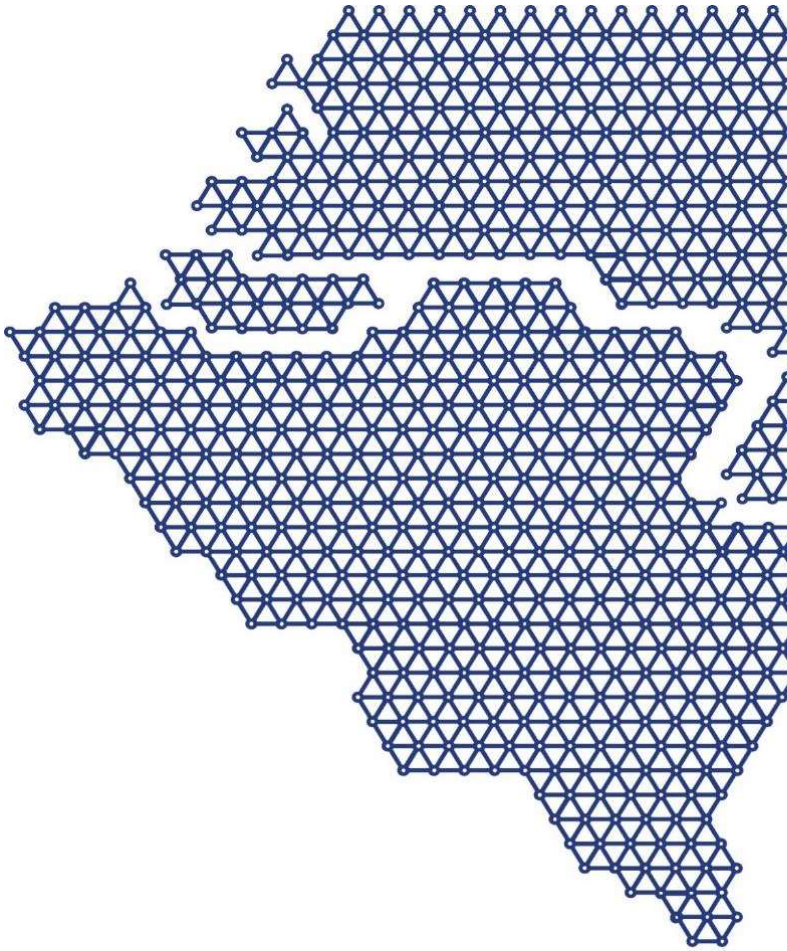


Einstein Telescope

Progress Report
Period 2024-Q3

P1.3_017 Version 1.0

ET-EMR project office

Authorisation

Name	Position	Initials
Stan Bentvelsen	Director	Adopted in the POD meeting of 7 October 2024
Arjen van Rijn	Director	
Hans Plets	Director	
Martijn Rumpen	Senior Strategist - Advisor	
Henk Schroen	Communication Manager - Advisor	
Theo Reinders	Project Manager	
Wim Walk	Technical Manager Subsurface	
Joseph Ickmans	Technical Manager Facility Infrastructure	
Johan Rutten	Environment Manager	
-	Contract Manager[1]	
John Kerstjens	Project Control Manager	

[1] In the current phase of feasibility studies, Project Control also includes Contract Management.

Table of contents

1 Introduction

This Progress Report 2024-Q3 provides an overview of the progress in the third quarter of 2024.

The Einstein Telescope opportunity

The objective of the Einstein Telescope is to build a large-scale research infrastructure that will be the next generation gravitational wave detector for further scientific research of the cosmos. The Einstein Telescope is adopted in the 2021 European roadmap for research Infrastructures (ESFRI). This confirms the excellent science case and the plans to construct the Einstein Telescope in Europe including the following steps towards a site selection.

The starting conditions of the Euregion Meuse-Rhine to host the Einstein Telescope are favourable. The unique soil allows for dampening vibrations and building the research infrastructure in a relatively quiet landscape. This region offers strong research institutes and high-tech industry. And the infrastructure and international living and business climate are attractive. There is already a high-level gravitational waves infrastructure with the ETpathfinder and E-TEST research centres and the Einstein Telescope Education Centre. Governments of the three EMR countries are cooperating and are open to other countries joining their ambition to host the Einstein Telescope.

The Einstein Telescope offers the Euregion Meuse-Rhine an unique opportunity to take a global leadership position in a new pioneering area of science: gravitational wave research. Housing the Einstein Telescope in this region will boost a positive impact on science, economy and society.

ET-EMR Taskforce and ET-EMR Project Office

At the ET Ministerial Conference 26 September 2023 in Brussels, delegates from Belgium, the Netherlands and the German Federal State of North Rhine-Westphalia agreed to prepare a bidbook and joint consortium to establish the Einstein Telescope in the Euregio Meuse-Rhine. The ET-EMR Taskforce has several tasks, including delivering the bidbook and the host consortium proposals. The ET-EMR Project Office is tasked to deliver all the feasibility studies (civil engineering, geology, environmental planning and cost) to realise the Einstein Telescope in the Meuse-Rhine. On 30 May 2024 the EMR ministers signed an addendum to the Declaration of Intent. This addendum aims to strengthen the governance of the project by clarifying the division of responsibilities and establishing transparent, multilateral decision-making mechanisms and delegates the necessary preparations of the bidbook to the Project Office.

