Victoria Svahn, City of Göteborg
Jenny Norrman, Chalmers University Technology
Lorena Melgaço, Malmö University/Lund University
Olof Taromi Sandström, Geological Survey of Sweden
Yevheniya Volchko, Chalmers University Technology
Fredrik Mossmark, Geological Survey of Sweden
Marilu Melo Zurita, University of New South Wales

Societal values and consequences of integrating geosystem services into subsurface planning

Results from research project funded by the call Planning for transformation, Stage 1

FORMAS

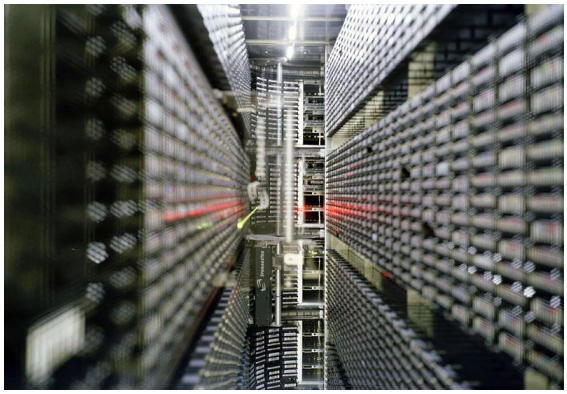
Göteborgs Stad Stadsbyggnadskontoret · SGU Geological Survey of Sweden · CHALMERS · UNSW · IUR

SUBSURFACE PLANNING AND GEOSYSTEM SERVICES

Why is the subsurface important for transformation to a sustainable future?

The subsurface is not only a construction basis which provides physical space for infrastructure and the possibility to create a better surface living environment: **the subsurface is a multifunctional natural resource**. Apart from physical space, it provides water, energy, materials, habitats for ecosystems, support for surface life, and a repository for cultural and geological heritage, all of which can contribute to achieve the SDGs and tackle challenges to transform to a sustainable society.

"Early management provides conditions that can enhance the realisations of social values for Gullbergsvass. Early planning and implementation are essential."
(Workshop participant)



"How can the social benefits be valued against the economic and technical benefits"?
(Workshop participant)

Why do we need subsurface planning?

The subsurface is invisible in planning and policy. In the description of the SDGs, only aquifers are explicitly mentioned. **In the Swedish planning legislation, there is no explicit mentioning of the subsurface**. Instead of considered a resource, the subsurface is often perceived as uncertain, problematic and costly. In Sweden, as elsewhere, the first-come first-served principle applies to access to the subsurface resources, hindering strategic planning and in the end, sustainable use of precious, sometimes non-renewable resources.

The development of subsurface planning, which both 1) takes the subsurface conditions into better account in the surface planning, and 2) balances the use of different subsurface resources, will create better possibilities for both urban and rural areas to transform sustainably.

Why introduce geosystem services in planning and policy?

Introducing the concept of geosystem services into planning processes will create benefits by:

- Making the resources of the subsurface more visible and support communication regarding the subsurface
- Clarifying the social/societal benefits of the subsurface and support a more holistic subsurface planning

The overall goal of the proposed research project is to develop a framework for structured consideration of geosystem services (GS) in spatial planning, with specific objectives to:

1. Elaborate the concept of GS to enable for consideration and integration of subsurface societal values;
2. Identify how GS should be strategically considered in spatial planning;
3. Develop methodologies for selected GS for integration into planning processes; and
4. Identify opportunities within a subsurface planning process for stakeholder engagement and communication.

Four **'Geosystem services and social values'** workshops aimed to:

1) create a network of stakeholders engaged in strategic planning of the subsurface from various perspectives;
2) investigate the concept of geosystem services and social values of the subsurface in collaboration with the stakeholders.

0

4 WORKSHOPS – 4 TOPICS

Workshop 1: Centralen area Göteborg

What different geosystem services play a role in the Centralen area? Would using a geosystems framework have helped communication among different stakeholders and put different aspects of the underground under one umbrella?

1

Workshop 2: Södra Närke

What are the conflicts of interests in this area? How can mining, tunnelling, groundwater usage, development of new residential areas co-exist? Can Geosystem services be considered in the upcoming work with the Askersund comprehensive plan?

2

Workshop 3: Malmö case

How can we integrate the concept of geosystem services into existing planning systems, tools and methodologies?

