underwent a major multiscale transition. Here, this transition was followed not only by the reprogramming of the site but the active social engagement in the process of remediation. Whereas Duisburg-Nord Landscape Park emphasizes the landscape and active reprogramming of its site, in Zeche Zollverein the emphasis is put on the layer of architectural expression. Further, what draws my attention in both cases, are the operations and the architectural values of the post-mining artefacts. In Duisburg-Nord Landscape Park, on the other hand, I explore 'The Water Park' (the human-mediated ecology of water), where the post-mining artefacts are reused under the altered functionality. Recently these artefacts serve as e.g. reservoirs, channels, aqueducts, and are engaged in reversing the cycle of natural systems degradation.

The temporal scale of the remediation of post-industrial territories is evident in New York's "Freshkills Park Project". Designed by James Corner's Field Operations in 2008, the project targets the transformation and remediation of a large-scale landfill on Staten Island. Here, the process of remediation has been planned for decades, and despite its span, its deadline has recently been postponed further into future. Another project tackling the evolution in time is the "Renaturation of River Aire" by the Atelier Descombes Rampini. This landscaping intervention is an example of the renaturation of the degraded/deterritorialized riverscape near Geneve in Switzerland. The project comprises the terraforming intervention aimed at partial renaturation of the released river and constitutes a laboratory of dynamic river flow under the condition of the automated landscape.



[1]



[2]



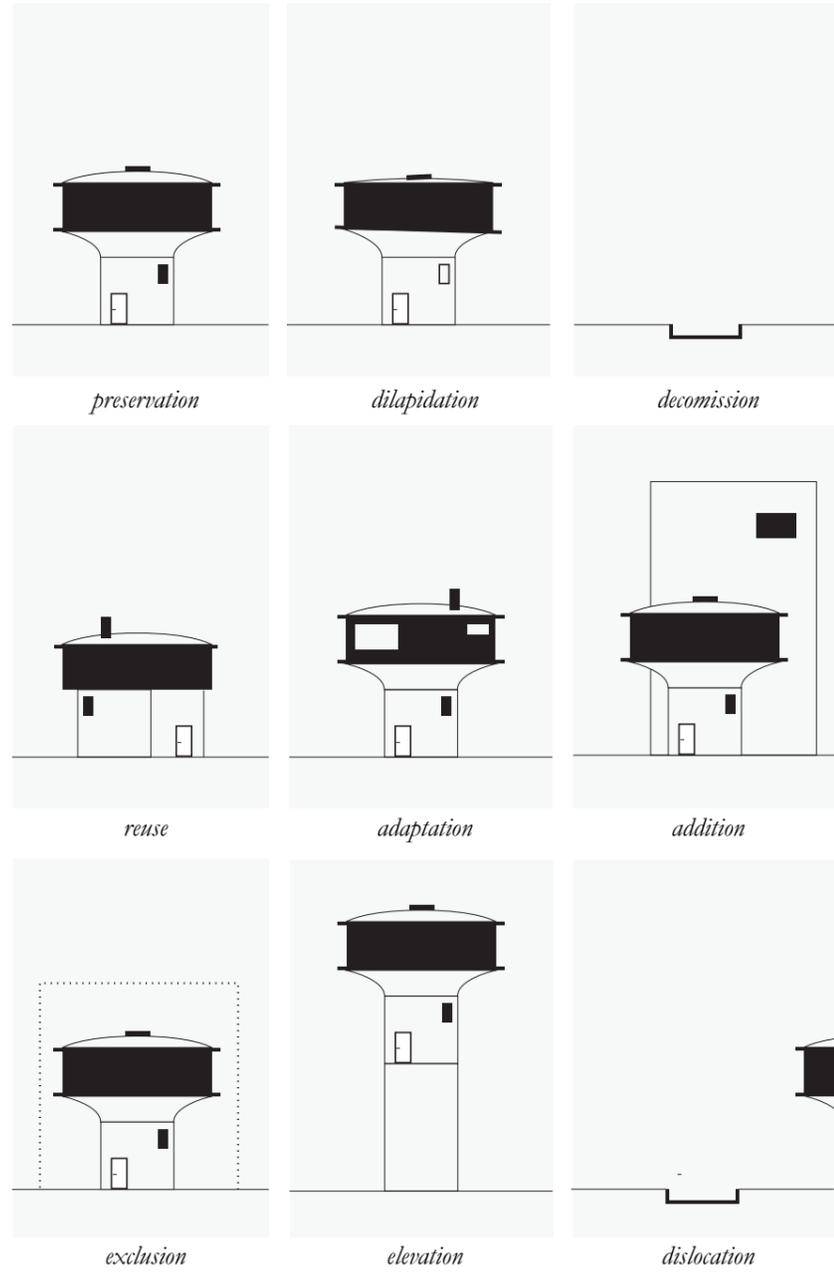
[3]

[1] Freshkills Park Project, *design by* Field Operations

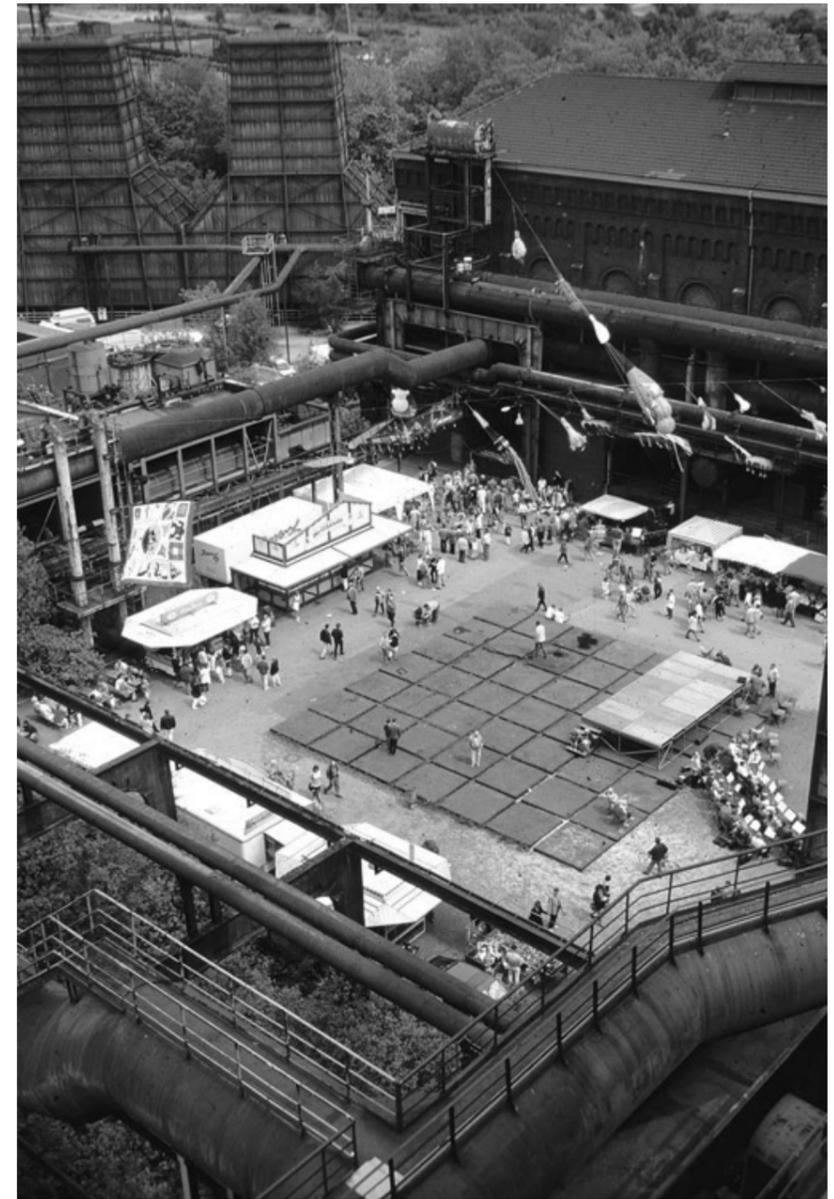
[2] Duisburg-Nord Landscape Park, *design by* Latz+Partner

[3] Zeche Zollverein Coal Mine Industrial Complex, *design by* OMA

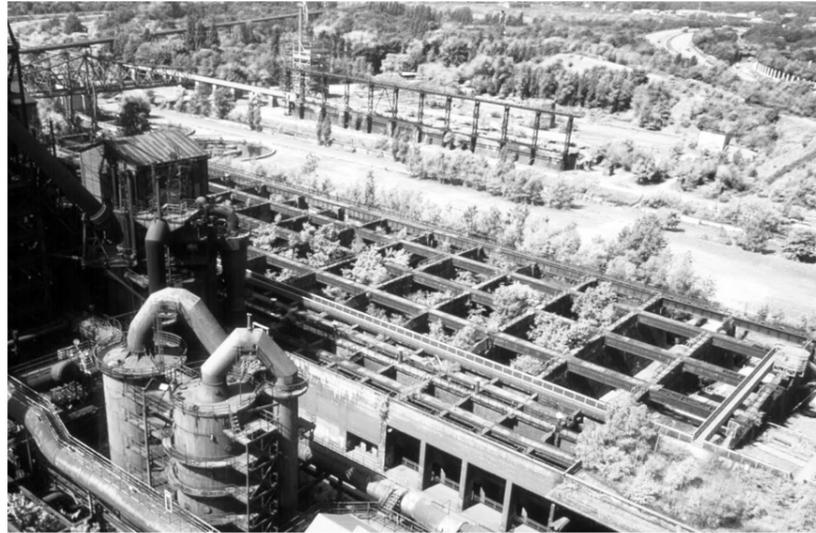
source: landezine.com



Operations on the Post-Industrial Artefacts
 author's drawing
 based on Bruna Canepa's 'Estrategias'