Feasibility studies and progress reports

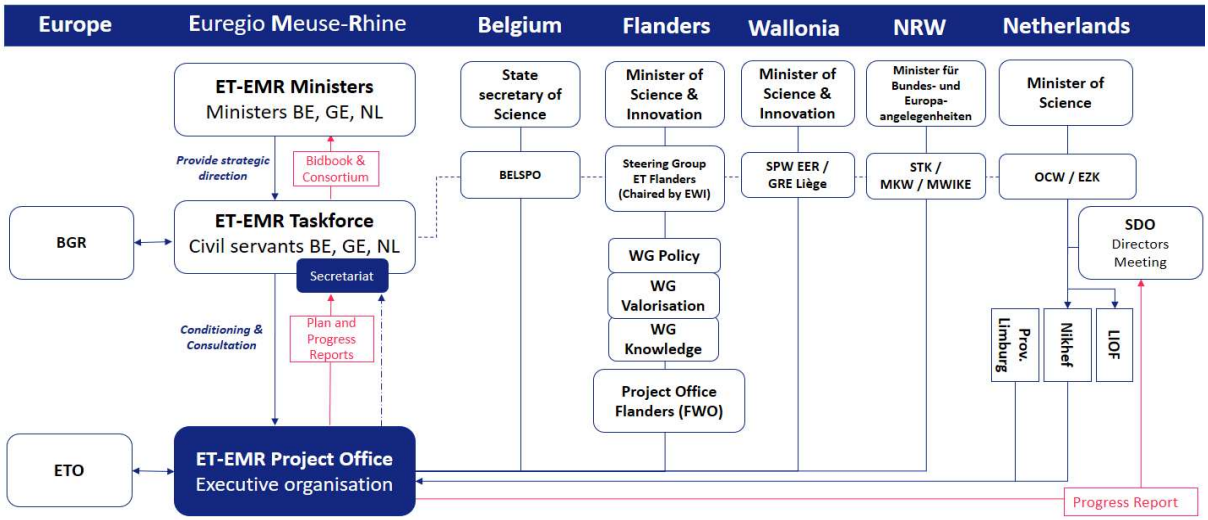
It is clear that a feasible plan to construct and operate the Einstein Telescope strongly relies on necessary governmental conditions, both financial and legal. The ET-EMR Project Office therefore addresses these issues at the ET-EMR Taskforce to provide these conditions. To ensure a clear understanding of each other's expectations, a close cooperation and open communication between the Project Office and the Taskforce is of crucial importance. In that respect, the Project Office provides the Secretariat to the Taskforce. There is a monthly meeting with the Taskforce Steering Group. And the Taskforce also receives and discusses all quarterly progress reports.

2 Project management

2.1 Administrative and political context

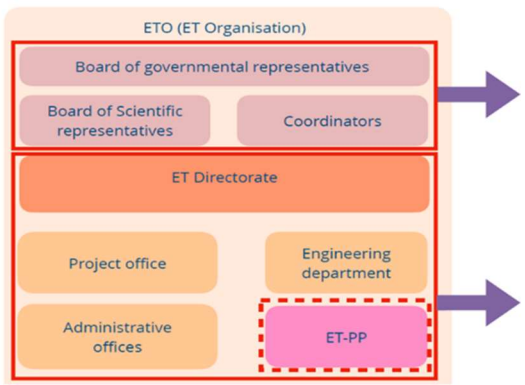
ET-EMR context

In 2023, the Project Office Directorate decided to work according to the IPM (integrated project management) model structure and implement this. The following figure below shows the position of the Project Office in the ET-EMR governance structure and the international cooperation:



European context

While the ET-EMR Project Office is focused on site-specific aspects, the European ET Organisation (ETO) is setting up the organisation to prepare a plan for the Einstein Telescope: the technical design, the organisation and financial management. The ETO Directorate has announced to develop a roadmap to deliver this plan. A proposal for the necessary ETO funding is prepared and discussed. The highest decision making body at European level, the Einstein Telescope Board of Governmental Representatives (BGR), will also have to agree on the process of realizing the Einstein Telescope, including the procedure and criteria for site-selection. The European timeline and requirements are ambitious and at the same time still uncertain. The Project Office Directorate is therefore in close contact with the ETO Directorate. It is expected that the BGR will present a site-selection procedure in 2024, based on the ETO plans. It has been indicated that the preparation of the above-mentioned items – including submission of the bidbook - will take at least until and including 2026.



BGR

- The site selection procedure;
- The legal entity and statutes;
- The financial framework;
- The Terms of Reference for the decisive interim Council.

ETO

- Technical Design Report
- Site Evaluation Report
- Planning report (phase 2-4)
- Organisation report (phase 2-4)
- Budget and Risk report (phase 2-4)

Scope; ETO design process for the civil engineering

The ETO is responsible for the civil engineering design process. One of the key basic requirements for the design of the Einstein Telescope (L-shape versus triangle) is still under investigation. In the scope of the European Strategy Forum on Research Infrastructures (ESFRI) and NGF application, a triangle configuration was selected as the baseline design. For this reason, the Project Office's feasibility study assumes for the moment a full-scope Einstein Telescope in the shape of a triangle. The Project Office Directorate is in a frequent dialogue with the ETO Directorate to monitor the design process and outcome. The risk of a change in the scope is also included in the register of risks.

In order to develop the site-specific studies by the EMR Project Office, it is essential to have timely input from ETO with regard to the functional and operational requirements for the civil engineering. ETO has been requested to clear following aspects as soon as possible:

- the ETO systems engineering framework, standards, process and tools;
- the common standard for the civil engineering design;
- the division and scope of works between the ETO and the EMR Project Office (who will study and design which part; what are the functional requirements for the Project Office parts);
- the design baseline (ESFRI CDR), the design process (phasing and design changes procedure) towards the TDR and involvement of the EMR Project Office in reviewing;
- the process of site characterisation / evaluation (framework, methodologies, activities, etc.) and the roles of the ETO and the EMR Project Office.

The ETO and the BGR are also anticipating the selection process and the objective comparison/ evaluation of sites. At the moment it is expected that preparations towards a site selection decision will take at least until and including 2026. The ET-EMR Project Office is invited to ensure capacities from the EMR to both progress on the site reports and also engage in delivering the framework, standards, methods and management activities necessary for the site characterisation reports.