3

Workshop 4: Effective use of underground constructions

How can we enable reuse of current facilities? How can we plan, design and build tomorrow's facilities for multifunctionality or potential future reuse? How can planning and underground construction support a sustainable and resilient society? What social values can we create by enabling use for several different purposes or reuse in the future?

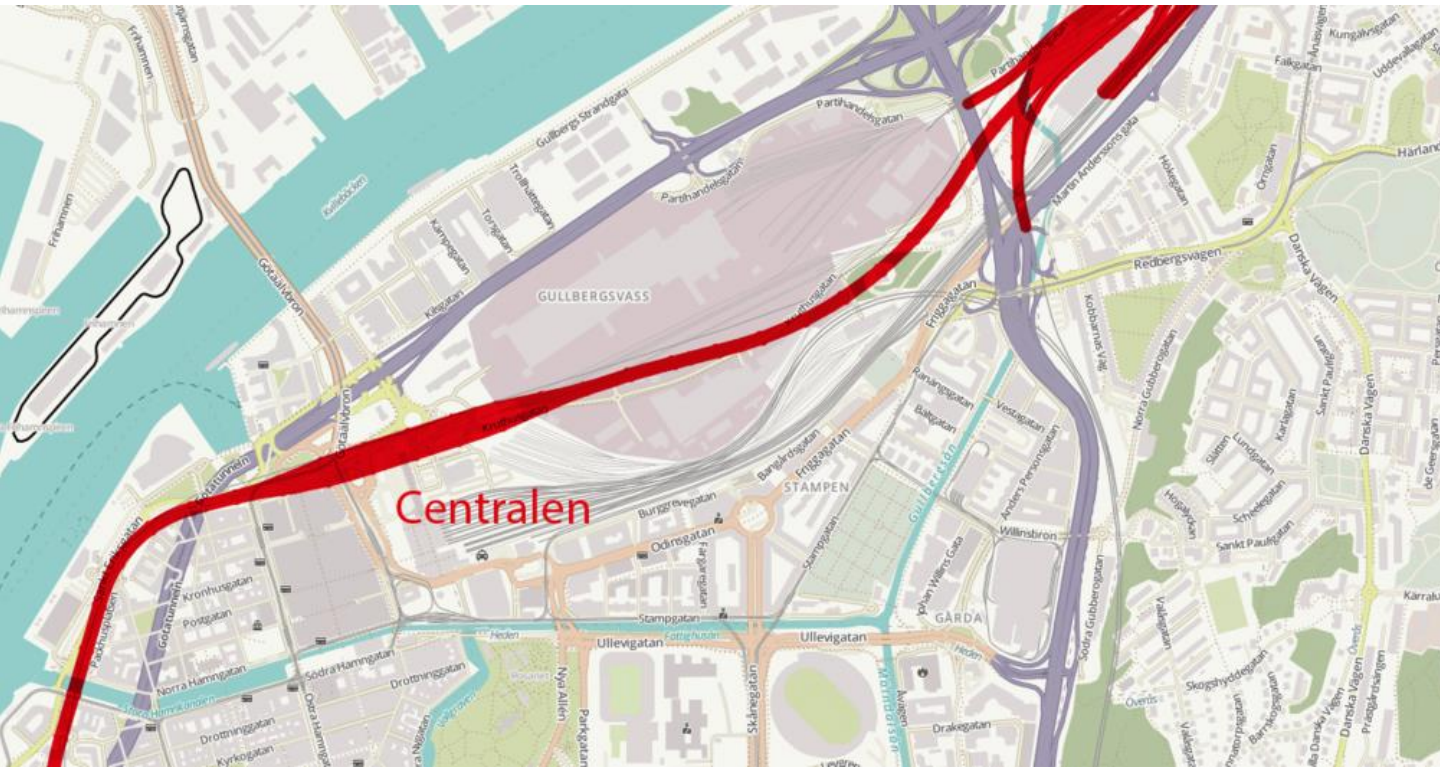
4

WORKSHOP 1: CENTRALEN AREA GÖTEBORG

24 September 2020, 9:30 - 11:30

CONTEXT

The Centralen area in Göteborg, which encompasses the land between the central station and the river Göta älv, is undergoing a massive transformation process. By providing more housing and office spaces, in the next 20 years the area will be developed into an attractive part of the city for the citizens. Today the area is dominated by traffic, in the future it will be a more diverse neighbourhood meeting the waterfront. The massive change in land use requires large infrastructural investments, laying a heavy weight also on the subsurface. The goal of this workshop was to investigate the challenges planning for a long-term urban transformation project considering existing and future uses of the underground.