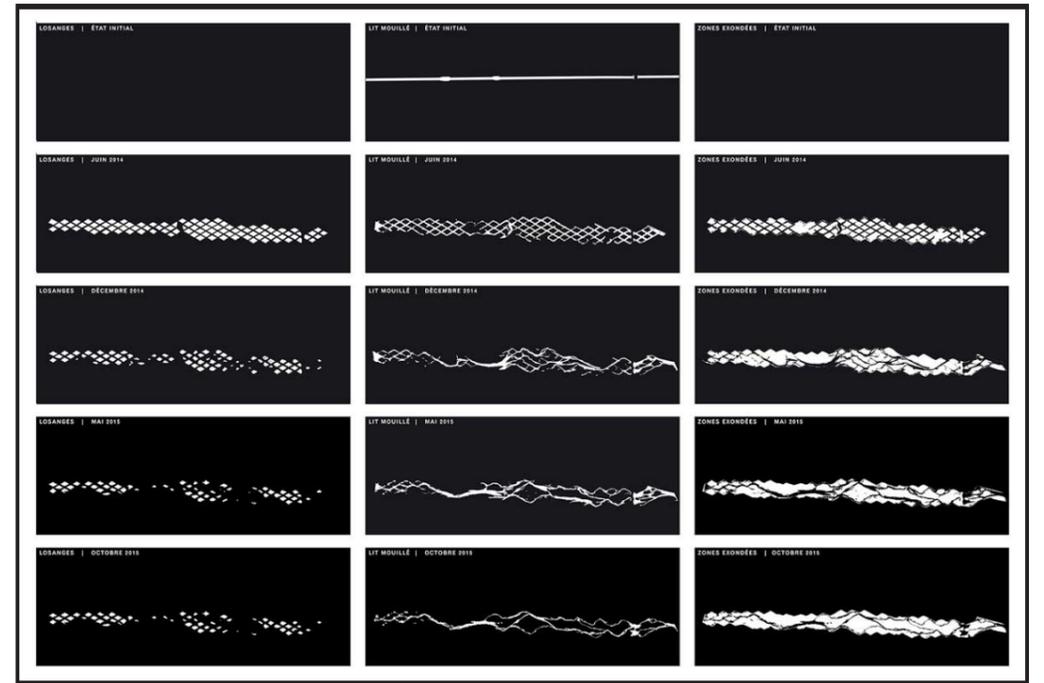
Reuse of the Blast Furnance Plates
 Duisburg-Nord Landscape Park
 Source: landezine.com



Exclusion of the Contaminated Infrastructure
Duisburg-Nord Landscape Park
Source: landezine.com



Addition of Social Programs
Duisburg-Nord Landscape Park
Source: landezine.com



1.10. Position.

Reversing the cycle.

Ever since the first coal mine was built, the extensive mining operations have had a profound impact on the conditions of both ground and surface waters. Even though this type of natural systems degradation will continue until the coal excavation is fully terminated, there is a chance to rethink the operations on the still existing post-mining artefacts. This could be achieved if we consider the discharged groundwaters as an opportunity that can channelled into the means of the active remediation of post-mining landscape. The transition 'from mining coal to mining water' does not have to be strictly infrastructural, yet can embed a deeper dimension of the remediation, if we consider treatment, reuse, and systemic impact of the discharged groundwaters. At least in its last decades, mine could be undergo the major transition from the *megamachine* of landscape destruction to the *megamachine* of landscape reconstruction.

To consider such a redevelopment of mine's infrastructure, it is necessary to look within and beyond the operations on the still existing post-mining artefacts, and consider the introduction of new types of infrastructures necessary for channeling, treatment, and examination of discharged groundwaters (e.g. water management systems, water purification facilities, research units) followed by the infrastructures applying the treated groundwaters into the remediation of soil (e.g. through phytoremediation). However, to tackle the integrative dimension of remediation that goes beyond the scope of infrastructures, it is necessary to include the active role of the human in the process of remediation. The evolution of the territory cannot be separated from the evolution of human perspective.



Site



Project Site
Territory of KWK Centrum in Bytom
author's photo



Project Site
Territory of KWK Centrum in Bytom
author's photo



Project Site
Territory of KWK Centrum in Bytom
author's photo



Project Site
Territory of KWK Centrum in Bytom
author's photo

2. Site: Bytom

2.1. Introduction.

“The mindlessly hollow rock mass is sinking, the earth is quietly absorbing Bytom, Bytom is pupating, human has abused the hospitality of nature, so nature blows human away, human turns out to be a thin, disposable layer of skin.”

(Zbigniew Rokita in Kajś, p.337)

Choice of the location.

Based on the comparison of 9 strategic post-mining sites mentioned in the previous chapter, I chose a location in the city of Bytom as the site for site-specific intervention. This very peculiar site lies at the intersection of mining and degraded natural systems and can be considered as an extreme case of the heavy impact of mining operations on the territory. Whereas in the past this site hosted one of the major coal mines of the city (KWK Centrum), recently it hosts the decay and degradation of both decommissioned post-mining infrastructure and the surrounding natural systems. Degradation of the waterscape, extreme land subsidence, soil pollution, and the uncertainty of terrestrial conditions are just few examples of material conditions intersecting in the city. These are followed by socio-economic changes - the aftermath of extensive mining operations, which up to this day remain unsolved at the end of the era of coal extractivism.

Project Site in Bytom
Based on geoportals.gov.pl / OSM

- Project Site (Lot)
- Post-Mining Infrastructure
- Surface Waters



2. Site: Bytom

2.1. Introduction.

Papal Curse.

Folktales say that Bytom has long been cursed before the coal. The history of this curse dates back to the XIV century when the outraged burghers drowned their parson in the pond. It is not known what exactly pushed the burghers to commit this act of violence, however, each version of the tale mentions parson's greed that triggered the rage. Priest's misfortune had far-reaching consequences, further than any one of the living could ever expect. Soon after the murder, the Vatican was informed. As a result, the city was cursed. To make matters worse, Pope released a prophecy that announced the impoverishment, decline, and rapid decay of the city - both material and spiritual. One may say that the pope's intervention had profound consequences: one of the silver mines was flooded (allegedly by the ghost), and city's fortune began to decline. Despite the severity of Pope's punishment, the curse was supposed to vanish with the lifetime of one generation (Nowacka-Goik 2011). However, up to this day six centuries later, its consequences are still visible with a naked eye.



2. Site: Bytom

2.2. Subjects of Concern.

"It's strange tell about it. You feel something ripple under your feet, as if the deck of a rocking ship."

(Zbigniew Rokita in Kajś, p.337)

Growing Abyss.

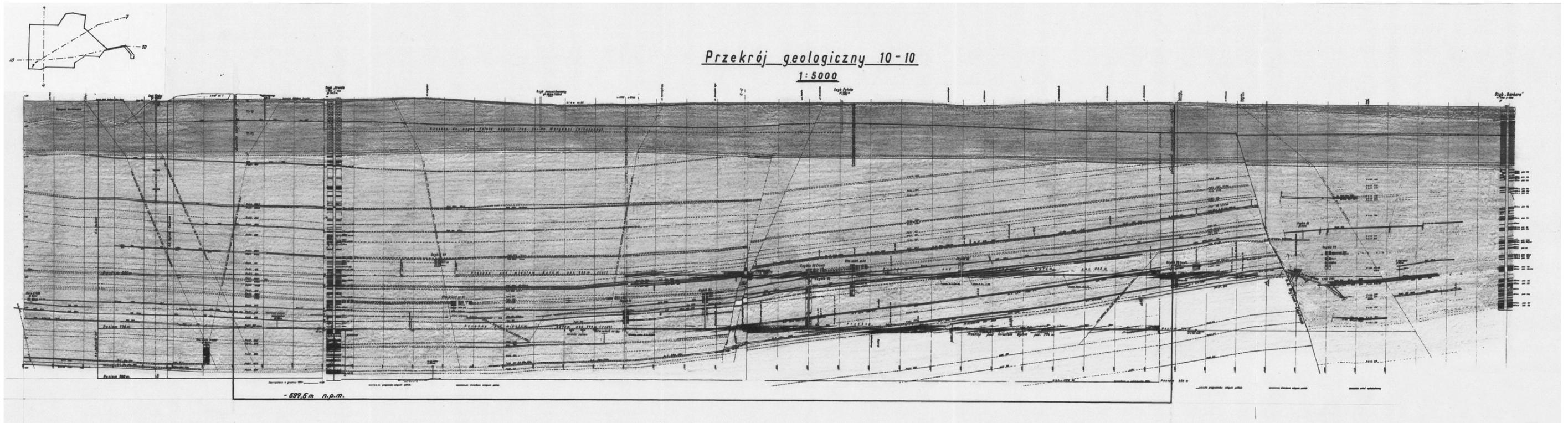
Since the middle ages extractivism has stood at the axis of Bytom's existence. In the 1920s under the German administration, it was already known that coal deposits situated under the city were too extensive for the city to stand in its place. As a result, Hitler's Germany planned to carry out a large-scale operation of deglomeration, namely to build new commuter towns far away from the coal deposits, and then, drill as much as possible (Mirosław 1970, p. 15). As history has shown, Germans did not manage to implement their operations. Soon, the IIWW broke out and 6 years later the borders were redrawn. Bytom came back to 'the matrix' (People's Republic of Poland). Then, the real extractivism began - coal was not excavated, rather, it was robbed. No one cared about the people living on the surface (Rokita 2020, p.331). Even after the Polish October (1956), when the image of Bytom-based extractivism leaked to mass media (e.g. Baraba Sass 1957 documentary "Sycylia"), and the problem became of public interest, this image did not influence the approach to coal excavation directly under the dense urban settlements.

Throughout all of the time from the end of the IIWW, the decision over the future of Bytom (preservation or deconstruction) was not solved. This was holding back the new investments and the development of the city. Only after the decision in 1960 to preserve the city, began further development (Mirosław 1970, p. 15). By this time the ground beneath the urban settlements was in a very poor condition, and as Rokita in his Kajś (2020,p.331) puts it, this ground "reminded of the Swiss cheese" (Rokita 2020, p.331).



Exploration for Coal under Bytom

old German mapping
Source: archives of KWK Centrum



Geological Section
cutting across the city of Bytom
source: archives of KWK Centrum

2. Site: Bytom

2.2. Subjects of Concern.

Polish Detroit.