Cooperation between Belgium, Germany, and the Netherlands

Trilateral Task Force

At the ET Ministerial Conference 26 September 2023 in Brussels, delegates from Belgium, the Netherlands and the German Federal State of North Rhine-Westphalia agreed to start preparations for a bidbook and a joint consortium to establish the Einstein Telescope in the Euregion Meuse-Rhine. A Taskforce has been assigned to develop the proposals and present a working agenda. In the collaboration of governments the ET-Ministerial meeting acts as the highest level and a Taskforce acts at the working level. The ET-EMR Project Office is assigned to deliver the feasibility studies leading towards the bidbook. The Project Office supports the Taskforce in delivering the Secretariat. The Taskforce also receives and discusses all quarterly progress reports.

The Taskforce adopted a Terms of Reference, following the tasks as assigned to the Taskforce in the Declaration of Intent as adopted in Brussels 26 September 2023. The Taskforce also has, with consent, taken notice of the plan for the feasibility studies and Q2-2023 progress report. Belgium and Germany were invited to provide for the additional funding, considering the budget constraints and contributions from the Netherlands. It was concluded by the Taskforce that the ET-EMR Project Office directorate and the Steering Group would discuss and present a proposal at the third Taskforce meeting, 20 November 2023 in Maastricht. In the Taskforce meeting of 20 November 2023 the Project Office Directorate has presented the plan and budget proposal 2024-2026, as addressed in a letter to the Taskforce (dated 8 November 2023; see paragraph 6.2).

Commitment

The Dutch government earmarked funds (€870 million) for the bidbook and realisation in spring 2022. Nikhef has been provided with funding by the Government of the Netherlands (23 M€) for the feasibility studies. The Province of Limburg of the Netherlands agreed to contribute (2 M€). The Flemish funding agency (FWO) also added a contribution (0.345 M€).

The Flemish, Walloon and Belgian federal governments have approved a contribution to financing feasibility studies, each for 4 million euro (total 12 M€). Discussions on how to use this funding and under which conditions are ongoing.

The German Bundestag made a budget of (€9 million) available for the Einstein Telescope; a final approval and the conditions for this budget need to be cleared. The distribution is discussed with the German GW-community. The funding is not to be regarded as a commitment of Germany to the Einstein Telescope project or the EMR candidacy preparations. The government of NRW is anticipating to decide on a contribution proposal for the feasibility studies. Final decisions on the federal and NRW level on the contributions for the feasibility studies are foreseen in 2024.

The government of North Rhine-Westphalia (NRW) did announce in January 2023 its intention to co-finance the candidacy, provided federal Germany will do the same. The German national Roadmap process aims for a shortlist in mid-2025; a German commitment for the Einstein Telescope will depend of the outcome of this procedure.

2.2 EMR Project Office organisation

The project roles within the Project Office and following the IPM-model were implemented since January 2023. The chart below is regularly updated with regard to implementing the IPM-model, the plan 2024-2026 and the desired further internationalisation of the Project Office.

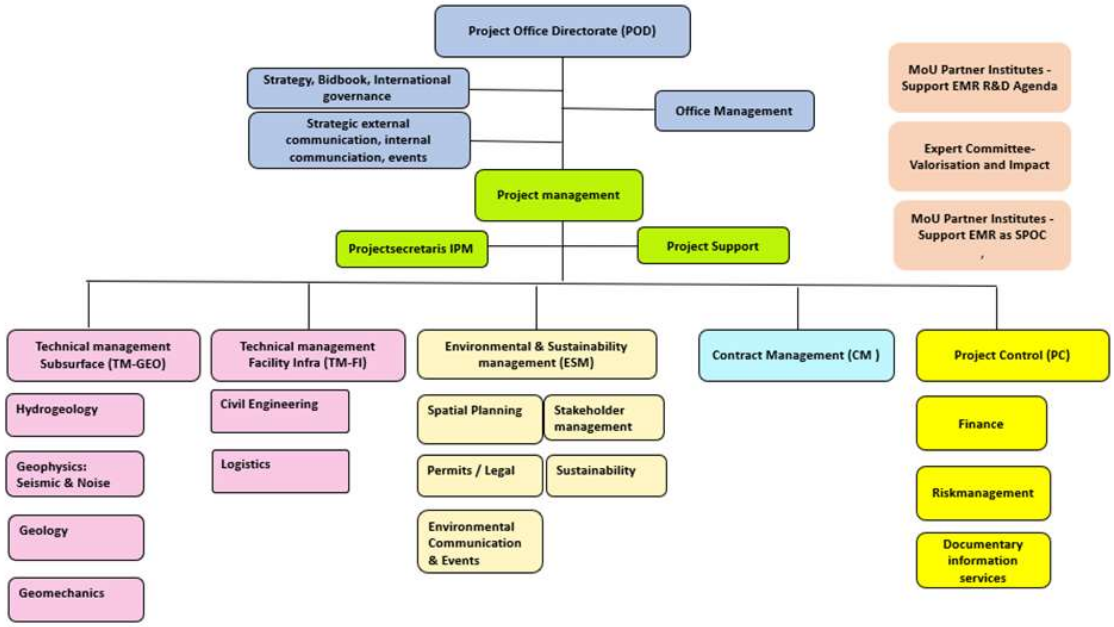
The Project Office

Directorate

- Director — Stan Bentvelsen
- Director — Arjen van Rijn
- Director — Hans Plets
- Senior Strategist (advisor) — Martijn Rumpen
- Communication Manager (advisor) — Henk Schroen

IPM-managers

- Project Manager — Theo Reinders
- Technical Manager Subsurface — Wim Walk
- Technical Manager Facility Infrastructure — Joseph Ickmans
- Environment Manager — Johan Rutten
- Project Control — John Kerstjens
- Contract Manager — -[2]



[2] In the current phase of feasibility studies, Project Control also includes Contract Management.

