Haib Copper Project

Air Dispersion Modelling Report

Knight Piésold (Pty) Ltd

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Acronyms

Chemicals

CO	Carbon Monoxide
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Oxides Of Nitrogen
$PM_{2.5}$	Particulate matter with aerodynamic diameters less than 2.5 µm
PM_{10}	Particulate matter with aerodynamic diameters less than 10 µm
PM	Particulate Matter
SO_2	Sulphur Dioxide

Units

Mtpa	Megatonnes per annum

Abbreviations

AAQS	Ambient Air Quality Standards
ADM	Air Dispersion Modelling
AQ	Air Quality
EHS	Environmental Health and Safety
EU	European Union
GLC	Ground Level Concentrations
IFC	International Finance Coporation
MMIF	Mesoscale Model Interface Program
PEA	Preliminary Economic Assessment
ROM	Run-Of-Mine
SRTM	Satellite Radar Topography Mission
TSP	Total Suspended Particles
US EPA	United States Environmental Protection Agency
WKC	WKC Group (PTY) Ltd.
WHO	World Health Organisation
WRD	Waste Rock Dump

WRF	Weather Research and Forecasting

1 Introduction

Knight Piésold (Pty) Ltd (hereinafter referred to as the ‘Client’) has contracted WKC Group (Pty) Ltd. (WKC) to undertake an Air Dispersion Modelling (ADM) study for the Haib Copper Project (hereinafter referred to as the ‘Project’), comprising open-pit copper mining, on-site concentrator plant, and heap leaching. The Project is located in the south of the Karas region of Namibia, close to the border with South Africa (defined by the Orange River).

This ADM Report presents information relevant to undertaking the ADM study and includes applicable air quality standards, assessment methodologies, and all relevant assumptions.

1.1 Objectives

The key objectives of the ADM assessment are as follows:

- To undertake an ADM study using the United States Environmental Protection Agency (US EPA) approved AERMOD to determine the maximum ground level concentrations (GLCs) for particulate matter (PM) and identified pollutants of interest over relevant averaging periods;
- To assess the operation of the mining and processing activities and facilities in terms of emissions from mobile and stationary sources; and,
- To quantify and assess the potential impacts of the operation phase of the Project in a cumulative context considering ambient air quality.

1.2 Pollutants of concern

The main pollutants considered in this assessment due to their known impact on the environment as well as human health and their potential to be released to the atmosphere from Project facilities are as follows:

- **Particulate matter (PM) or dust:** Resulting from vehicle emissions and fugitive dust emissions from the operation of vehicles on roads, mining, and other infrastructure. National air quality regulations and international guidelines generally specify standards for two size fractions of PM due to their known health risks:
    - **PM_{10}:** Airborne fine particulate matter with aerodynamic diameters less than 10 µm. PM_{10} is a product of fuel combustion, but significant contributions include non-combustion sources like construction, earthworks, fine material handling, wind erosion and tyre-road interactions resulting in resuspension. PM_{10} can be inhaled, and likely to deposit on the surfaces of the larger airways of the upper region of the lung and can induce tissue damage, and lung inflammation. Short-term exposures to PM_{10} have been associated with worsening of respiratory diseases, including asthma

and chronic obstructive pulmonary disease (COPD), leading to hospitalisation and emergency department visits.

- **$PM_{2.5}$**: Respirable particulate matter with aerodynamic diameters less than 2.5 µm. $PM_{2.5}$ is primarily a product of fuel combustion, but is also contained in dust generated by vehicle traffic and by ore processing and handling. $PM_{2.5}$ is more likely to travel into and deposit on the surface of the deeper parts of the lung and can be absorbed into the bloodstream. Short-term exposure has been associated with premature mortality, increased hospital admissions for heart or lung causes, acute and chronic bronchitis, asthma attacks, and other respiratory symptoms.

Other pollutants include products from combustion of fuel, such as nitrogen oxides (represented by NO_2), sulphur dioxide (SO_2), and carbon monoxide (CO). These will be emitted from both stationary and mobile sources that use diesel as fuel, however, will be of a much lower magnitude than the dust emissions. Combined with the intermittent and transient operation of the equipment, these pollutants have therefore been screened from the modelling assessment.

1.3 Air Dispersion Modelling Scope of Works

The scope of the air dispersion modelling study includes the following:

- Identify the scenario associated with the operation of the equipment that reflects the worst-case scenario in terms of emission loads, release velocity, and other applicable operating conditions to be considered within the context of the detailed assessment;
- Quantify emissions from the equipment for key air pollutants;
- Undertake ADM for emissions from selected cases / scenarios associated with the proposed project to determine Ground Level Concentrations (GLC) contours and exposure to sensitive receptors in latest version of AERMOD Software and assess their compliance; and,
- Assess the potential cumulative impacts by taking the latest baseline data into account with the predicted Project contributions.

