A GEOLOGICAL 3D-INFORMATION SYSTEM FOR SUBSURFACE PLANNING IN URBAN AREAS - CASE STUDY DARMSTADT (HESSE, GERMANY)

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INTRODUCTION

In 2014 52% of the global population lived in urban areas, with significant variations from region to region. While the urbanisation level in the least developed countries (according to the UN classification) is 31%, the European Union already reached 75%. But even here the level of urbanisation differs from 40% in Bosnia and Herzegovina to 98% in Belgium. By 2030 estimations see another 1 billion urban dwellers, which is equal to a global urbanisation level of 60%. [1]. Behind these numbers some basic needs and challenges are hidden, such as the availability and sustainable use of resources like sand, gravel and water. Or an intelligent and prudent urban planning, considering the near-surface subsoil as one of the most important keys for developing urban areas efficiently and successful.

To establish successful and sustainable urban and/or subsurface planning in the federal state of Hesse, the Hessian Agency for Nature Protection, the Environment and Geology (HLNUG) initialized the development of a geological 3D-information system for subsurface planning in urban areas. As area of interest the city of Darmstadt has been chosen due to a complex geological setting and various running geoscientific research projects which will provide relevant content. Altogether nine institutions work together, making this project a multi-institutional cooperation (Fig. 1).

Figure 1: Institutional framework for realizing the geological 3D-information system for subsurface planning in the city of Darmstadt

MAJOR CHALLENGES

Major challenges appear to be of both technical and content-related origin. From the technical point of view it is required to combine two information systems which do not fit together right away. In addition data distribution and rights of use need to be organized according to the requirements of all parties involved. Finally a joint front end has to be established which pays respect to the specific characteristics of content to be visualized, e.g. exaggeration of subsurface features while city information ideally keeps its real world extent.

From the content-related point of view the project team (survey staff, PhD-student, MSc- and BSc-students) needs to get along with a huge variety of data storage solutions (RDBS, Excel, etc), database models, data types, spatial references and data quality. In addition geological information needs to be translated in information that supports the daily business in urban planning which mostly is conducted by non-geologists, e.g. diggability or where weak construction ground conditions are given. In this context it is essential not to overinterpreting punctual information from e.g. drillings while deducting full coverage maps (Fig. 2).

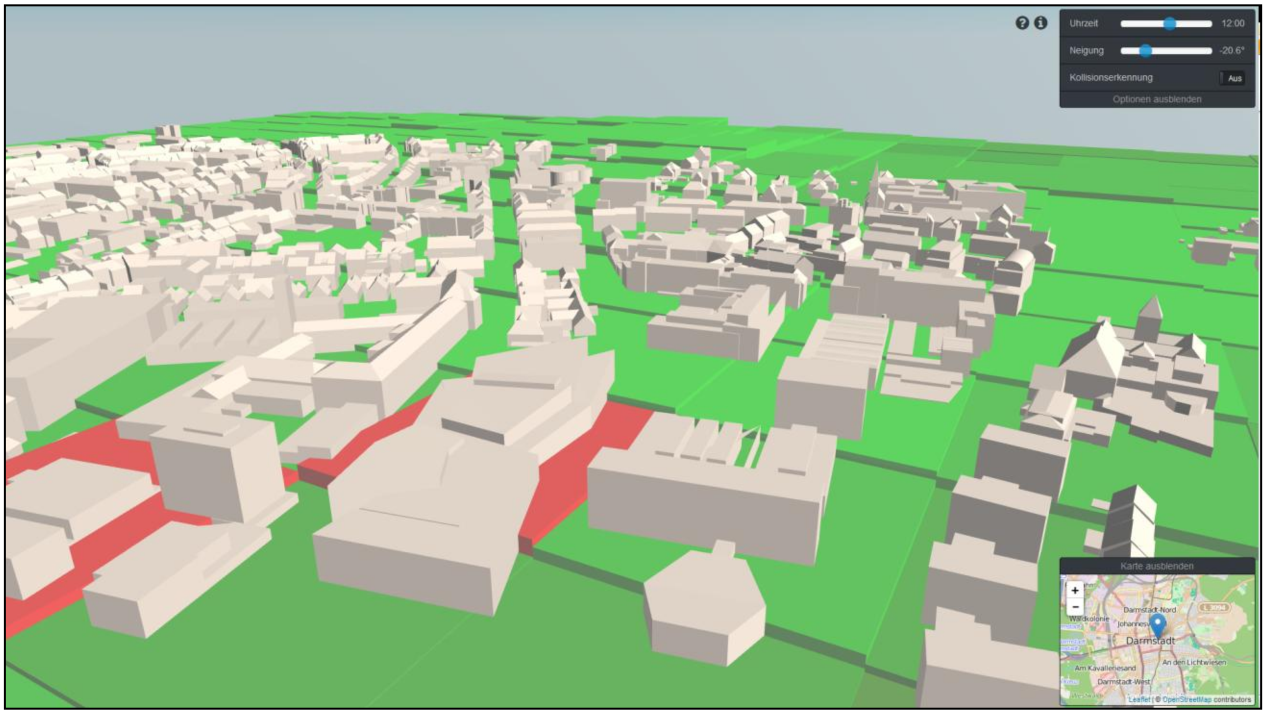

Figure 2: Section of the city of Darmstadt showing buildings (LOD2) and the probability of the appearance of silt in the depth of 2-5 meters below the surface. Red rectangles indicate a high probability, green rectangles a low probability.

GOAL

Goal of the project, which is scheduled for the next three years (Fig. 3), is a full content information system that includes technical subsurface infrastructure (sewage system, water and gas supply), geology as surfaces (stratigraphic horizons, faults) and volumes (solids and voxels) as well as derivatives from geological features (e.g. diggability, weak construction ground). Results will be made available through desktop clients supporting operations like cross sections and virtual drillings.

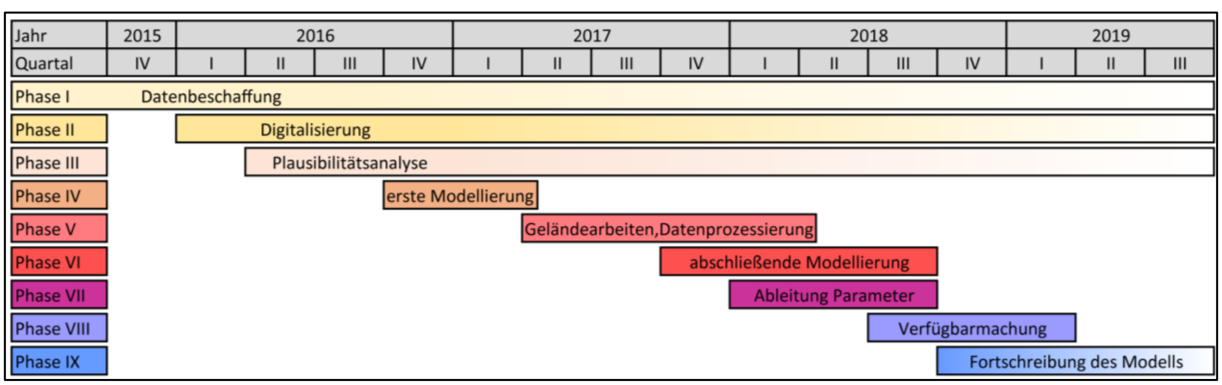

Figure 3: Project schedule

REFERENCES

[1] World Bank (2016): World Development Indicators 2016. Washington, DC: World Bank. doi:10.1596/978–1-4648–0683–4. License: Creative Commons Attribution CC BY 3.0 IGO