Internationalisation

The signing of the Declaration of Intent 26 September 2023 and the addendum 30 May 2024 by the Belgian, German and Dutch ministers clears the international coordinating position of the Project Office with regards to the EMR feasibility studies and relation to the EMR Taskforce. The integral plan for the feasibility studies is also an invitation to the Belgian and German governments to participate with manpower and means. Nikhef and FWO have already agreed to integrate their current project executive capacities in the ET-EMR Project Office. A start has been made to come to an MoU-agreement with EMR funders on available resources and governance, to execute feasibility studies within the (consolidated) plan and budget 2024 – 2026. A draft for final feedback is presented in August and is waiting for feedback. A final version of the MoU-agreement is expected to be proposed and signed by Q4 2024.

At the moment almost all staff members are from Belgium or the Netherlands. The expected funding contributions from the Belgian and German governments are expected to further balance the influx of funding and 'in kind' capacities from the three countries.

There is already a direct and frequent contact between the Project Office and contact points of the competent environmental authorities. Periodic consultations on the fields of engineering, the environment (communication and urban planning), and project management have been and will be held with all contact persons. These contacts produce valuable information. Strengthening ties with environmental authorities - especially in Flanders and Wallonia - is urgent considering the search area for the Einstein Telescope in the EMR region.

3 Contract management

3.1 Purchasing & Tendering

Tenders in Q3-2024:

Engineering

- Analysis of drilling data Cottessen (and Banholt) — completed
  Note: the analysis has been completed; a second opinion will follow.
- Minimum requirements for tunnel, shafts, caverns (tunnelling technology) — completed
- 1st Drilling campaign (Flanders, Wallonia, Netherlands) — completed
- Borehole measurements — completed
- Three component seismic nodes — completed
- Civil Engineering (study of alternatives, draft design, cost estimation, logistics plan, register of risks) — completed
- Seismic Campaign Feasibility Phase — pending

Environment

- GIS support/support of Landscape design — completed
- Pre-planning study — completed
- Drilling permits — completed
- Private-law study — completed

Project organisation Project Office:

- Project control manager — completed
- Project manager — completed
- Environment manager — completed
- Sustainability manager[3] — aborted

General:

- Safety assessment & guidance — completed

The following tender is expected to start in Q4-2024:

- 2nd set of boreholes.

Progress reports
The quarterly progress reports are made available on the website www.einsteintelescope.nl.

[3] Given the outcome of the Environment Manager tender, where the sustainability aspect is strongly present in the profile of the selected candidate, the tender for the sustainability manager has been discontinued. I.c.w. the environment manager, the possible further fulfilment of the sustainability manager role will be examined.

4 Technical management

4.1 General

The next version of the Technical plan was completed, including a list of individual work packages highlighting current activities, while maintaining the critical integration between the technical disciplines involved: geology, geophysics, hydrogeology, geotechnology, and civil engineering.

The focus remained on gathering and analysing geo-data to characterize the subsurface, develop a noise impact assessment, and de-risk construction feasibility and costs.

The first drilling campaign of 11 boreholes is about to close, with the final borehole drillings nearing its completion.

Workshops are ongoing to evaluate the cores from all finished boreholes and to develop an updated geomechanical understanding of the search area. In general, good quality rock has been encountered allowing convergence of the search area to more likely triangle trajectory scenarios.

4.2 Continue, unless…

Early September, the schedule for a series of “Continue, unless…” evaluations was triggered. These evaluations are held to decide to continue the project, unless some obtained data or insights are compelling enough to stop the project.

An evaluation of the results of this first borehole campaign has recently taken place. Each discipline reviewed the available data and information and concluded that from its perspective, lights are still on green to continue the project. The quality of the rock appears to be good, in fact harder than originally expected. While this is good news for the constructability of caverns and tunnels, some of the drilling was slowed down by the hard rock and some 1-2 months of delay were introduced to the schedule. An independent review by TNO (Geological Survey of the Netherlands) of the available data supported these conclusions and resulted in a recommendation to continue the project. With this positive outcome, the ET-EMR Project Office passed its first ‘continue, unless moment’.

4.3 Technical progress

In Q3-2024, the following progress was made:

Geological model

- The subsurface model continues to be updated with new geological, geomechanical and geophysical data. All new subsurface data (such as core logs, rock stress tests and water flow measurements) are being stored centrally and integrated into a consistent model.

Boreholes

- The drilling of the first set of 11 boreholes is all but one finished. The final borehole (at Vijlenerbos) is near to completion. The quality of the rock appears to be good, in fact harder than originally expected. While this is good news for the constructability of caverns and tunnels, some

of the drilling was slowed down by the hard rock and some 1-2 months of delay were introduced to the schedule.

- Collaboration with the drilling company Stump continued to be very effective with good safety inspection review results. A brief release of subsurface-originated H_2S gas at far-below toxic levels was handled promptly and adequately.
- The Core House in Aubel is nicely filling up with core material, and workshops are held at that location to evaluate the rocks from every borehole. Core measurements by specialised companies (Terratec and SolExperts) are progressing according to schedule.

Noise and seismic measurements

- The next critical technical activity will be to measure noise levels at the bottom of six selected boreholes. Installation of seismometers at the bottom of these wells has started. A network of permanent and mobile sensors will supplement the analysis and derivation of the ET noise budget at EMR.
- Also, a plan to measure noise from wind turbines has been drafted. The plan includes the development of recommendations to mitigate this type of noise and to advise on the development of regulations and permits for companies interested in deploying wind turbines.
- A tender to contract a third party to execute seismic measurements will be closing soon.

Civil engineering

- An effective interface has been set up with ETO and the instrumentation teams in the Collaboration to discuss the impact of detector designs on civil engineering construction alternatives and the overall construction cost.
- The first few alternative construction models are being considered.
- Geotechnicians have become fully involved in logging and evaluating cores for their geotechnical characteristics and to determine the rock's properties and suitability for tunnelling.

Hydrology

- Water flow measurements and pressure tests are being executed at selected completed boreholes with specialized equipment and are being fed into an overall 3D subsurface ground water model. This model will be used to estimate the risk and mitigation of water encounters during tunnelling and to develop mitigating measures to seal off and remove excess water during the operational phase of ET.