This report presents the assessment of potential impacts associated the operation phase of the Project. In line with a conservative assessment, various representative cases of the normal operations once the mine and processing facility are at full capacity was considered. The operation phase emissions and associated impacts were modelled using the internationally recognised AERMOD air dispersion modelling software, and were assessed in isolation and cumulatively relative to the applicable standards / guideline values. The maximum modelled GLCs at the nearest sensitive receptors (SRs) were compared directly with the ambient air quality standards and impact assessment criteria detailed in Section 3.

2 Project Description

2.1 Project Background

Haib is a porphyry copper exploration Project located in the Karas Region of southern Namibia, approximately 6 km north of the border with South Africa and between 12 km and 15 km east of the tarred B1 highway that connects Namibia with South Africa.

Koryx Copper Inc. has a 100% interest in Haib Holdings (Pty) Ltd (formerly Deep South Mining Company (Pty) Ltd.), a Namibian subsidiary which holds the exploration rights to the Haib Project (the Project). Exclusive Prospecting Licence (EPL) 3140 allows for the exploration of base, rare and precious metals over an area of 36,571 hectares (ha).

Towards advancing the copper mining activities at Haib, a comprehensive Environmental and Social Impact Assessment (ESIA) with an associated Environmental and Social Management Plan (ESMP) and public consultations are currently being undertaken and developed to meet both Namibian national requirements and International Finance Corporation (IFC) standards for the Project. The ESIA is being prepared to obtain an Environmental Clearance Certificate (ECC) for the Project from Namibian authorities and to support the standards of disclosure required by the Canadian Securities Administrator in a technical report (NI 43-101) providing environmental and social compliance components.

The proposed Project comprises an open pit mine, a 28 million tonnes per annum (Mtpa) crushing, milling and flotation concentrator, a hydrometallurgical plant consisting of an 7 Mtpa heap leach, copper solvent extraction, impurity removal and copper electrowinning plant, as well as infrastructure on and off site necessary to support these operations (waste rock dumps, stockpiles, tailings storage facilities, pipelines and abstraction works, power infrastructure, roads, offices etc.). The operation will achieve a combined throughput of 35 Mtpa. The mining schedule indicates a total material movement of approximately 87.5 Mtpa, providing approximately 23 years' supply of mineralised material. This equates to a total of 1.58 billion tonnes of material to be mined.

The proposed Project is currently in the exploration and studies phase, whereby the feasibility of the Project is being defined through ongoing investigations and analysis.

2.2 Project Description

The site layout has been designed around critical landform features such as topography, sensitive biodiversity areas, and heritage features. The optimisation has additionally considered the efficiencies required for the mining operation.

It must be noted that this site layout represents the results of preliminary studies, however, it is not final. The final layout will be informed by specialist impact studies and the broader environmental and social impact assessment, as well as ongoing design processes. This finalisation process will also integrate considerations received through the regulatory public consultation process.

A summary of the key proposed project components are as follows:

Open Pit - The Haib deposit straddles the ephemeral Volstruis River and forms the basis for the open pit. The open pit consists of four target areas which will combine to form the larger pit.

The Concentrator Processing Plant - The concentrator processing plant has been laid out to the east of the pit. The Volstruis River valley, in which the pit is found, flattens to the east as it joins the Haib riverbed. This relatively flat area allows flexibility of the plant layout and an opportunity to minimise earthworks. The Run-of-Mine (ROM) tip pads are located close to the pit edge and are at a similar elevation to the pit rim. The typical processing plant supporting infrastructure comprises a change house, administration facility, workshop, stores, reagents stores, sewerage and water treatment facilities. The final copper and molybdenum concentrate will be dried in a filter press and exported by road.

The Concentrator design is based on a 28 Mtpa facility, executed in a single phase and comprising two 14 Mtpa crushing, milling and flotation circuit modules. The Concentrator will treat higher grade primary sulphide material containing at least 0.275% copper (Cu), for recovery of copper and molybdenum (Mo) minerals, and will produce separate copper and molybdenum flotation concentrates (dependent on market conditions and feed grade), which will be trucked to and shipped to international customers.

Hydrometallurgical Plant - The area in the north-west of the EPL footprint on the flatter plain, as well as the area directly north of the pit have been identified as alternatives currently being assessed for the heap leach and hydrometallurgical plant. Mineralised material will be crushed at the ROM pads and conveyed to the agglomeration plant before being stacked on the Heap Leach pad.

The heap leach, solvent extraction and electrowinning plant is designed with a feed capacity of 7 Mtpa, to process 179 million tonnes (Mt) of low-grade primary sulphide mineralised material containing between 0.175% and 0.275% Cu, as well as small quantities of oxide or secondary sulphide mineralised material over approximately 17 years. Copper cathode produced in this circuit will be exported to the market.