CHALLENGES

Large projects such as the ones within the Centralen area are, to a large extent, conducted at a first-come first-served basis. This leads to increased costs of construction, often disadvantages for those who come second, and few thoughts are given to future opportunities that might need present preparation.

There is no budget allocation at early stages of large projects to consider future options. It also becomes more complicated as the stakeholder performing the present project is seldom the one interested in the future investment.

Finally, the focus on the financial analysis of projects renders (social) values less relevant. There is little engagement of citizens, who are neither fully informed of subsurface projects, nor participate in decisions at that level.

RESULTS

The discussions during the workshop highlighted the need to overcome the first-come first-served principle.

There is the need for a better overview of the subsurface and at least one organisation with full access to sensitive information and legitimate to coordinate and act for collaboration among stakeholders.

The municipalities need to have a financial model that allows them to act as a bank, giving them leverage in negotiations and act in favour of future citizens.

There is need for better communication with citizens and work procedures that allow them to give social input throughout the process. Working closer to the public will likely enrich projects and create increased awareness in the decisions.

8 external participants from 6 institutions:
Jernhusen (public company, national owner, manager and developer of real estate in the vicinity of railway stations;) City of Göteborg (City planning authority, Real estate department); Skanska (construction company, contractor); Tyréns (consultant, also representing the Traffic Administration); COWI (technical consultant).

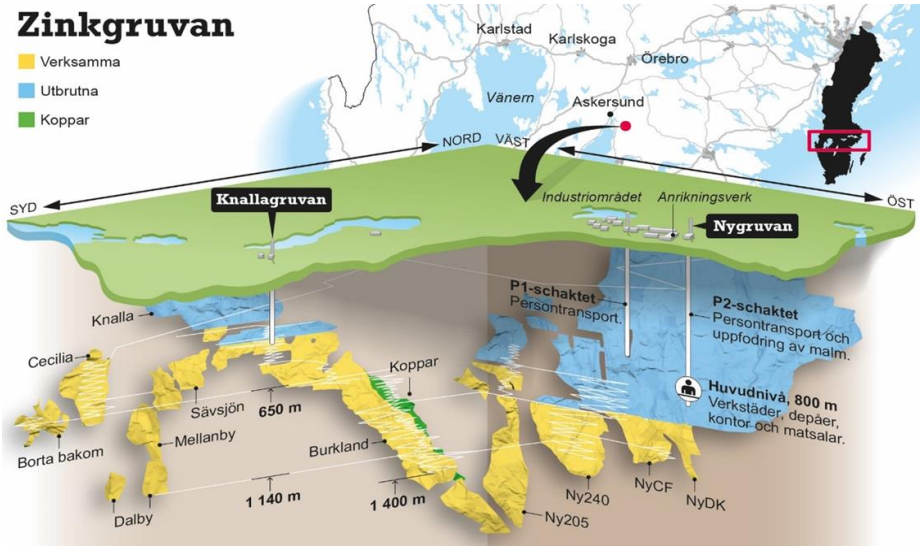
4 from project team, 4 organisations:
City of Göteborg, Chalmers University of Technology, University of Malmö and University of New South Wales.

WORKSHOP 2: SÖDRA NÄRKE

16 November 2020, 10:00 – 12:00

CONTEXT

The workshop focussed on three municipalities (Askersund, Laxå and Lekeberg) that are located in the southern part of the Närke province, between Lake Vättern and the city of Örebro. There is an underground zinc and copper mine, groundwater usage for drinking water, exploitation of eskers for sand and gravel and plans for rail and water tunnels. The area is sparsely populated, with population densities between 9 to 18 people per square kilometre.



CHALLENGES

Zinc and copper mine releases contaminated water that influences the quality of the groundwater.

Radon and contaminated land in areas for new residential neighbourhoods

RESULTS

One important aspect of planning is communication with stakeholders. It was the view of the participants that while the local municipalities are good at communicating with the inhabitants, the large-scale infrastructure (water/rail) projects often lack in that aspect.