5 Environmental management

5.1 Urban planning/integration

Integration into the landscape
The ET infrastructure is anticipated to be built almost entirely underground. Above-ground facilities for the Einstein Telescope such as buildings and shafts and the integration has to be carefully designed with respect for environment, nature (including water aspects) and landscape. Integration of the landscape is included in the feasibility studies, as far as it goes based on currently available information on the design of the ET.

Public law aspects

End of Q3 a study was completed on the public law situation, with following main conclusions:

- to obtain the main public law decisions requires an average lead time of about 5 years. In the Walloon Region, there is a combined plan permit procedure that will take in average 5 years. In the Flemish Region, two separates procedures will have to be followed: one for the modification of the Sector plan by a SIP; and one for the application of the 'omgevingsvergunning'. These two procedures will take in total also about 5 years. In the Netherlands, the new Project decision will be applied. It is the equivalent of a plan permit procedure, expected to take 4 years;
- before plan modifications and permit applications can be submitted, a stable civil engineering design for the Einstein Telescope will have to be in place, an established legal international entity within the EMR region that can act as the (legal) initiator will have to be set up, and a tender will have to be completed in order to select an engineering firm to perform the planning studies. These steps in themselves also require the necessary lead time and preparation time;
- Modifications in legislation could accelerate procedures and guarantee the legal existence of the plan modification and permits to be delivered for the Einstein Telescope.
- public participation will have to be coordinated in the decision-making process, also in order to limit the administrative and judicial proceedings of all kinds.

Private law aspects

In addition to public law aspects private law aspects are also considered, regarding how to deal with land ownership and land use during construction and during the operation of the tunnel. It turns out that the legal situation in the countries and regions within the search area is also here not uniform. In cooperation with Hasselt University further details of these private law aspects are under study.

Geographical information (GIS)

In Q3 the GIS officer supported the preparation for the upcoming research campaign led by the project office of the Einstein Telescope, in collaboration with the University of Liège and the Royal Netherlands Meteorological Institute (KNMI). The purpose of this campaign is to measure the background acoustic waves that spread into the subsurface within the study area for the potential installation of the Einstein Telescope.

5.2 Preventing undesirable activities

Efforts remain undiminished to prevent undesirable activities (seismic noise vibrations) within the search and protection area in relation to the possible siting of the Einstein Telescope.

The Netherlands

As a result of the moratorium, introduced by the Province of Limburg ordinance, it is forbidden to realise new wind turbines. Mining and excavations are only allowed if they do not hinder the Einstein Telescope.

Flanders and Wallonia

- Administrative commitments have been received from Flanders and Wallonia regarding the exclusion of subsurface noise in the search and protection area.
- Administrative guidelines have been formulated in that context on how to act in the case of new initiatives. Further legal safeguards are an issue and, for now, it seems that the interests of the Einstein Telescope candidature are sufficiently safeguarded.
- A permit application has been submitted to SPW Liège in May by Luminus for 4 wind turbines on the Haut Sarts industrial estate, which is situated within the protection area of the Einstein Telescope. The Flemish Department of the Environment reacted on the permit application. Based the directive of the DG of SPW TLPE to the functionnaires délégués (FD), we anticipate that respective FD's will not allow this application to proceed.

New Walloon Mining Code:

It is concluded that (at this moment) there is no immediate threat arising from the new Mining Act in Wallonia in terms of new permits. It is recommended that, as soon as there is an initiative to draw up a Strategic Plan, the perimeter around the Einstein Telescope protection area (i.e. the search area and the buffer zone around it) should be included as a 'zone blanche' in the Strategic Plan, so that it will be established with certainty that no exclusive subsoil exploration and exploitation permits can be granted in this area. The proposal to provide in a white zone for the Einstein telescope is proposed to be discussed by the Taskforce and the Walloon government.

North-Rhine Westphalia

- State Secretary Gonca Türkely-Dehnert has made the following statement during the interministerial conference in Brussels (26 September 2023) : "*Minister Nathanael Liminski has reached an understanding with the mayor of Aachen to the effect that the expansion of wind energy there should not compromise the development of the Einstein Telescope. The huge opportunity provided by the Einstein Telescope are in the shared interest of the entire region and therefore also the City of Aachen*." To complete the feasibility studies and necessary conditioning aspects the Project Office Directorate has requested the NRW Ministries represented in the Taskforce to provide the necessary underpinnings.
- By the end of 2023 there was an application for a permit to exchange an existing wind turbine in the German part of the protection zone. There was a response by the Province of Limburg (NL), advising not to give the requested permit considering the conflict of interest within the Einstein Telescope 10 km.-buffer zone.

5.3 Stakeholder management

Preparing studies/activities

In preparation for the various drilling campaigns and studies in the search area, Environmental Management is in contact with the relevant stakeholders, in preparation for the permit applications to be submitted. These include meetings with the involved municipalities. There is also contact with the German community in Belgium considering the plans for subsurface studies in that area.

State supervision – Dutch State Supervision of Mines and Mining Advisory Council

After an initial consultation with representatives of the Netherlands' State Supervision of Mines (SSM), resulting from the advice of the National Growth Fund, had taken place in Q1-2023, SSM and the Ministry of Economic Affairs and Climate Policy looked into the legal position of SSM.
Based on this initial exploration, it was concluded that SSM would have no legal role in the ET project, as the aim of the project is scientific in nature and not aimed at minerals extraction. There will be further discussions with the Ministry of Economic Affairs and SSM. The Mining Advisory Council has declared not to have a role in the project. The role of state supervision will also be discussed at the international level.

