

# WaterMiner

## Recirculation and reutilization of mining impacted waters in Halong City - Vietnam

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In 2016, the WaterMiner project and the Vietnam National Coal – Mineral Industries Holding Corporation Limited (VINACOMIN) agreed on a collaboration in order to develop mine water recirculation and reutilization concepts and measures for Hon Gai hardcoal mining area in Quang Ninh. The R&D project is sponsored by the BMBF (German Federal Ministry of Education and Research) and is coordinated by the Institute of Environmental Engineering and Ecology (eE+E), Ruhr-Universität Bochum.

The project is divided into 7 work packages (see Fig. 1) where WP 1-3 establish the necessary data management structures. WP 4 uses the data to set up a regional water-related material flow management model and scenarios.

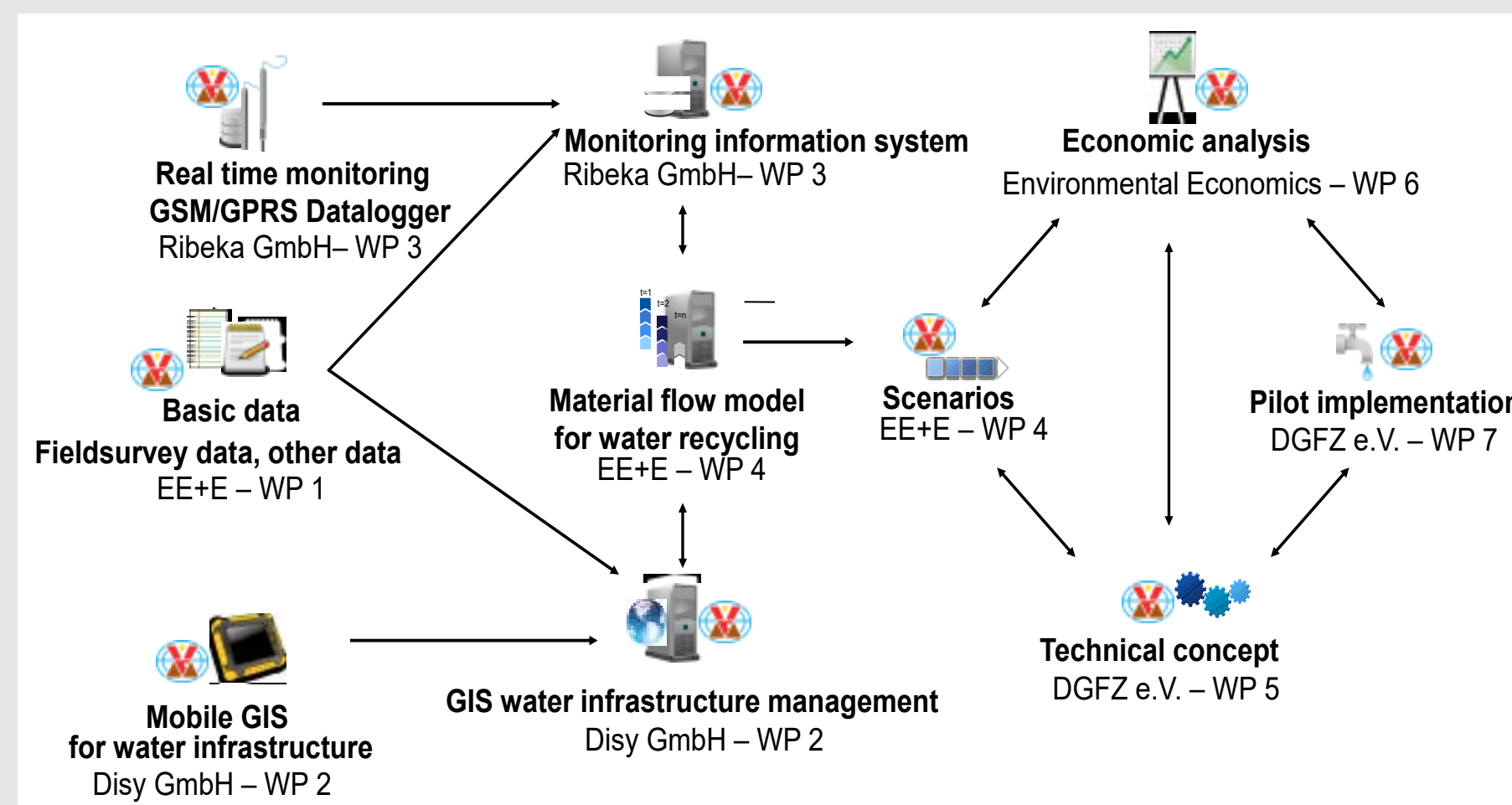


Figure 1: Project structure / collaboration partners

The WP 5 and 6 support the optimization of scenarios related to treatment technologies and economic efficiency. WP 7 supports the exemplary implementation of developed concepts in a selected area.