Negative geosystem services were discussed, problems with radon and contaminated land in new residential areas.

Not in my backyard: would a new mine get the support of the community? Legislation about extraction gives little leverage to the community, minerals are national priority and interests.

Rail and water tunnels have limited impact and pass through fairly uninhabited locations.

Upcoming work with a new comprehensive plan for the Askersund municipality. Geosystem services could be a supporting tool.

5 external participants from Sydnärkes Byggförvaltning

4participants from the project team, 4 organisations:
Geological Survey of Sweden; University of New South Wales; Malmö University

WORKSHOP 3: MALMÖ

25 November 2020, 11:00 - 12:00

CONTEXT

Ecosystem Services (ES) are already well implemented into the organisation and in policies in the City of Malmö. Several ES described in Malmö are in fact geosystem services (GS). For example, 100-year rain protection parks are anthropogenically created and partly consisting of geosystem services (infiltration and buffering systems).

Malmö is currently planning several large underground projects and solutions, for example metro stations and sewage tunnels. These are examples of supporting GS.

The deep geothermal drilling to extract heat from the earth interior and convert to central heating is another very large project in Malmö, and an example of a provisional GS (energy).

CHALLENGES

The main challenge identified in the Malmö case study is how we can integrate the concept of geosystem services into existing planning systems, tools and methodologies.

RESULTS

One very important result from the workshop is that there is a real need for a practical way of highlighting different values from the underground into spatial planning processes and documents.

An interesting idea is to use already existing and developed tools for ecosystem services and incorporate geosystem services as a part. For instance, The City of Malmö is today using ESTER (a newly developed ecosystem services valuation tool for detailed spatial planning; Boverket 2020) and sees the need for complementing the tool with geosystem services valuations.

For comprehensive planning, strategic tools and methods are needed. Another idea is to test and evaluate the newly developed tool called SUB-matrix (matrix for supporting Sustainable Use of the subsurface), which aims to support a systematic inventory of geosystem services in municipal planning processes (Norrman et al 2020).

Boverket (2020). *ESTER - verktyg för kartläggning av ekosystemtjänster.*
Norrman, J., Ericsson, L.O., Markstedt, A., Volchko, Y., Nilsson, K.L. & Sjöholm, J. (2020). Nya dimensioner i svensk planering – en utredning om undermarksplanering och geosystemtjänster. BeFo Rapport 214, 1-174.

5 external participants from City of Malmö

3 from project team, 3 organisations:
Geological Survey of Sweden; Chalmers University of technology; University of New South Wales.

WORKSHOP 4: MULTIFUNCTIONALITY

09 December 2020, 12:30 - 14:30

CONTEXT

The workshop focused on the reuse of old rock caverns and the multifunctionality of tunnels. Culture and sport activities, aquaculture and hydroponics, storage of heat, cold and other materials, bomb shelter, concert hall and theatre as well as parking space were potential reuses suggested by the workshop participants for old rock caverns.

The following functions could potentially be combined in tunnels: traffic, stormwater management, district heating and geothermal heating; defence facility, bomb shelter and storage of food for emergency cases; bomb shelter, railway station and shopping mall; and service tunnel and cycling tunnel.

Photo: Åke E:son Lindman

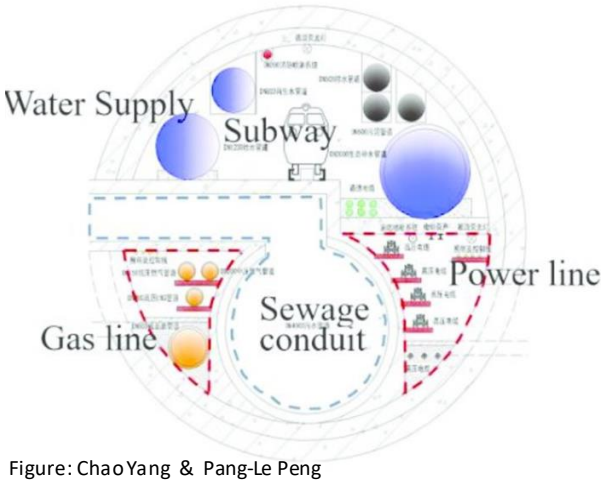


Figure: Chao Yang & Pang-Le Peng

CHALLENGES

The main challenges for reuse of old oil caverns: uncertainties with respect to environmental quality standards; financial uncertainties – high remediation costs, uncertain return on investment, uncertain profitability; psychological aspects – uncomfortable feelings; and lack of funding for underground plans.