5.4 Regional communication

- In a project office team meeting, the topic of developing internal communication was discussed. Ahead of this, preparations have started for a video series in which colleagues within the project office in particular present themselves. This is intended for external channels and internal use.
- To show that local entrepreneurs are already benefitting of the feasibility studies, several videos have been made in which these entrepreneurs talk about this. Intended for external channels.
- The announcement of the Einstein Academy generated a lot of exposure around the presentation of the Dutch budgetplan ('Prinsjesdag'). Prior to this, RTL Nieuws (RTL4) broadcast a report on the Einstein Telescope and the ET pathfinder in September.
- In recent months, so-called 'viewing moments' at the drilling sites were well attended. About 25 interested people attended each time, who were given explanations by geologists. The credit for the success of the viewing moments therefore goes to the geologists.

5.5 Sustainability

The aspect of sustainability is an integral part of the work packages within both the field of technology and the field of environment. Sustainability is a subject in civil design, implementation methods, logistics during construction and operation, as well as in subjects such as landscape integration, energy consumption and energy supply. Sustainability has explicitly been assigned to the environment manager.

Logistics
The logistics surrounding the handling of large quantities of materials excavated from the subsurface, combined with the delivery of construction materials and the location of the work site, are the subject of the feasibility study. Discussions are taking place with Infrabel-NMBS about possible options relating to rail logistics and the use of the railway yard at Montzen in this regard. It is also being discussed with the Walloon and federal governments.

6 Project control

6.1 General

A number of operational management and project control topics are dealt with in the field of Project Control. These topics focus on facilitating the Project Office and the managers of the specialist fields, guiding processes, monitoring the goal of the feasibility study, and managing risks.

6.2 Finances

Plan and budget 2024-2026

Nikhef has been provided with funding by the Government of the Netherlands (23 M€) for the feasibility studies. The Province of Limburg of the Netherlands agreed to contribute (2 M€). The Flemish funding agency (FWO) also added a contribution (0.345 M€). As the Project Office Directorate estimates the total budget required for the preparatory phase to be 49 M€, it requested the EMR Governments for the additional funding of 24 M€, addressed in a letter to the Taskforce (dated 8 November 2023). The status of the requested additional budget looks as follows:

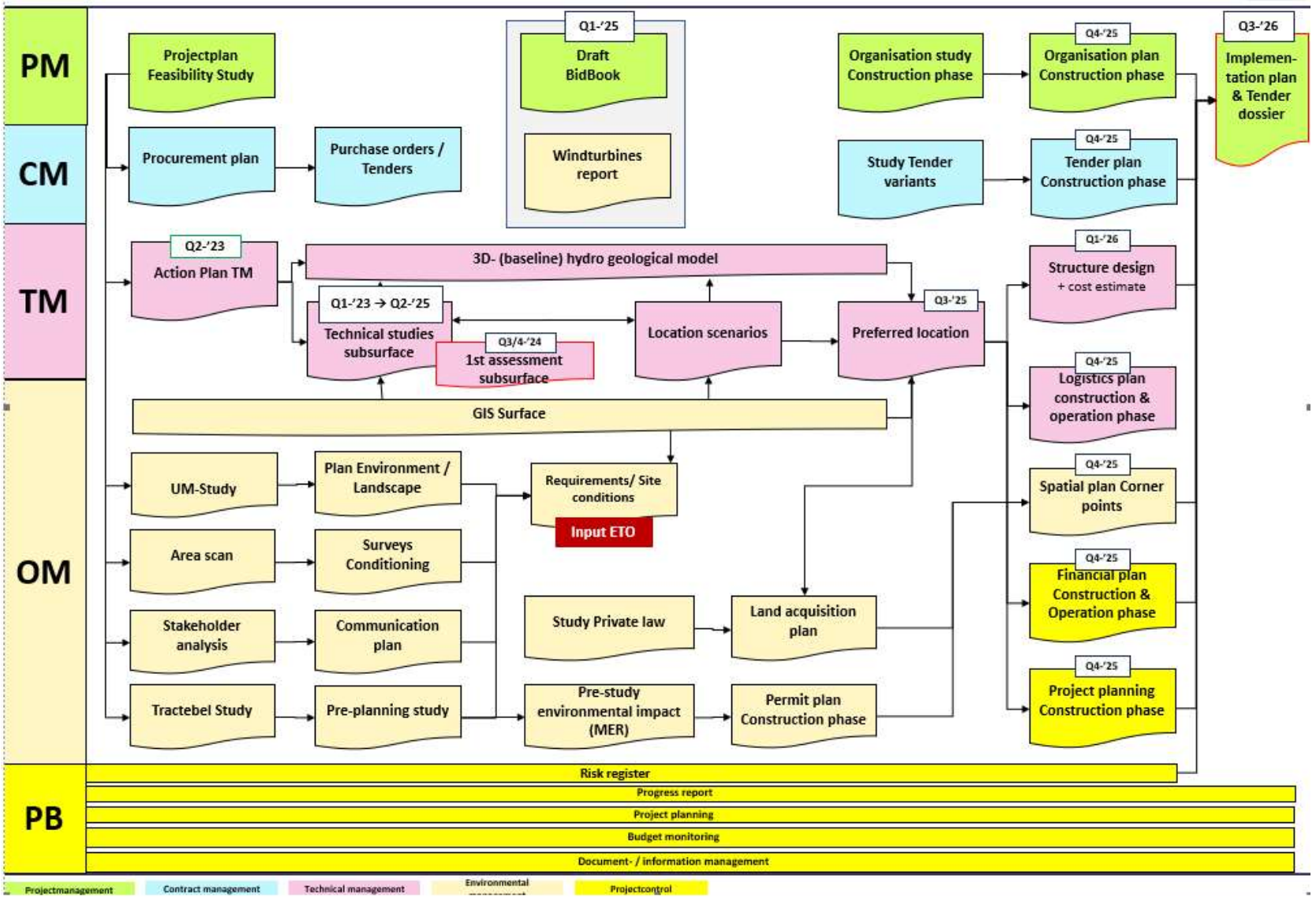
- Belgium: € 12 million euro has been committed;
- Germany: contributions are still unsure;

As long as the anticipated substantial funding gap remains, the Project Office Directorate cannot commit to a timely execution of the plan 2024-2026 and the additional tasks listed in the DoI addendum. This issue has been addressed to the EMR Taskforce in the meeting of 2 October 2024.