The negative image of Bytom has long been present in Polish mass media. While exploring the press statements regarding the condition of the city, it is relatively easy to encounter headlines heralding its collapse. In these texts, Bytom is seen as an example par excellence of a shrinking city on Polish ground. This explicitly pessimistic perspective is not groundless as long-lasting stratification of degenerating conditions (e.g. political, structural, environmental, tectonic) led to profound socio-economic issues followed by the urban decline. Thus, since the 1990s the city has witnessed a high unemployment rate, an increasing rate of poverty, profound demographic changes (e.g. the aging of society). These have been fueled by the unsuccessful transition from the industrial to the service economy. The socio-economic changes happen at a slow pace and stretch in time. There is no doubt that not enough actions are taken to tackle the stratification of the issues. Thus, the status quo is preserved, while the sinking continues.



Vacant Site in Bytom
author's photo

2.3. Site Analysis.

2.3.1 Project Site .

Situation within the Urban Context
Based on geoportal.gov.pl / OSM

- Project Site (Project Lot)
- Post-Mining Infrastructure



2.3. Site Analysis

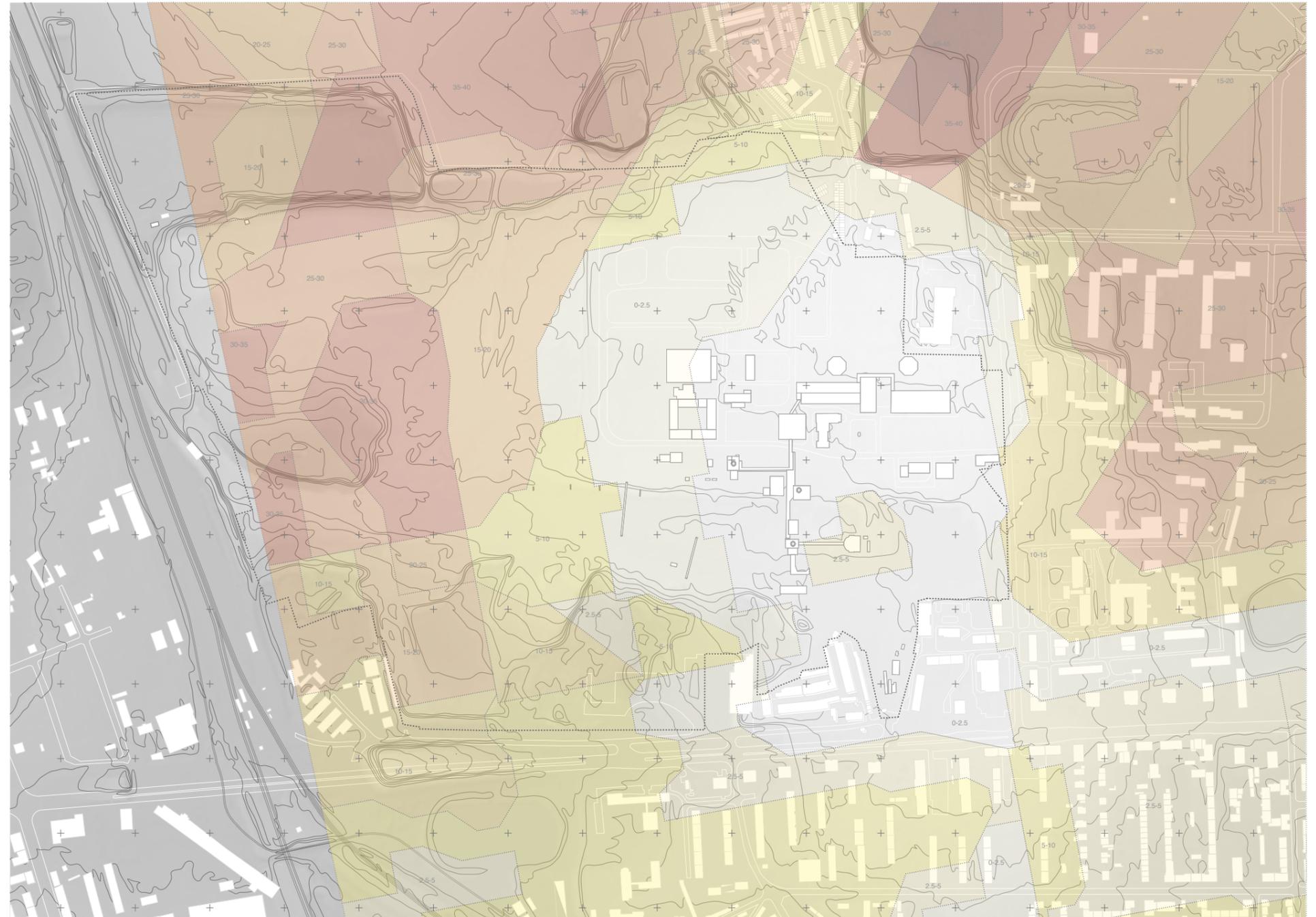
2.3.2. Physical Exhaustion of Soil

Degree of the Underground Excavation
Source: KWK Centrum archives

- Project Site (Project Lot)
- Post-Mining Infrastructure

- Degree of the underground excavation
- High
 - Medium
 - Low
 - None

5-10 Thickness of the excavated rock (fig. in meters)



2.3. Site Analysis

2.3.2. Physical Exhaustion of Soil

Introduction of the Foundation Zones

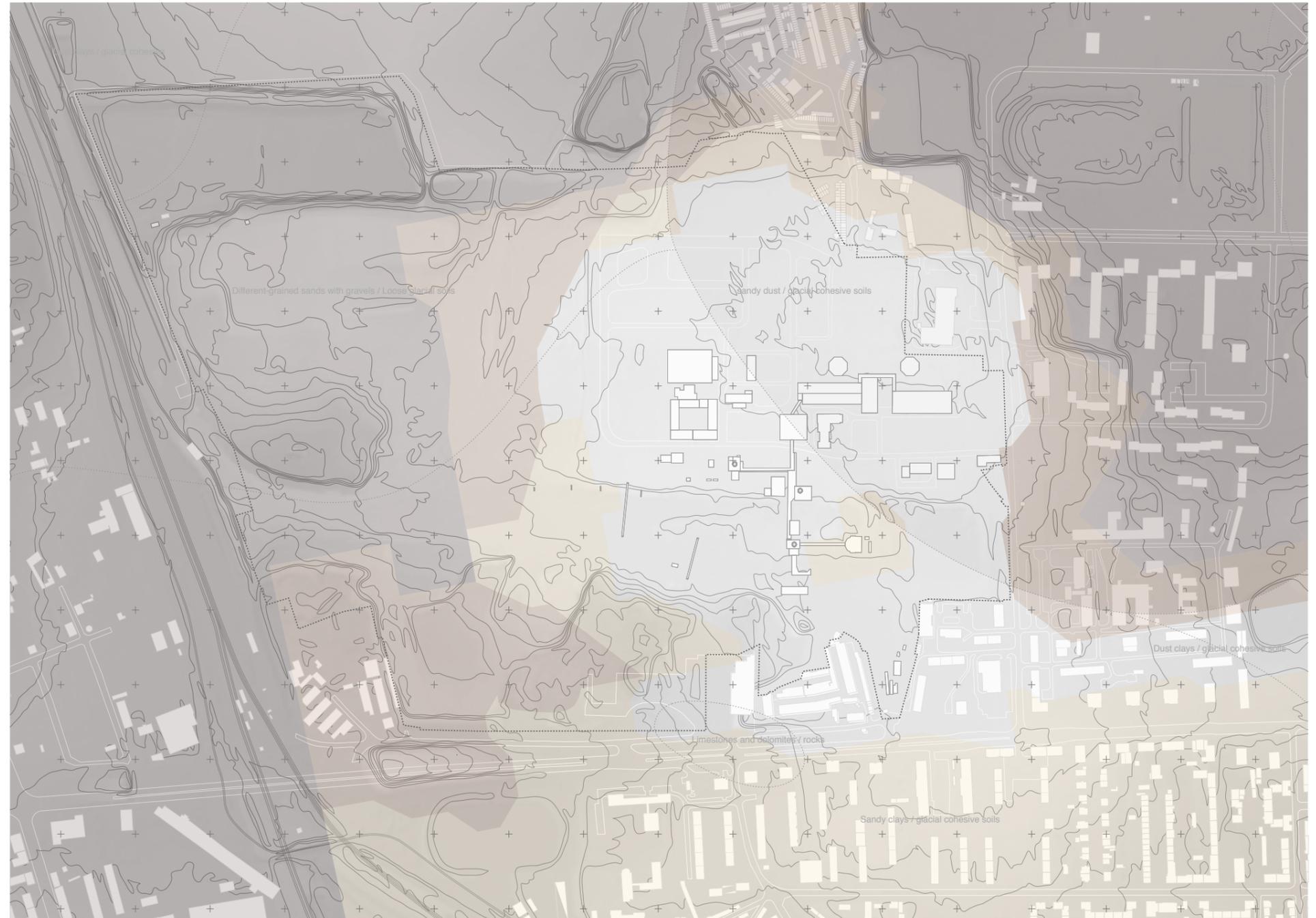
Based on KWK Centrum archives

- Project Site (Project Lot)
- Post-Mining Infrastructure

- Foundation Zones**
- Zone 4 (highly insecure) / 45-20 m of extracted rock
- Zone 3 (insecure) / 20-10 m of extracted rock
- Zone 2 (relatively secure) / 10-2,5 m of extracted rock
- Zone 1 (secure) / 2,5-0 m of extracted rock