Challenges of combining several functions in one location: safety risks – fire, explosion, sabotage risks and antagonistic threats; legislation – it could be challenging to locate several functions in one space; and time – combination of various functions in a road tunnel should be planned at least 10 years in advance.

RESULTS

Important social aspects of multifunctional use and reuse of old rock caverns were identified as: meeting places underground for social activities; psychological aspects of being underground; public involvement into planning of underground spaces; food security – aquaculture and hydroponics underground within the city borders; more free space for amenities aboveground when functions are located underground; new underground uses instead of moving current aboveground functions underground e.g. e-commerce, material storage, energy storage, hubs for exchange and storage of materials and things; climate change adaptation – storage of cold underground; and resource efficiency – reuse of blasted materials for construction purposes instead of disposal.

Important questions arose during the workshop: Which funding schemes can be used for underground plans? Which methods can be used for public engagement in planning of underground spaces? How to manage phycological aspects of being underground? How to evaluate social values of multifunctional use? Can the concept of geosystem services support the evaluation?

Photo: Johnny Waldman

11 external participants from 8 organisations:

Swedish Association of Local Authorities and Regions; WSP Civil (consulting company); Swedish Traffic Administration
Ecoloop (consulting company); BeFo – Swedish Rock Engineering Research Foundation; City of Stockholm, City planning authority + City development department; City of Göthenburg, Försäkrings AB Göta Lejon (The City's insurance company); Geological Survey of Sweden & previous Statens oljelager (retired participant)

5 participants from the project team, 4 organisations:

City of Gothenburg, City planning authority; Geological Survey of Sweden; Chalmers University of technology; University of New South Wales.

MULTIDISCIPLINARY RESEARCH – WHY IS IT NEEDED?

The subsurface has traditionally been handled in sectors, and in various planning themes. Sectorial organisation and management without a holistic view on the subsurface has led to undervaluing of the various resources in the subsurface and has acted to strengthen the first-come-first-served principle. To be able to better account for the subsurface in planning and to better manage the subsurface resources, an increased understanding and better communication is needed between disciplines, as well as between practitioners and researchers. Geosystem services is a concept which strongly relates to geology and natural sciences, but as with the concept of ecosystem services, social sciences is an integral part. Planners need to be able to communicate with experts within a broad range of disciplines, but other disciplines also need to be able to communicate with planners, timely and in an understandable way.

FUNDING - FORMAS Call "PLANNING FOR TRANSFORMATION"

The call Planning for transformation from Formas - A Swedish research council for sustainable development aim to fund research projects that contribute with new knowledge and solutions for developing Swedish spatial planning so that it creates the conditions to transform towards a sustainable society. Stage 1 of the call allowed for planning grants to develop project concepts and create collaborations for Stage 2 applications. The project "Societal values and consequences of integrating geosystem services into subsurface planning" (Dnr 2020-00042, Project leader Olof Taromi Sandström, SGU) received a planning grant in spring 2020 and is now being further developed into a stage 2 proposal.

FORMAS

TIMELINE FOR PROPOSED PROJECT STAGE 2

Project start by mid 2021, end by mid 2025, if second stage FORMAS funding is successfully obtained.

Jan 2021
Stage 2 Project proposal submission

June 2021
Decision by Formas
If positive – contracts and partners agreements

Sept 2021
Project startup

2021

Project work: scientific basis and case studies
Knowledge exchange activities & result dissemination

2022 - 2024

Spring 2025
Final project seminar

Mid 2025
Project end

2025

INTERNATIONAL COLLABORATORS

University of New South Wales
Norwegian Geotechnical Institute
Municipality of Oslo
Municipality of Rotterdam
Municipality of Glasgow
City of Helsinki

CONTACT

Dr Jenny Norrman
Chalmers University Technology
T: +46317722182
E: jenny.norrman@chalmers.se

Dr Olof Taromi Sandström
Geological Survey of Sweden
T: +46311781
E: olof.sandstrom@sgu.se