6.3 Schedule

Following the message from the European ETO organisation, the delivery of the bidbook is expected for earliest in 2026. This poses the risk of a ‘Longer lead time’. The consequences for both the schedule and the budget have been incorporated into the updated project schedule (Annex 1) and budget.

The first assessment of the subsurface is part of this report. The next page shows the diagrammatic representation of the product planning.


PM
CM
TM
OM
PB
Projectplan Feasibility Study
Procurement plan
Purchase orders / Tenders
Q1-'25
Draft BidBook
Windturbines report
Organisation study Construction phase
Q4-'25
Organisation plan Construction phase
Study Tender variants
Q4-'25
Tender plan Construction phase
Q3-'26
Implementation plan & Tender dossier
Q2-'23
Action Plan TM
3D- (baseline) hydro geological model
Q1-'23 → Q2-'25
Technical studies subsurface
Q3/4-'24
1st assessment subsurface
Location scenarios
Q3-'25
Preferred location
Q1-'26
Structure design
+ cost estimate
Q4-'25
Logistics plan construction & operation phase
GIS Surface
UM-Study
Plan Environment / Landscape
Requirements/ Site conditions
Input ETO
Area scan
Surveys Conditioning
Stakeholder analysis
Communication plan
Study Private law
Land acquisition plan
Q4-'25
Spatial plan Corner points
Q4-'25
Financial plan Construction & Operation phase
Tractebel Study
Pre-planning study
Pre-study environmental impact (MER)
Permit plan Construction phase
Q4-'25
Project planning Construction phase
Risk register
Progress report
Project planning
Budget monitoring
Document- / information management
Projectmanagement
Contract management
Technical management
Environmental
Projectcontrol

6.4 Quality

To ensure quality, a start was made on setting requirements. The requirements encompass:

- The process of preparing and submitting a compelling bidbook;
- The process of meeting the terms of the NGF grant decision;
- The Einstein Telescope system (below and above ground);
- The temporary system serving the construction of the Einstein Telescope.

The timely input from the European ET organisation ETO is crucial:

- Baseline design detector;
- Demarcation of the system breakdown structure between ETO and ET-EMR/TETI.
- Functional requirements for infrastructure and above surface facilities;
- Change procedure.

6.5 Risks

Below are the risks that were specifically addressed in 2024-Q2:

Risk	**Management**
Co-financing entities have diverging views on what is needed for the bidbook.	Careful scrutiny by Project Office, based on expert advice, of propositions from co-funding entities
Subsurface noise; plans for wind turbines, mining activities and geothermal energy in the protection area could emerge.	We monitor the conditions. The Taskforce is provided with the information to discuss the conditioning aspects. A study on mitigating measures will be carried out. We refer to paragraph 5.2 for the current situation.
Longer lead time because of, e.g., • deliverables from ETO • decision-making in various countries • subsurface studies	Monitor ETO closely Intensive coordination within Task Force Carry out studies simultaneously Planning and budget have been adjusted based on the indication from ETO.
Stress on budget	Manage costs Additional cover (partners) is proposed; see paragraph 6.2.
No scientific consensus on the shape of the Einstein Telescope	Focus on current scope as adopted by ESFRI and NGF (triangle);

(triangle versus L).	Monitor development closely; Establish a formal framework and information exchange between the ETO and Project Office directorates.
Unstable scope ETO – ET Collaboration (optical design, detector design, design- and operational requirements)	Put on the agenda for the ETO directorate – PO directorate meeting.

6.6 Information management

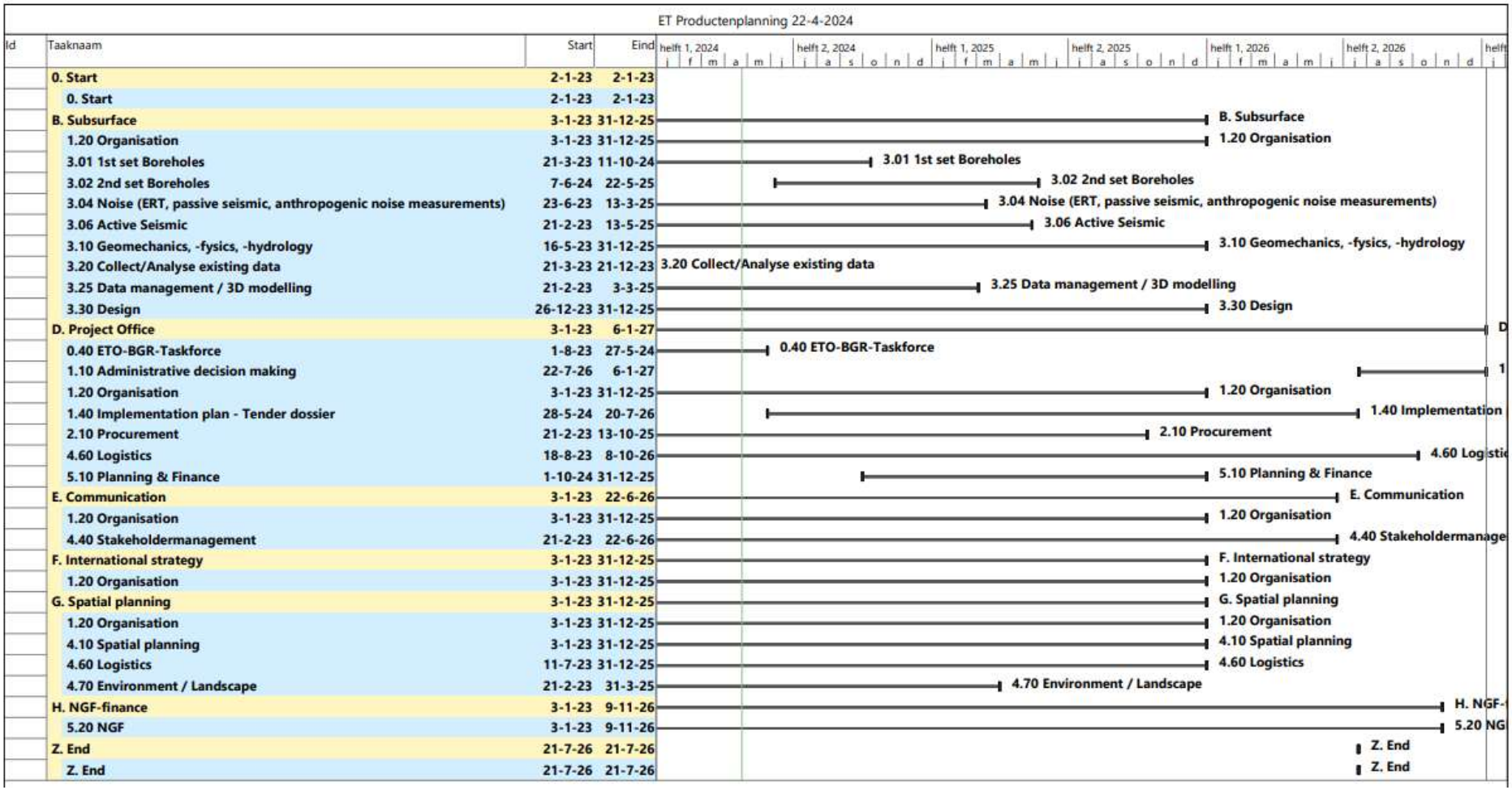
Document management/control information
After the system for archiving, document management (SURFdrive) and project information was set up and put into operation since Q1-2023, it is structurally and systematically filled from Q2 onwards, so that this information is available to the members of the Project Office.