- Topsoil range

the darker shade of the foundation zone indicates worse topsoil conditions



2.3. Site Analysis

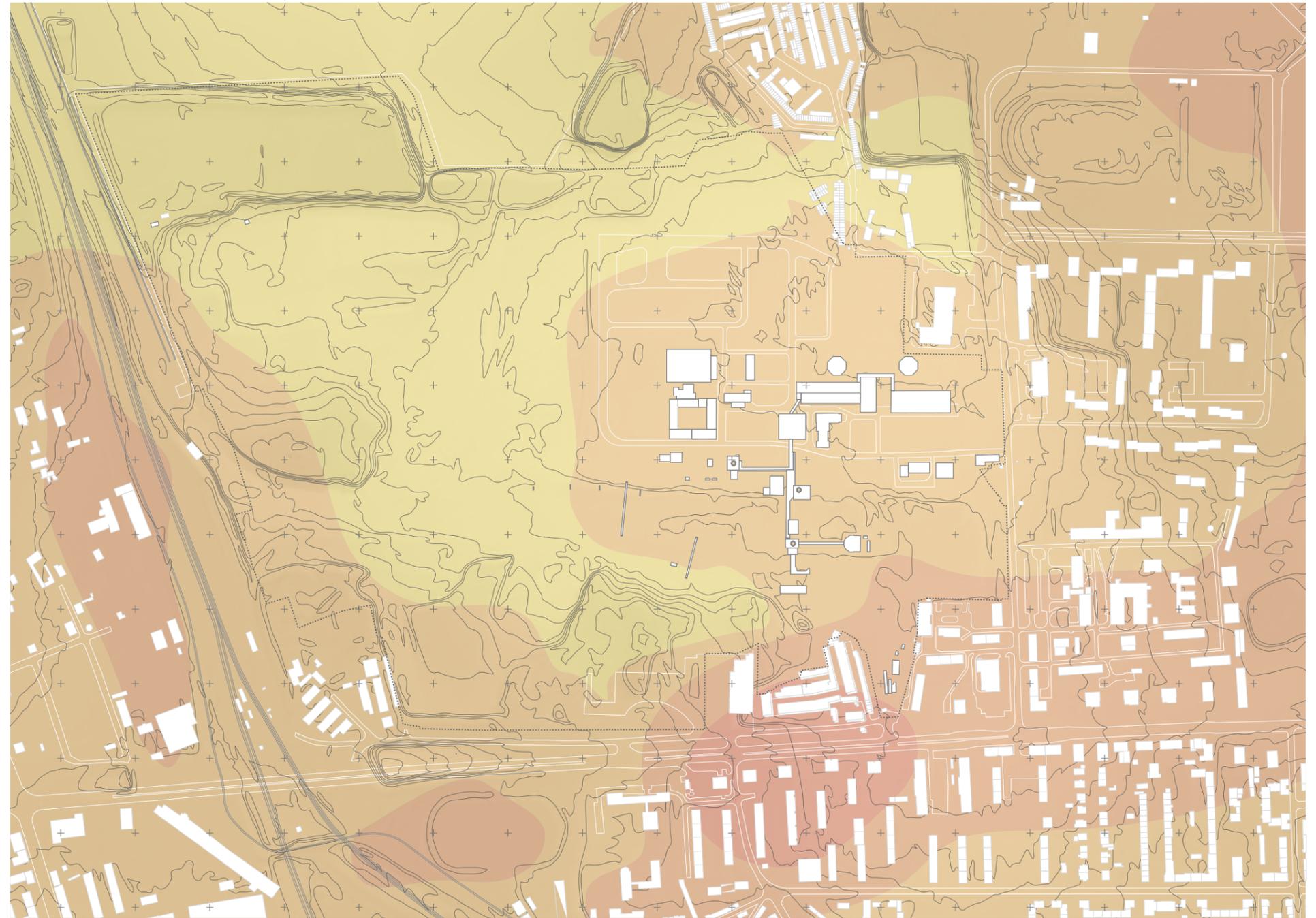
2.3.3. Chemical Exhaustion of Soil

Heavy Metal Contamination - lead (Pb)
Based on PIG-PIB (2021)

- Project Site (Project Lot)
- Post-Mining Infrastructure

Degree of Soil Contamination
Extremely High

- Extremely High*
- High*
- Medium*
- Low*
- Very Low*



2.3. Site Analysis

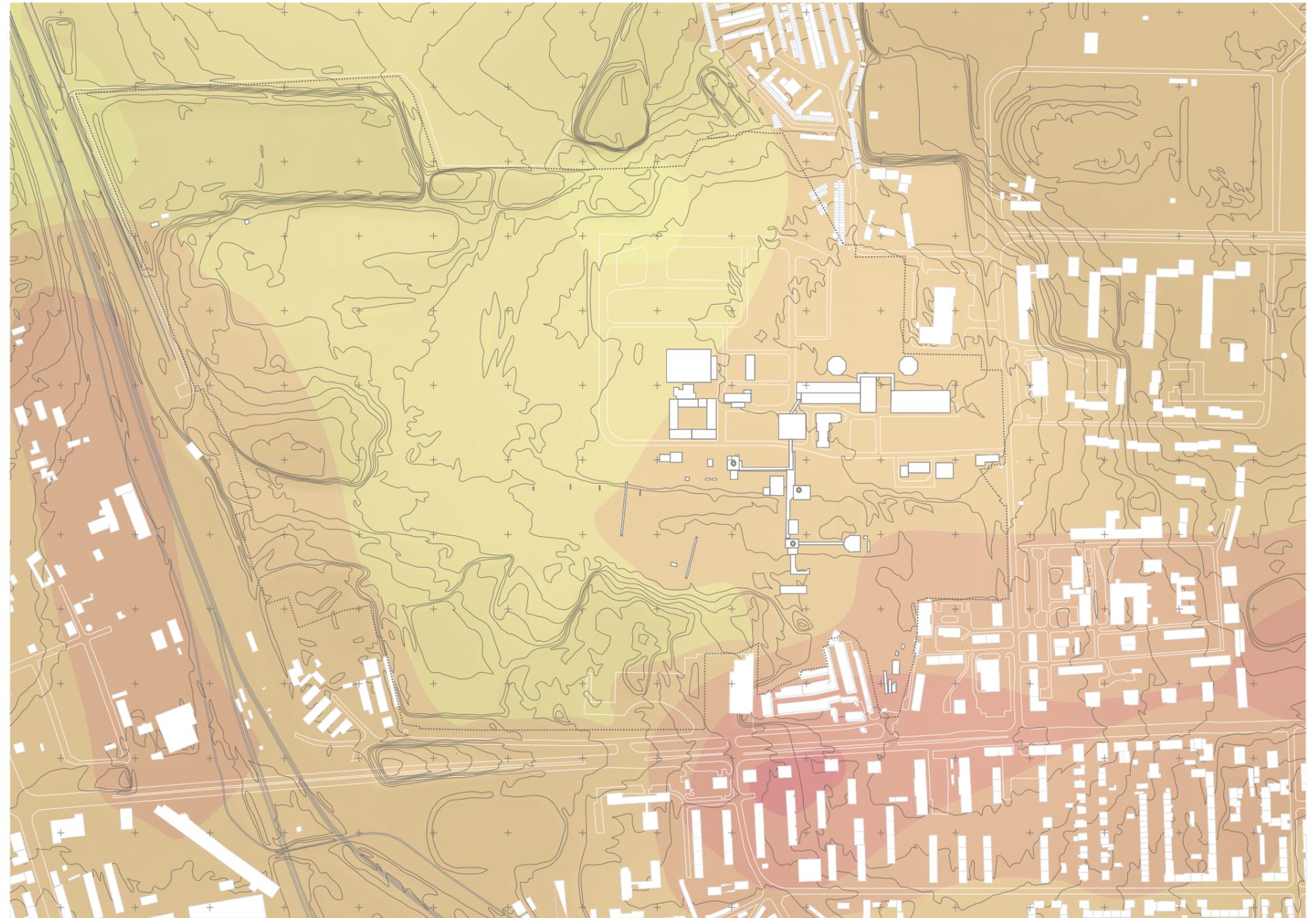
2.3.3. Physical Exhaustion of Soil

Heavy Metal Contamination - zinc (Zn)
Based on PIG-PIB (2021)

- Project Site (Project Lot)
- Post-Mining Infrastructure

Degree of Soil Contamination
Extremely High

- *Extremely High*
- *High*
- *Medium*
- *Low*
- *Very Low*



2.3. Site Analysis

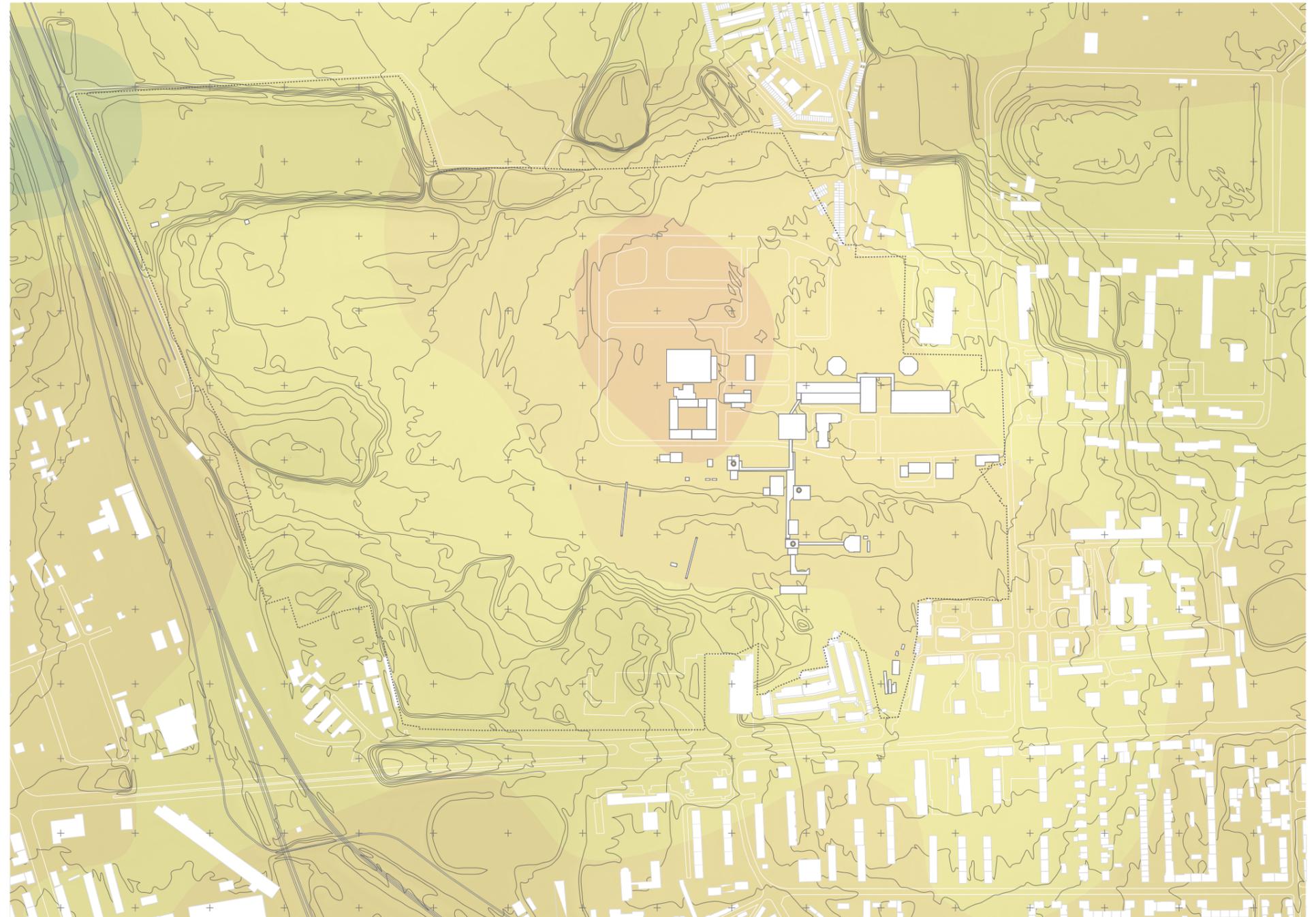
2.3.3. Chemical Exhaustion of Soil

Heavy Metal Contamination - copper (Cu)
Based on PIG-PIB (2021)