The mine water recirculation and reutilization concepts are developed for the period of active mining as well as for the period where mining activities will stop or move from open pit to underground mining and for the post-mining period.

All related data are integrated into a central data management system.

### Research Area

Hard coal mining in the province Quang Ninh is taking place for more than 130 years. The area is the most important hard coal mining area in Vietnam. It provides about 95% of the total national hard coal production. The mines are managed by the state-owned VINACOMIN group.

Beside mining, in recent years Quang Ninh province has developed into an important touristic attraction for domestic and international tourists. Ha Long Bay is recognized as a UNESCO World Natural Heritage.

Conflicts occur especially in the field of environment as the hard coal mining areas are located near the coast and near residential areas and cause significant environmental impacts (see fig. 3).

### Mine water planning

The project aims to combine a regional water-related material flow management and suitable recycling with the reuse of water generated from coal mining in Halong City, Quangninh Province, Vietnam (see fig. 4).

The reclamation of coal dust for further utilization is one important aspect considered to increase the ecological and economic efficiency. The spatial and temporal material flow management is to be developed for the active mining until mine closure and for post-mining uses (see fig. 5).

### Expected Results

- 1.) Data management system (DMS) on hydrology, hydrogeology, water resources management
- 2.) DMS part on water infrastructure
- 3.) DMS part for water monitoring
- 4.) Spatial and temporal material flow management for water reuse
- 5.) Comprehensive technical concept including water treatment, water distribution, regional integrated control, coal dust reclamation
- 6.) Economic concept, acceptance
- 7.) Exemplary implementation of a technical concept.