In Q2-2024 Relatics was adopted as a central tool for project management.

6.7 Facilities

Based on the action plan and in consultation with the managers of the specialist fields, it will be ensured that appropriate staffing of the Project Office; accommodation; integrity and social safety protocols in the workplace; insurance cover; complaints protocol, etc., are in place.
These issues were successively addressed during the first half of 2023.

Annex 1 Project planning



Annex 2 Status review ET-EMR subsurface research

TNO innovation for life

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Date
9 October 2024

Our reference
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P.O. Box 80015, 3508 TA Utrecht

To whom it may concern

Subject: Status review ET-EMR subsurface research
Separate attachment(s): 1. Continue Unless Statement 9/2024

LS,

On October 2, 2024, I conducted a status review of the research into the suitability of the subsurface for constructing the tunnels and shafts of the underground Einstein Telescope gravitational wave observatory in the Dutch-Belgian-German border region. This research is part of a larger feasibility study to host the facility in the Meuse-Rhine Euregio (EMR), which considers a full range of relevant environmental and socio-economic factors. The study is being conducted by a collaboration of research institutes and universities from Belgium, Germany and The Netherlands, coordinated by Nikhef, and will be further referred to as the ET-EMR project.

The subsurface research is conducted by a team that was represented by Wim Walk (Nikhef, overall coordinator), Martin van Grootveld (RHDHV, discipline lead for civil engineering), Michael Kiehn (Nikhef, discipline lead for geophysics), Philippe Orban (University of Liège, discipline lead for hydrogeology), and Geert-Jan Vis (TNO - Geological Survey of the Netherlands, discipline lead for geology). The outcomes of their study will serve as input for the Einstein Telescope bid book, meaning that the level of elaboration and detail should support a compelling bid and the prospect of a viable project. While the study will include geological, hydrogeological, and geotechnical assessments, as well as a preliminary design of the underground construction, it should not be considered part of the actual engineering works that would be initiated if the bid is successful.

The research plan includes several 'continue unless' decisions, ensuring that work is discontinued if results indicate that the ET-EMR project is unviable. This meeting was organized to make the first such decision. A decision not to proceed at this stage can be based on two types of findings:

- Positive identification of a subsurface condition that would inhibit the construction of the Einstein Telescope.

- The prospect of further efforts that would be too large to complete the bid book before the submission deadline in 2026.

A document summarizing the status per discipline was prepared (attached), and based on this, each discipline recommended proceeding with the project. My findings are as follows:

1. The research has been fit for purpose:
   - The subsurface of the study area has never been comprehensively studied down to the target depth of 200-300 m. This means that the geological research first needed to focus on establishing a general framework that will serve as geotechnical context for the civil engineering discipline.
   - The hydrogeological work has delivered an initial hydrogeological model and first estimates of the hydraulic parameters. The model needs further refinement through new data, necessitating intensified cooperation with the geology team.
   - The geophysical work appears to be a promising addition to the geological study, providing insights into the stratigraphic and tectonic structure that could inform both the hydrogeological and geotechnical models that are to be constructed. An important focus for the next period will be on noise measurements, which relate to the operation of the actual observatory rather than the integrity of the underground construction that hosts it.
   - The civil engineering discipline is the most recent addition to the subsurface team. Their tasks include to construct an engineering geological model and to make a preliminary design of the underground constructions.

2. Based on the results obtained so far, I concur with the research team's conclusion that no geological, hydrogeological, geophysical, or geotechnical conditions have been identified that would render the ET-EMR project unviable at this stage. However, this does not preclude the emergence of such conditions later on.

3. The team indicates that the work that lies ahead is manageable, and I have no reason to disagree at this stage.

I am making this assessment in my role as Chief Geologist of the Geological Survey of the Netherlands, which includes releasing our subsurface models based on outcomes of the QA/QC procedure. I am therefor familiar with making impartial judgments regarding the work our organization is involved in, as is the case here. While I have been involved in setting up the subsurface research in an advisory capacity, I have not participated in its execution.

Sincerely,

ValidSigned by Michiel van der Meulen
on 2024-10-09 16:43:54

Dr. M.J. van der Meulen, EurGeol
Chief geologist