- Project Site (Project Lot)
- Post-Mining Infrastructure

Degree of Soil Contamination
Extremely High

- *Extremely High*
- *High*
- *Medium*
- *Low*
- *Very Low*



2.3. Site Analysis

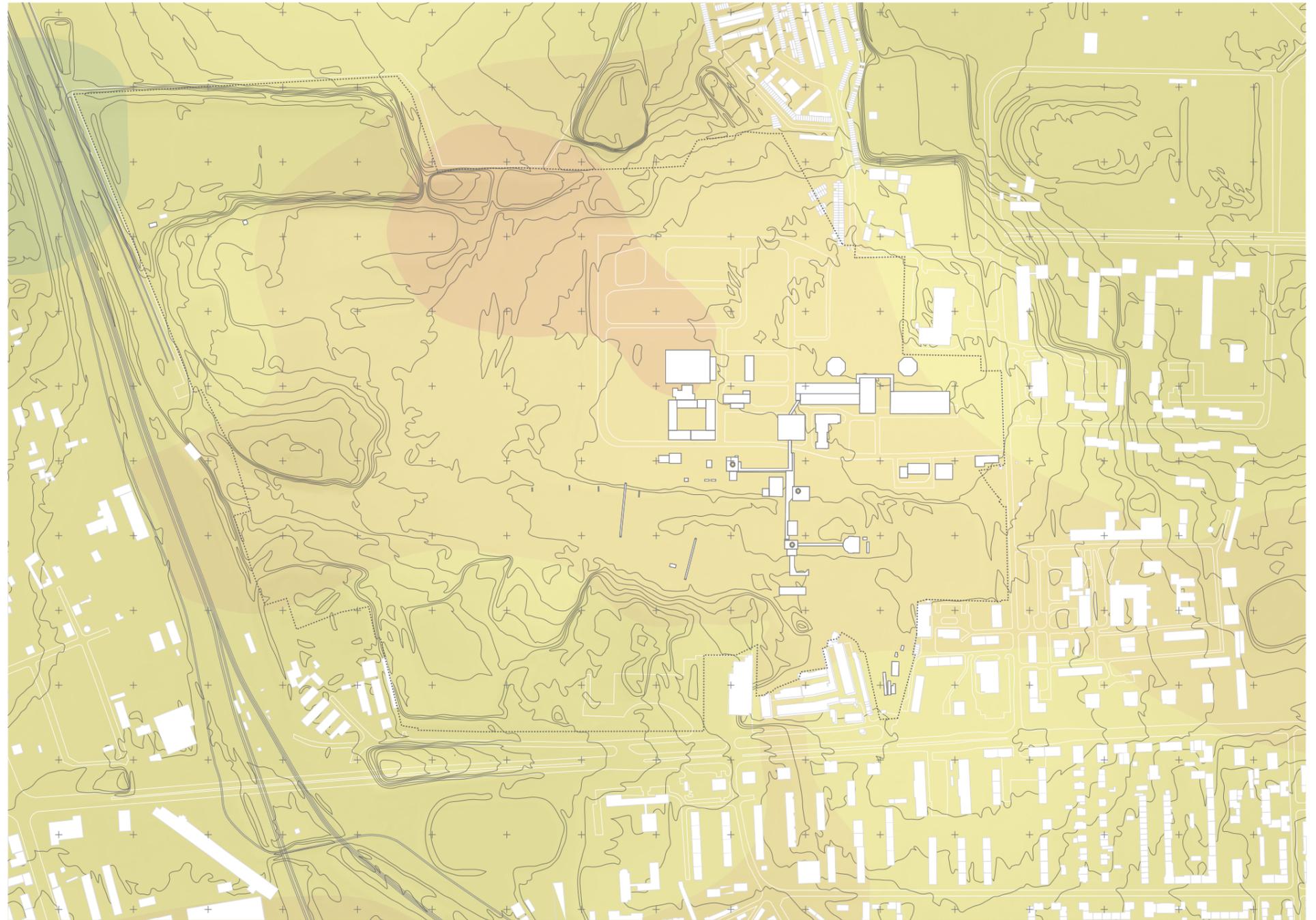
2.3.3. Chemical Exhaustion of Soil

Heavy Metal Contamination - nickel (Ni)
Based on PIG-PIB (2021)

- Project Site (Project Lot)
- Post-Mining Infrastructure

Degree of Soil Contamination
Extremely High

- *Extremely High*
- *High*
- *Medium*
- *Low*
- *Very Low*



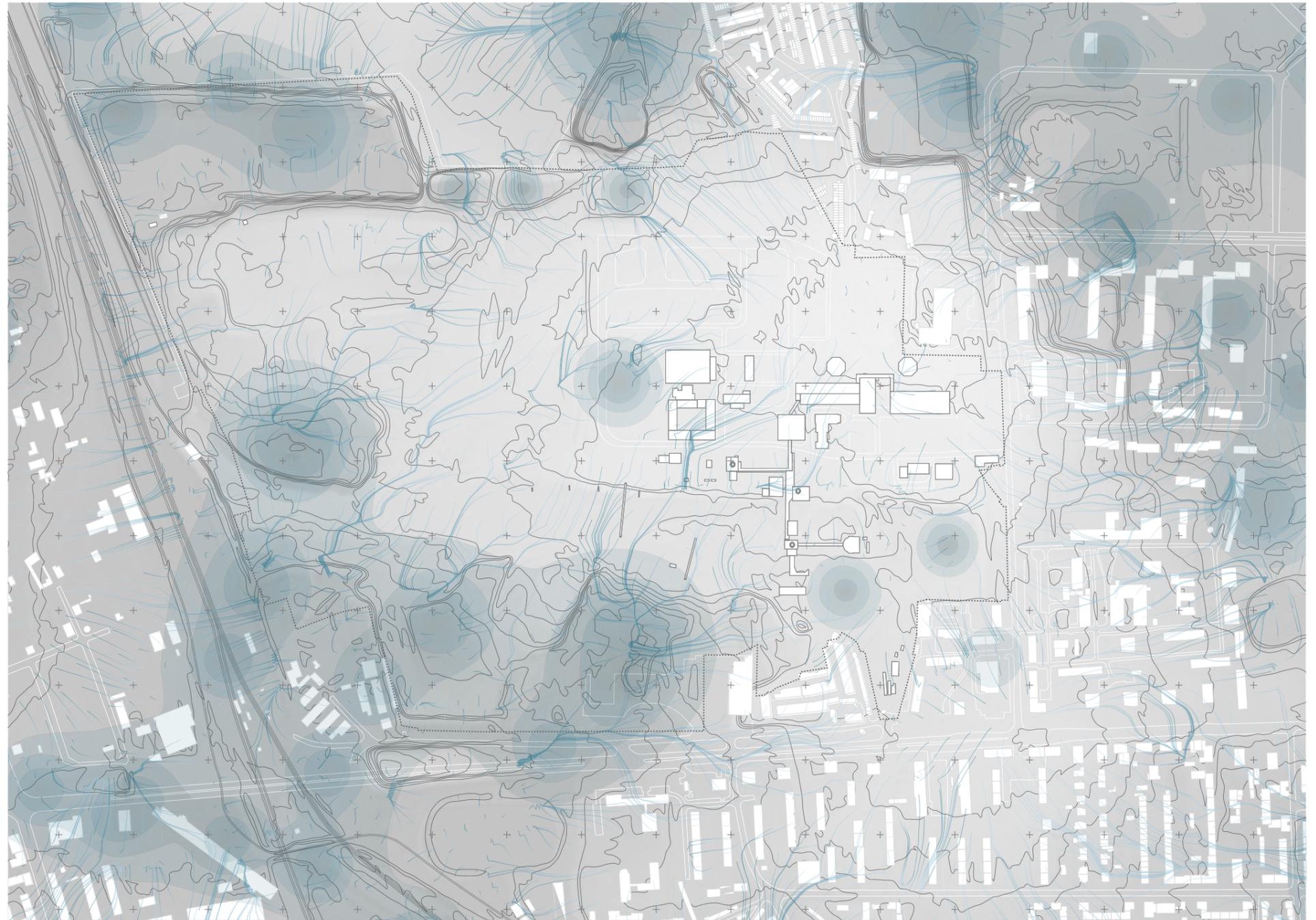
2.3. Site Analysis

2.3.4 Water Flow

Surface Water Flow / Accumulation of Surface Waters
Analysis generated based on the topographic model