Figure 2: RAME project site

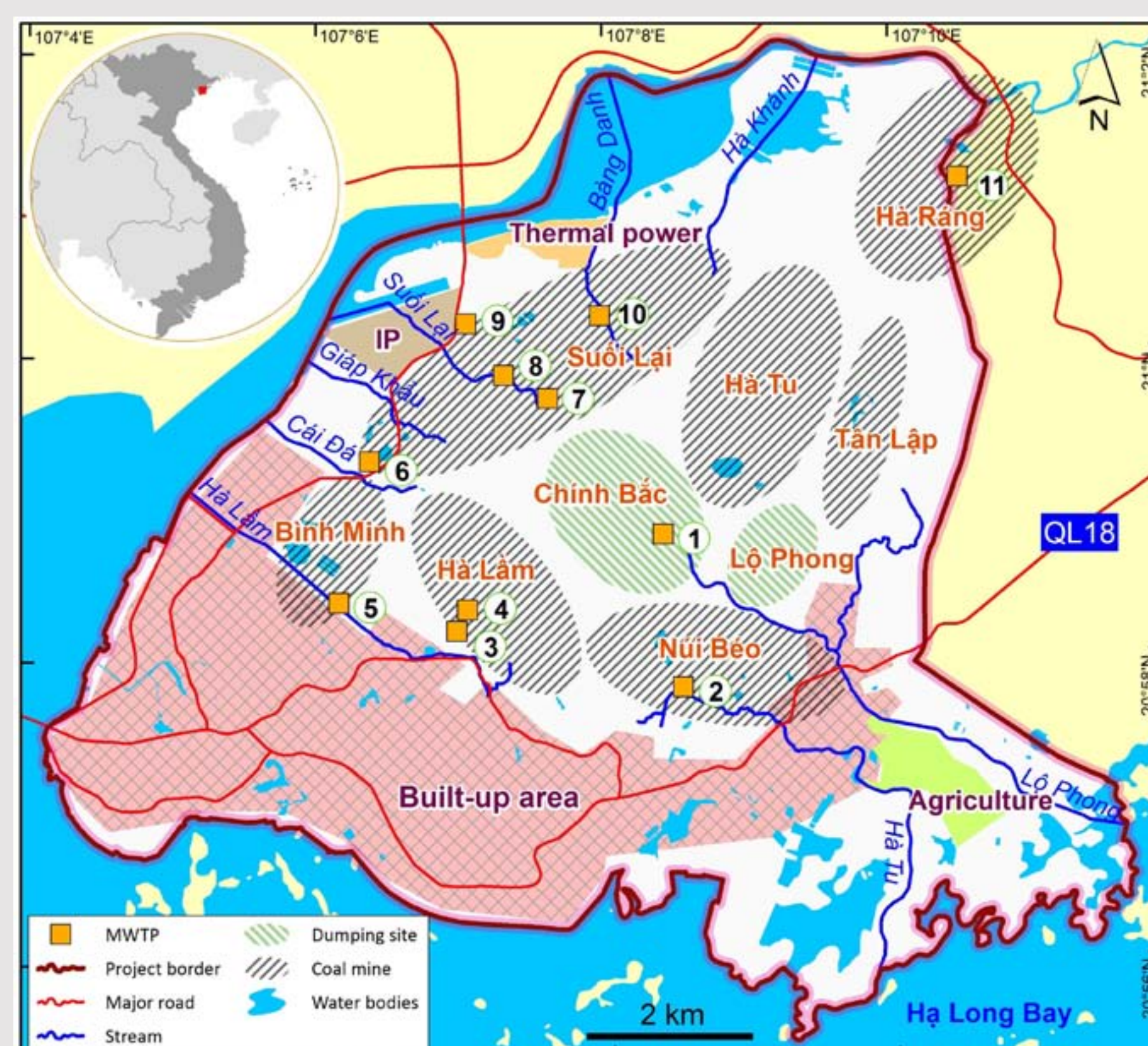


Figure 4: Methodological approach

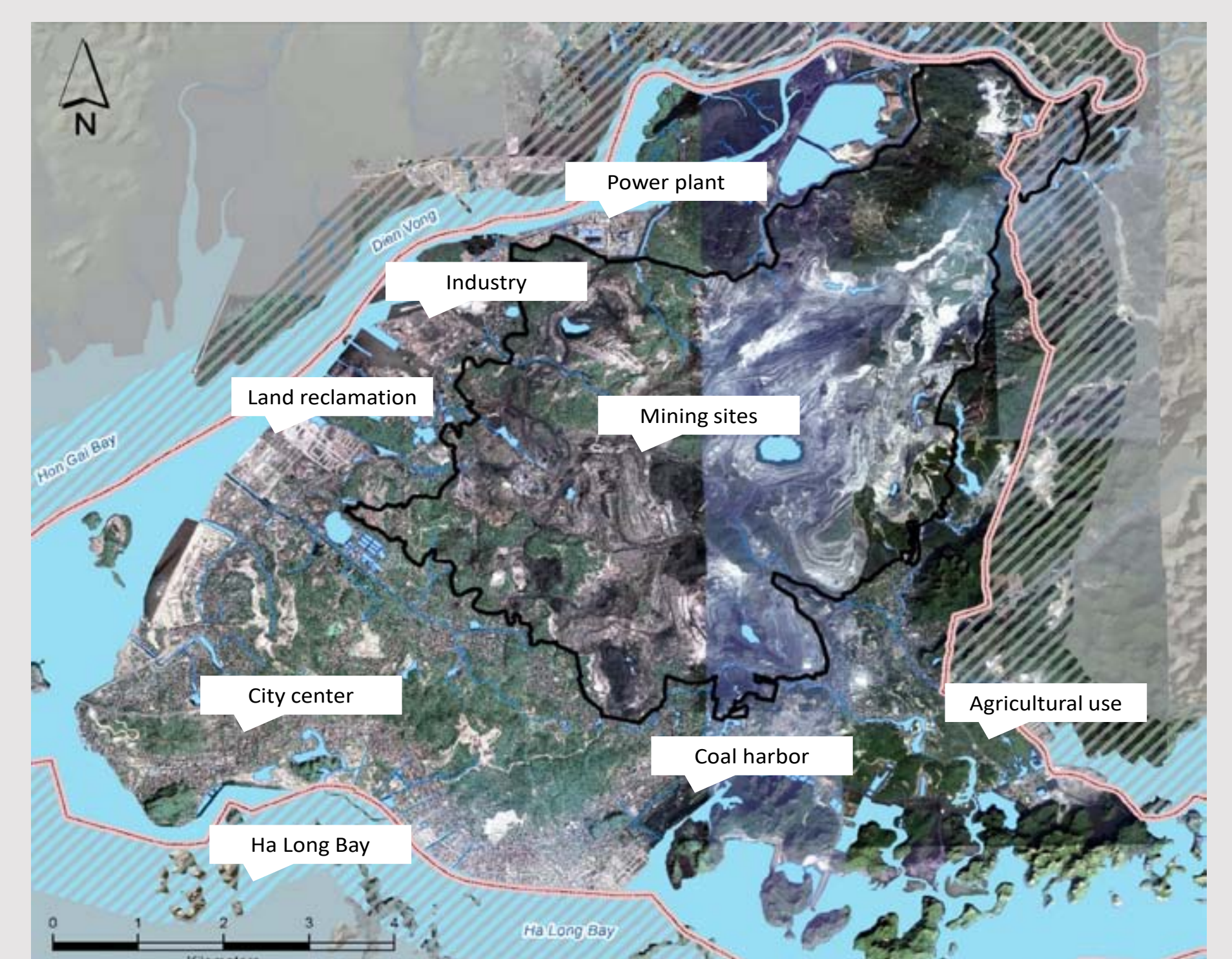


Figure 6: Potential water user on Hon Gai peninsular

The project is located on Hon Gai peninsula, which has an area of 124 sq km. The natural landscape of Hon Gai is dominated by rock formations reaching up to 450 m asl in the center of the peninsula. This is the area where mining takes place.

Flat lowland areas can be found along the coastline where the urban areas are concentrated. Dotted lime stone formations from Ha Long Bay (see fig. 2, green dotted line) in the southern coastal and lowland areas complete the picture. Large scale land reclamation through backfilling takes place along the southern and western coastal lines.

Ha Long City (fig. 2, orange line) is the economic, administrative and touristic center of the province Quang Ninh. Ha Long City has 220,000 inhabitants (Year 2010). It is situated about 170 km north-east of Hanoi.

The project will contribute to address the lack of water for coal production in the dry season in the coming years under the climate change and check the feasibility for an upgrade of the quality of treated mine water to the standards of tap water as requested by the plan on Water Resources Use in the Quangninh Province.

Research partner: Environmental Engineering + Ecology (eE+E) Ruhr-Universität Bochum, Environmental Economics Universität Koblenz-Landau, DGFZ e.V. Dresdner Grundwasserforschungszentrum e.V.,

Industry partner: Disy Informationssysteme GmbH, ribeka GmbH

Vietnamese partner: Vietnam National Coal – Mineral Industries Holding Corporation Limited (VINACOMIN)



Figure 7: Water user (agriculture, settlements, mining)