- Project Site (Project Lot)
- Post-Mining Infrastructure

- Degree of Surface Waters Accumulation
- High
- Low
- Water Flow Pathways



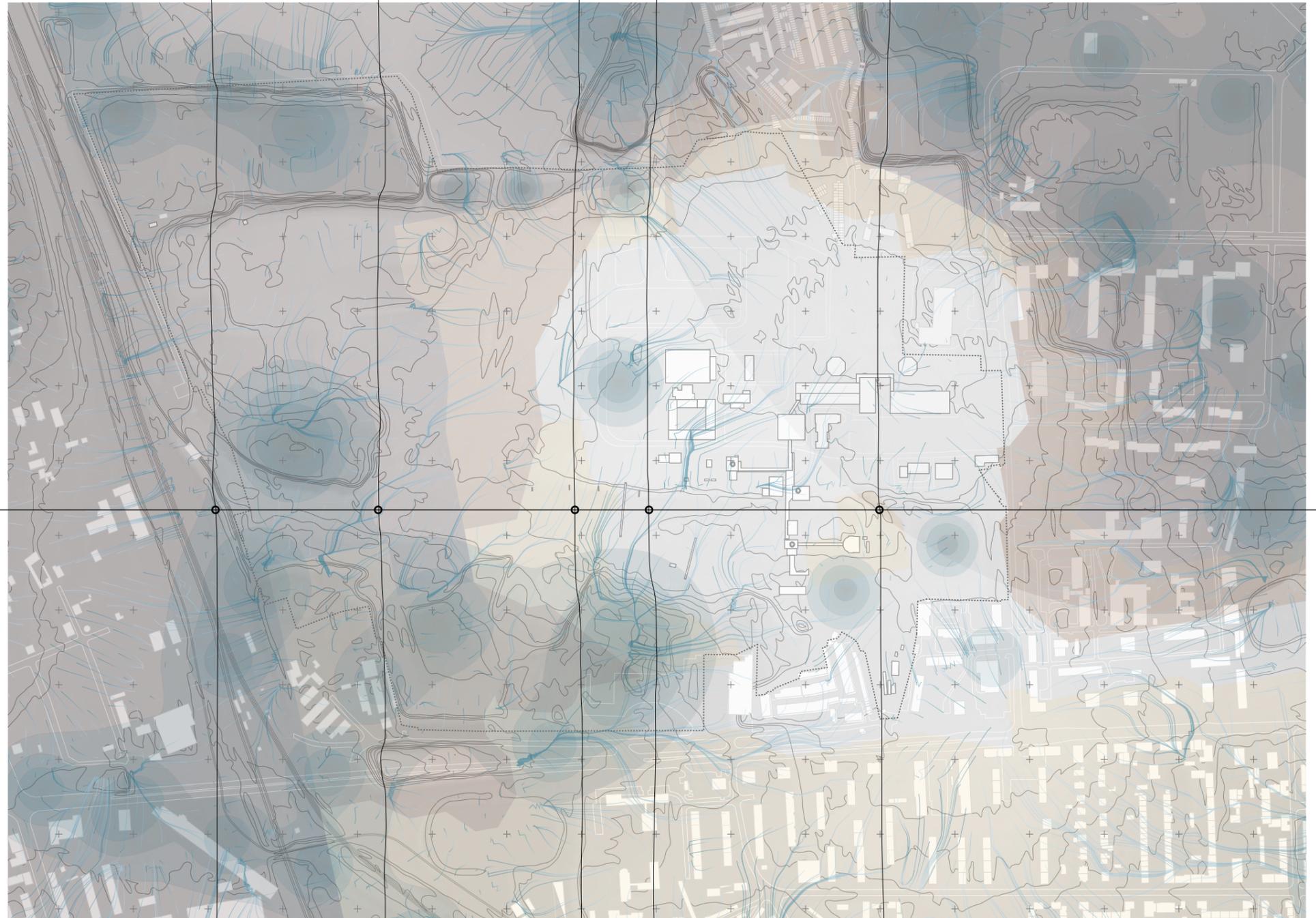
2.3. Site Analysis



Formation of the Water Axis
author's photos

2.3. Site Analysis

/ critical section (foundation zones)
 / axis of the released groundwaters
 / axis of the intervention



2.3.5 Superposition of Critical Layers

Introduction of the Critical Section and Key Thresholds

- Project Site (Project Lot)
- Post-Mining Infrastructure
- Degree of Surface Waters Accumulation
 - High
 - Low
- Water Flow Pathways
- Foundation Zones
 - Zone 4 (highly insecure) / 45-20 m of extracted rock
 - Zone 3 (insecure) / 20-10 m of extracted rock
 - Zone 2 (relatively secure) / 10-2,5 m of extracted rock
 - Zone 1 (secure) / 2,5-0 m of extracted rock
- Critical Intersection



critical thresholds for the remediation of soil and water

threshold 5

threshold 4

threshold 3

threshold 2

threshold 1

2.4. Problem Statement

Situated in Bytom, the project site can be seen as an extreme case of the territory at the intersection of the post-mining conditions. The still-active infrastructure, discharge of groundwaters, insecure terrestrial conditions, soil pollution - all happen at once at this very specific territory of the former underground coal mine 'KWK Centrum' in Bytom. The presence and the operations on the post-mining artefacts raise the question regarding the integration between the old with the new infrastructures which joint together could initiate the reversal of the cycle of environmental degradation. As the research proposes the multiscale approach to the remediation, there is a question regarding the site strategy that would interweave the axis of the released groundwaters with the key thresholds identified in the research. While these thresholds are based in the areas of different terrestrial conditions, their planning requires consideration of the unconventional building practices in relationship to their planned functionality. Further, there is the question regarding the critical intersections and the approach to the introduction of the architectural objects under specific programs in relationship to the site strategy. Here, the architectural scale entangles the consideration of the human experience of the evolving site, the accessibility, and how the post-mining site comes back to the urban surrounding in the eyes of the average citizen.

2.5. Design Question

How to integrate the active post-mining infrastructure with site-specific programming of space to achieve multiscale remediation along the axis of the released groundwaters?

Subquestions :

Macro: *What kind of landscaping strategy/-ies should be introduced for the remediation of soil in light of the reuse of the post-mining groundwaters?*

Mezzo: *How to approach the intersection between the landscaping strategy and the architectural artefacts? How the landform integrates with the built form?*

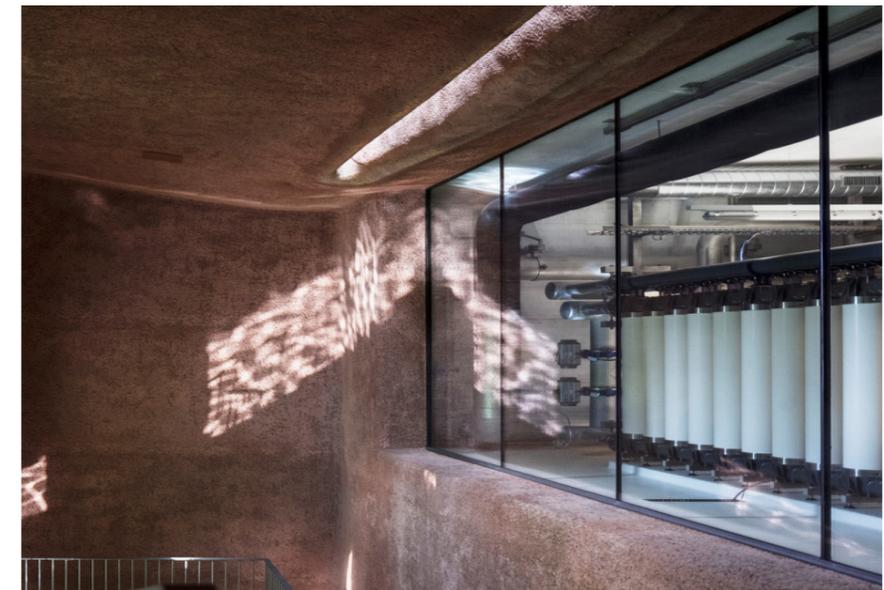
Micro: *How and what the architectural artefacts come into being at the intersection of water/soil treatment and terrestrial conditions? What are their spatial and material qualities?*

2.5. Threshold Suitability

Threshold 1: Water Purification

The primary step before the release of groundwaters on the site is their purification. This is because the groundwaters pumped out of mines in Upper Silesia are highly saline. The salination of groundwaters at the project's site (former coal mine "KWK Centrum" in Bytom) is estimated at 2,1 g/dm³. Thus, the purification of waters is a necessary step that is achieved with the use of reverse osmosis technology.

Subsequently, the chemico-physical properties of the purified groundwaters have to be closely monitored at the water purification unit as following their purification, waters are released on the project's site. The most suitable location of the water purification unit is in the area of the most secure terrestrial conditions and is due to the spatial and technical requirements of the machinery.



Muttentz Water Purification Plant

Reverse osmosis filters
Source: trends.archiexpo

2.5. Threshold Suitability

Threshold 2: Plant Biotechnology Laboratory

In the light of the project, Plant Biotechnology Laboratory is an R&D unit of a local university focused on the use of tissue culture and genetic engineering techniques to test and produce genetically modified plants that exhibit new or improved phytoremediation qualities. Here, phytoremediation is considered as a technique of phytotechnology, which is defined as:

“The use of vegetation to remediate, contain or prevent contaminants in soils, sediments and groundwater, and/or nutrients, porosity, and organic matter. (...) Phytotechnologies implements on-site scientific and engineering solutions to contaminants found predominantly in soils and groundwaters, via introduced vegetation that is targeted to be self-sustaining and integrated in the site design.”

(Kennen & Kirkwood 2015, p.5-6)

At the Plant Biotechnology Laboratory, the research of phytoremediation is coordinated with soil sampling, which is aimed at measuring the complex physicochemical properties of topsoil. This provides the basis for the research and choice of plant species, which under different phytoremediation techniques, such as phytoextraction, phytostabilization, phytoextraction, are introduced to the testing fields at the project's site.



Heavy Metals on Post-Mining Sites

phytoexcluders	Festuca rubra Merlin	Red Fescue	Herbaceous	Cu, Zn, Ni
	Lolium spp.	Ryegrass	Herbaceous	Cu
	Oenothera glazioviana	Evening Primrose	Herbaceous	Cu
	Sinapis arvensis L.	Wild Mustard	Herbaceous	Cu, Zn, Pb, Cd

hyperaccumulators	T. caerulescens	Zinkboerenkers	Herbaceous	Cu, Zn
	Arabidopsis halleri	Rockcress	Herbaceous	Cd, Zn
	Minuartia verna	Spring Sandwort	Herbaceous	Zn
	Rumex acetosa	Rumex	Herbaceous	Zn
	Thlaspicaerulescens	Alpine Pennycress	Herbaceous	Cd, Zn
	Thlaspi caerulescens	Alpine Pennycress	Herbaceous	Cd, Zn
	Thlaspi caerulescens ssp. Rotundifolium Viola calaminaria	Pennycress Viola	Herbaceous Herbaceous	Zn Zn, Cd, Pb

accumulators	Agrostis delicatula	Bentgrass	Herbaceous	Zn, As, Cu, Mn
	Arrhenatherum elatius	False Oat Grass	Herbaceous	Ni, Cu, Cd, Co, Mn, Cr, Zn
	Brassica juncea	Indian Mustard	Herbaceous	Cu, Cd, Cr(IV), Ni, Zn
	Brassica napus	Rapeseed	Herbaceous	Cd, Cu, Zn
	Chicorium intybus var. foliosum	Chicory	Herbaceous	Cd, Cu, Zn
	Festuca arundinacea	Tall Fescue	Herbaceous	Zn
	Helianthus annuus	Sunflower	Herbaceous	Cd, Zn, As, Ni
	Linum usitatissimum	Flax	Herbaceous	Cd
	Zea mays	Corn (hybrids)	Herbaceous	Cd
	Solanum nigrum	Black Nightshade	Herbaceous	Cd, Ni, Zn
	Salix spp.	Willow	Shrub	Cd, Ni, Zn
	Populus spp.	Hybrid Poplar	Tree	Zn, Cd



phytostabilization

onsite stabilization of pollutants

easy

phytoextraction

biomass production (requires harvesting)

difficult

phytoextraction

biomass production (requires harvesting)

very difficult

(strategy)

(extraction)

Types of Phytoremediators / Plant Species Selection

according to Poland's plant hardizone
source: Kennen & Kirkwood 2015

Source: Kennen & Kirkwood 2015

2.5. Threshold Suitability

Threshold 3: Phytoremediation Nursery

What follows the previous research phase, is the Phytoremediation Nursery. The necessity of such a programmatic domain lies in the fact that the project's site becomes the incubator for the plants exported to different contaminated sites in the region. Thus, the intervention has a systemic effect not only on the quality and quantity of soil and water but on the spread of remediation-focused plant species in the region. These specific species are selected based on, inter alia, place-specific soil conditions, but also on the USDA hardiness zones, which determine the plants most likely to thrive in the region. The Phytoremediation Nursery has to be oriented on the axis north-south and should provide a controlled climate with the exposed sunlight.



2.5. Threshold Suitability

Threshold 4: Water Leisure

The following step in the multiscalar treatment of the project's post-mining site is the introduction of social programs, which exist in correspondence with the changing levels of water accumulation. These programs embrace the water leisure activities (such as swimming, sunbathing, fishing, canoeing), which now are given a chance to legally return to the project's site. Further, these programs are focused on the underprivileged citizens of Bytom, who long have had to meet their leisure-oriented needs at the margin of urban settlements.



2.5. Threshold Suitability

Threshold 5. Balance of Accumulation / Observation

The final threshold in the intervention is focused on observation of the evolution of the site and the balance of water accumulation, where the latter is achieved with the final earthfill clay-cored dam controlling the volume of waters. However, the excess of the waters has to be managed properly. This is achieved with a two-fold procedure, which aims at releasing the excess waters to the river. Thus, first, the excess volume is pumped out with the floating irrigation pump to the retention reservoir in the northern part of the project's site, from where the excess (treated) waters are released to the river, hence, improving the systemic quality and quantity of surface waters.



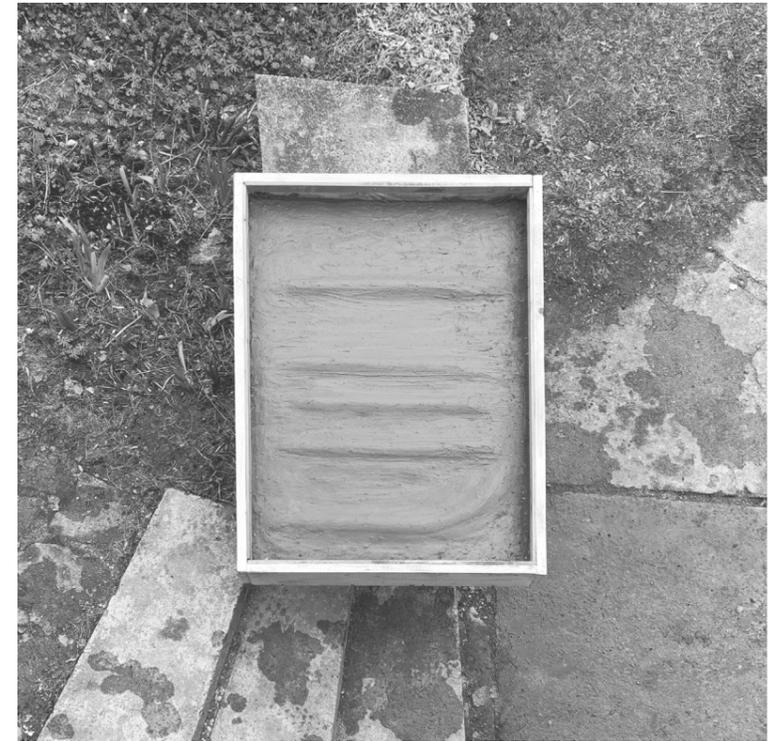
2.6. Testing

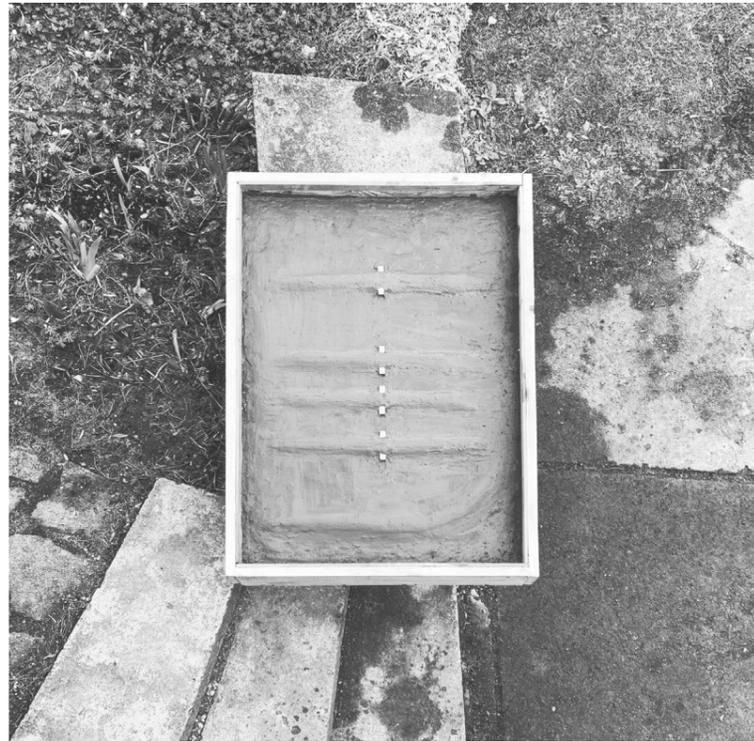
To test the initial thresholds indicated in the site analysis, I employed a performative clay-based model, which helped mimic the site conditions if the earth-fill thresholds were introduced. Then, when the model was ready, I ‘released’ water to observe the flow and accumulation of the sediment. At this point, I concluded that the magnitude of processes on the project site requires a proper design response that will enforce the grounding of the intervention. Thus, the intervention becomes a starting strengthened framework and the subject to the unfinished transformation of the site.



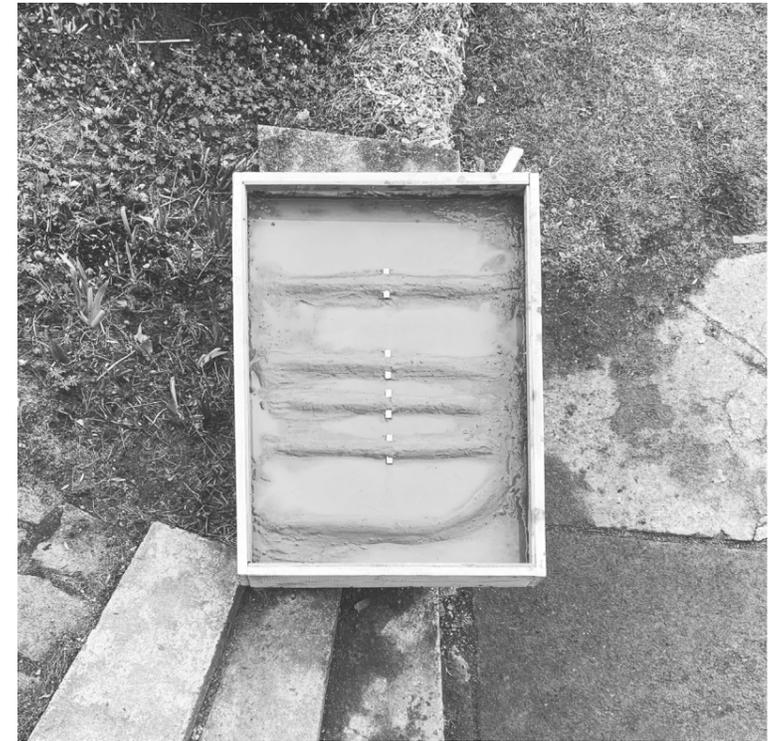
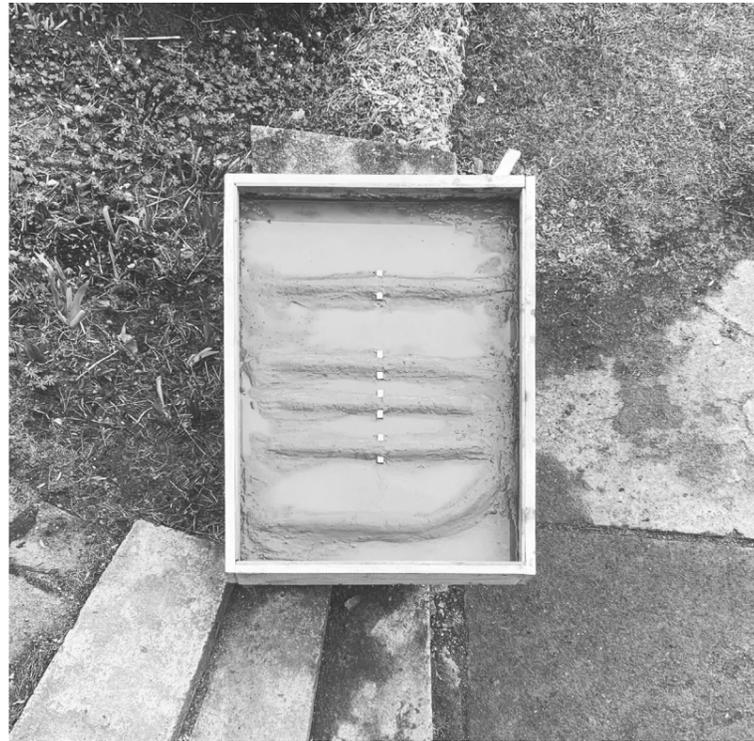












The Project

3. The Project

3.1. Proposition

Reversing the Cycle

The departure from coal in Poland results in a long process of decommissioning of the underground coal mines. These, based in the region of Upper Silesia, undergo a paradigm shift - 'from mining coal to mining water', as the systemic discharge of groundwaters is crucial for the underground security of still-active mining operations.