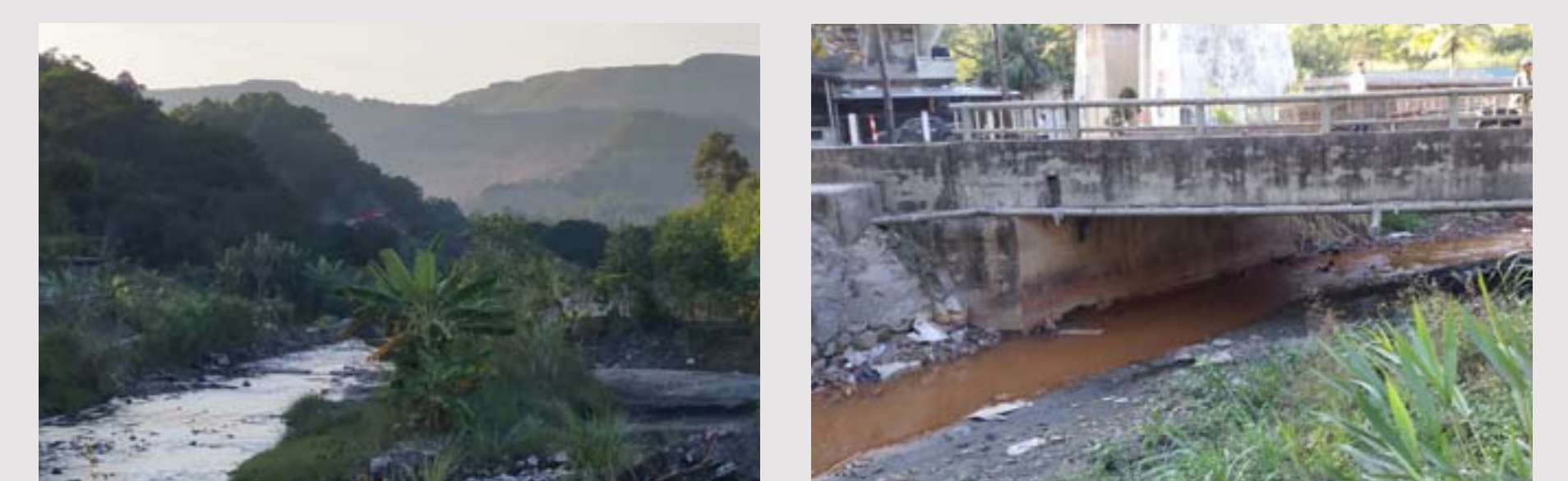


Figure 8: Mining influenced rivers in Ha Long



Figure 3: View from Nui Beo dump plateau towards Ha Long Bay

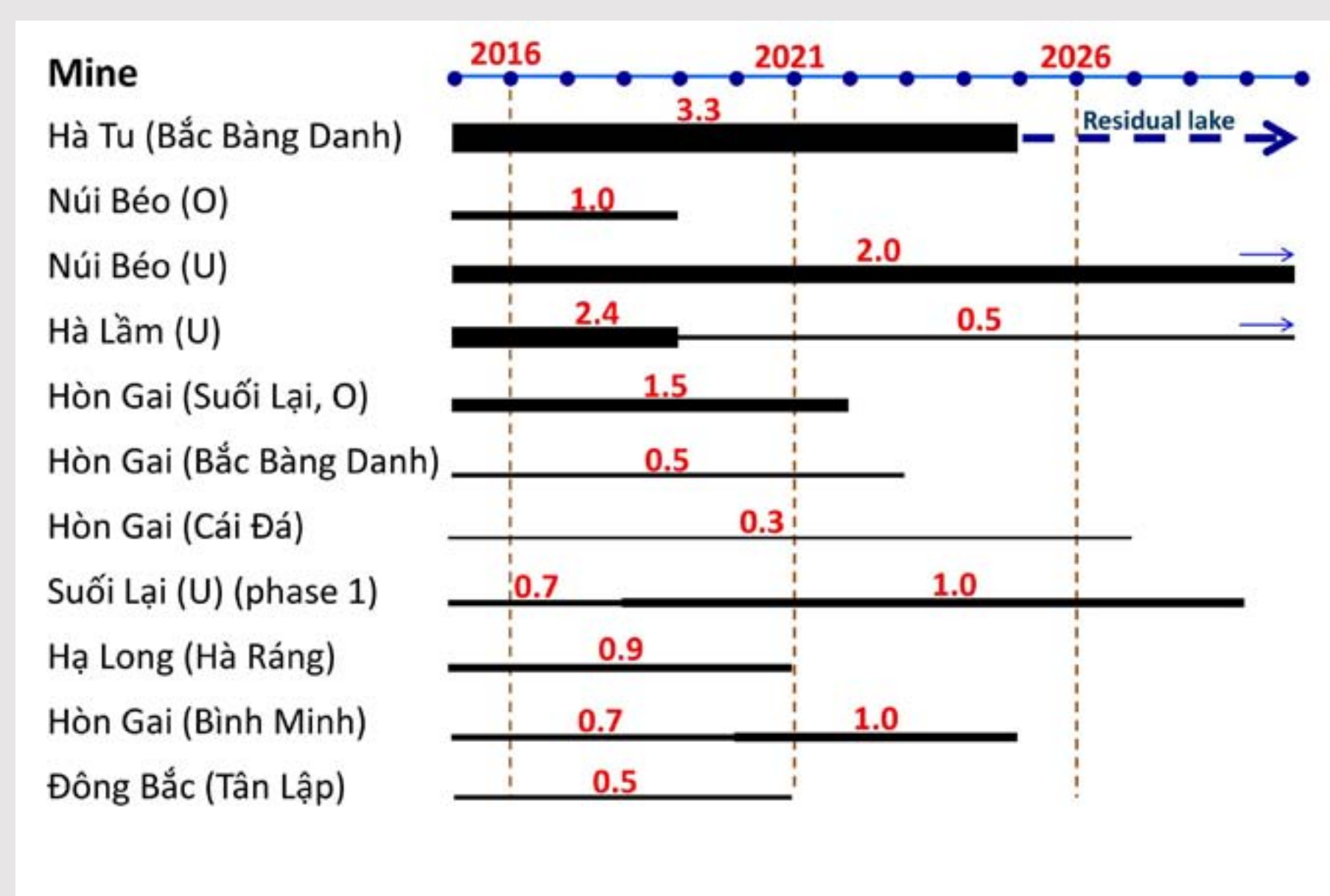


Figure 5: Coal production plan next 15 years (10<sup>6</sup> tons)



Figure 9: Ha Long Bay