Here, rather than an obstacle, the project recognizes a valuable asset in the released groundwaters, which while still at hand, are channeled into the multilayered remediation of post-mining territory. While mining infrastructure, even though decommissioned, is still employed in groundwater modeling, at least in its last decades, it is turned from the megamachine of landscape deconstruction to the megamachine of its reconstruction, hence, reverting the cycle of ecosystems degradation.

Site Strategy

Rather than discharging the groundwaters into the river, the project aims to treat, release, and reuse these waters on its site to establish a terraforming laboratory, a regional test site in Bytom aimed at the multiscale remediation of the degraded post-mining territory. In the project, the remediation employs not only the treatment of the contaminated soil and water but the productive reintegration of the site with social programs and urban settlements. This is expected to evoke the final return of the site to the city, hence, influencing the industry-centered local identity by interweaving the emotional attachment to the mining symbols with the much-needed environmental values.

To achieve the remediation, based on the site analysis, key programmatic thresholds are introduced. These, following the axis of the released waters, constitute the consecutive 'intensive' phases in the treatment of the site and consider the sequence of operations: water purification, research, and application of phytoremediation strategies, the introduction of leisure-oriented social programs. Subsequently, while the thresholds cut through the site, they divide the territory producing a gradient of various zones of experience. These thresholds range, inter alia, in the degree of control of the water environment, and the intangible atmospheres produced by varying wetness and inclusiveness. Thus, just as in Tarkovski's 1979 *Stalker*, humans discover the zone, its evolution, finally to become the active actors in the process of remediation side by side with the non-human ones.

'Between the Land and the Built'

The critical intersections of the intervention are where the land- and built forms come together. This transition, however, is ambiguous as the project recognizes no distinction between these two forms. Thus, in the project, the architecture blends with landscape both in terms of functionality and materiality, adopting an active role of 'the terraforming interface'. Here, however, the role of the architecture lies not only in modeling the landscape but in framing the perspective, and the personal experience of a local citizen immersed in the evolution of the post-mining territory.

3. The Project

3.2. Objectives

1. Reverting the Cycle

Rather than an obstacle, the project treats the released groundwaters as a valuable asset. Subsequently, with the use of the post-mining infrastructure, these waters are channeled into the layered remediation of the territory. Thus, at the end of its operative existence, the post-mining infrastructure takes an active part in the treatment of the degraded post-mining territory. Further, it undergoes a two-fold paradigm shift: 'from mining coal to mining water', and 'from destruction to reconstruction' while reverting the cycle of ecosystems degradation.

2. Multiscalar Approach

The project's intervention, aimed at remediation of the post-mining territory, requires a multiscalar, thus, multi-disciplinary (hence systemic) reconceptualization. Therefore, in the project, the emphasis is put on the necessity of the multiscalar approach where the project defines its "site" (intervention strategy) as a multi-disciplinary ground. Hence, the projects stress the significance of the intersections between different material and temporal scales, such as landscape/architecture, environment/society, architecture/mind, which are crucial for the application of the remediation intervention on the post-mining territory.

3. Model Example

As the project considers the redevelopment of a specific site in the city of Bytom, it becomes a model example for the treatment of the remaining (strategic) post-mining sites in Upper Silesia. Subsequently, it becomes a laboratory for the territory evolution under the condition of the released groundwaters at the end of the coal mining industry in Poland.

Further, conclusions drawn from the project's intervention are thought to serve as the guidelines for the redevelopment of the remaining post-mining (strategic) sites and enrich the local knowledge in the procedures that can be applied to the degraded territory.

3.3. Relevance

1. Environment (Systemic Impact)

The impact of the project's intervention surpasses its site. The treatment, release, and reuse of the groundwaters have a systemic impact on the environment as these operations reduce the systemic pollution of surface waters in the first place. Further, while released on the site, the groundwaters are applied to the remediation of both physically and chemically exhausted soil. This has a positive impact not only on the condition of the soil but on the ecosystem as a whole. This ecosystem includes both human and nonhuman actors who in light of the project share equal rights to the post-mining territory.

2. Society (Channeling the Identity)

Through the introduction of the intervention in Bytom, the city standing at an extreme intersection of post-mining conditions, the project envisages an impact on channeling the local identity. Prior to the introduction of the project, this identity was solely based on the emotional attachment to the past industrial era. From now on, however, this identity is thought to evolve as the project becomes a singularity in the Deleuzoguattarian sense - a turning point on the canvas of the post-mining territory. This can be achieved as the whole project site becomes open to the public what enables the local citizens to discover the evolution of the site in time.

3. Mind (Emotional Attachment)

Although the socio-economic gap, the aftermath of the 1990s structural changes, will remain regardless of the intervention, the project will address this gap as it speculates that this is one of the ways to productively interweave the emotional attachment to the mining symbols with the much-needed environmental values. Thus, the aforementioned remediation will embrace not only the environment but the local society and individuals who willingly or unwillingly will become the actors in the process of remediation of the post-mining site.

3. The Project

3.4. Spatial Concept

a. Configuration and Composition

Rather than draining the groundwaters into the river, the project aims to treat, release, and reuse these waters on its site. Thus, following the topography, the released groundwaters establish a longitudinal (east-west) axis of the multilayered intervention. At the same time, this axis constitutes a critical site section through the range of the terrestrial conditions (from secure to highly insecure), and later becomes a symbolic link between two different scales - the local (through the urban entry) and the regional (through the railway station).

As the longitudinal (east-west) axis is drawn, the lateral (north-south) thresholds are introduced in correlation with the specific water and soil conditions. These thresholds, the land formation constructed with the accumulated topsoil sediment, both manage the accumulation of water and soil and establish the basis for the emergence of consecutive programs crucial for the treatment of post-mining territory. Here, however, the management of the material accumulation is not the sole purpose of the threshold as they provide pedestrian accessibility between two sides of the site.

b. Performance

While the lateral (north-south) thresholds cut through the site, they divide the territory producing a gradient of different zones of experience. These zones range, inter alia, from the controlled to the uncontrolled water environment; from dry to wet, from the enclosed to the open. Subsequently, this gradient of environments is followed by different atmospheres emphasized by the change in the materiality of the thresholds that happens in correspondence to the range of the terrestrial conditions.

Further, as the lateral (north-south) thresholds manage the accumulation of soil and water, their performance comprises two phases. The first phase is focused on the channeling of the groundwaters and is planned to end by 2050 with the end of coal excavation. The second exceed this date and is, on the other hand, foreseen to focus on the accumulation of water and the retention-based functionality of the site. This is due to the increasing shortage of water in the light of both progressing systemic depletion (dewatering operations) and climate change.

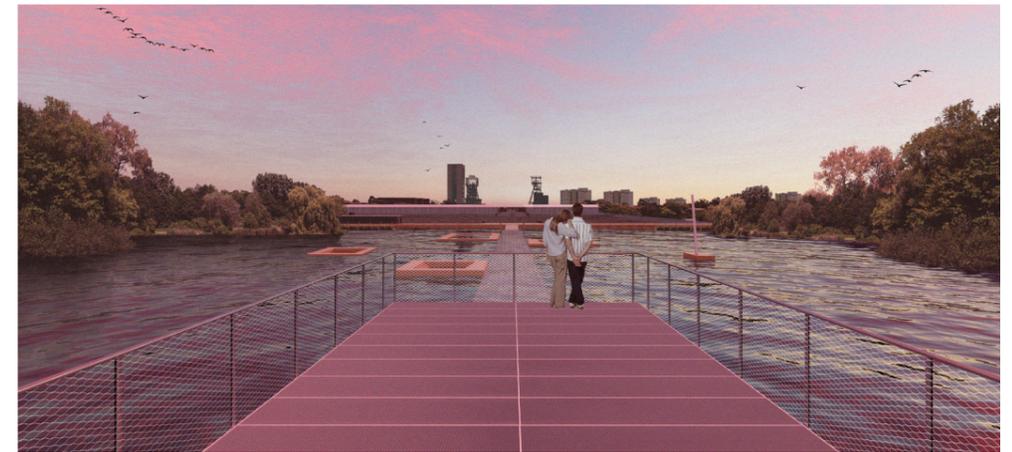
c. Function and Program

Based on suitability analysis, 5 lateral thresholds are established on the site. Subsequently, they create the basis for the introduction of consecutive programs aimed at multiscale remediation. While these programs conceive a sequence that follows the treatment of water and soil, they 'open' for the public as the release of waters continues. Thus, the programmatic sequence follows in order: water purification, plant biotechnology laboratory, phytoremediation nursery, water leisure, balance, and observation. Then, between these 5 thresholds different phytoremediation testing fields are introduced, which coordinated by the R&D unit of the local university, gather and analyze data from the site. Finally, as the site opens to the public in its western part, water leisure takes over. As the site comes back to the citizens, it comes back to the city.











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