Tailings Disposal - Three (3) Tailings Storage Facility (TSF) options are currently being assessed (Options 3, 4 and 5). Two (2) valley impoundment zoned rockfill dams (options 3 and 5) with an upstream lined face and one raised ring feed structure (option 4).

The TSF options are currently unlined, based on the assumption that the tailings are non-acid generating, non-metal leaching, and the quality of the effluent will be above the effluent standard and waste management guidelines (as per the Namibian Water Quality Standards set out in Annexure 11 (Regulation 67) of the Water Resources Management Regulations 2023). The TSFs will have an underdrainage system and downstream seepage interception trenches / wells to maximise seepage water recovery. The TSF options are designed to Global Industry Standard on Tailings Management (GISTM) published in 2020.

Waste Rock Dumps / Stockpiles - Waste Rock Dumps were designed as close to the pit exits as possible to optimise productivity and minimise waste mining costs or environmental impacts.

Access and Haul Roads - The Project can be accessed from Windhoek or Noordoewer through the B1 National Highway and then via sets of farm roads and tracks developed during the various exploration programmes. Different access road options were investigated during the conceptual design stage, and the access (road) going along the Haib riverbank was rated most favourable in terms of geometrics, gradients, and cut and fill material balance. Based on the capital cost, maintenance costs, ease of construction, dust mitigation, and visual aesthetics, a sealed road option is recommended for the mine access road for use by commercial haulage trucks, buses, and general vehicles. A gravel wearing course and dump rock pavement layer with a dust suppressant is recommended for the haul road section between the open pit and processing stockpiles, as well as to the waste rock dumps to lower dust emission, wear, and damage to the road surface.

Bulk Water Infrastructure - The proposed Project's water demand is 20 million cubic metres per year (Mm^3/yr) of which supply is being investigated from two options, that is from the Orange River only or from an Orange River and Neckartal Dam option. Full abstraction from the Orange River is being pursued under this ESIA process.

Raw water supply from the Orange River assumes seasonal reliability of supply. Off-channel storage facilities will offset the impacts of limited to nil water abstraction during the dry season or drought periods. The proposed system comprises an abstraction weir, intake structure, a low-lift pumping station and two high-lift booster pumping stations, as well as a pipeline to a site reservoir. Two sites for abstraction are under investigation.

Mine Camp - On-site mine camp accommodation will be used during construction and operation to accommodate 2,500 rotation-based personnel. The mining camp is to be placed north of the main mining activities on flatter ground near the Project access road and solar photovoltaic (PV) plant. The design includes workers' accommodation, multi-purpose warehouses, gravity-fed water and sewer system, and associated infrastructure services to ensure functionality. The camp will include a comprehensive internal and bulk infrastructure network covering water supply, wastewater management, internal roads, solid waste disposal, and electrical reticulation. Access to the camp will be facilitated by a gravel road linked to the planned access road route. Electrical supply will be via a 33 kilovolt (kV) overhead line connected to the main substation, with a dedicated smaller substation near the camp and internal overhead or underground distribution, including street lighting.

Bulk Power Supply - The power supply concept design includes a hybrid solution combining a solar PV plant (150 MWp (megawatt peak)) and a connection to the regional grid system from the local service provider, the Namibia Power Corporation (NamPower). The system is sized to meet the proposed Project's peak demand that may be up to a maximum of 150 MVA (megavolt-amperes) and annual consumption of 1,123.3 GWh (gigawatt-hour). However, power optimisation studies are still ongoing and expected to provide improvements through introducing efficiencies. The grid supply is recommended to be via a double circuit overhead transmission line (OHTL) configuration for redundancy. The solar PV supply will include either 30% or 100% supply, subject to regulatory approval. Wind energy is a secondary option that was identified.

All infrastructure underwent alternative assessment, which considered designing the site around critical landform features such as topography, sensitive environmental habitats / areas, and heritage features. The process additionally considered the efficiencies required for the mining operation towards identifying an optimal layout. The presented site layout is a result of these considerations.

2.3 Project Location and Site Layout

The Haib Copper Project (EPL 3140) covers an area of approximately 36,571 ha and is located in the south of Namibia, approximately 9 km (from the south-western boundary) from Noordoewer (Figure 2-1). The B1 Road forms the north-western boundary of the EPL. The Orange River runs immediately to the south of the EPL, and a number of farms surround the EPL. The biggest portion of EPL 3140 lies on state land. The eastern part of the EPL is located on Farm Tsams and the Farm Withoek is located within and on the north-eastern boundary of the EPL. The proposed site layout is provided in Figure 2-2.

Figure 2-1 – Project Location / EPL 3140

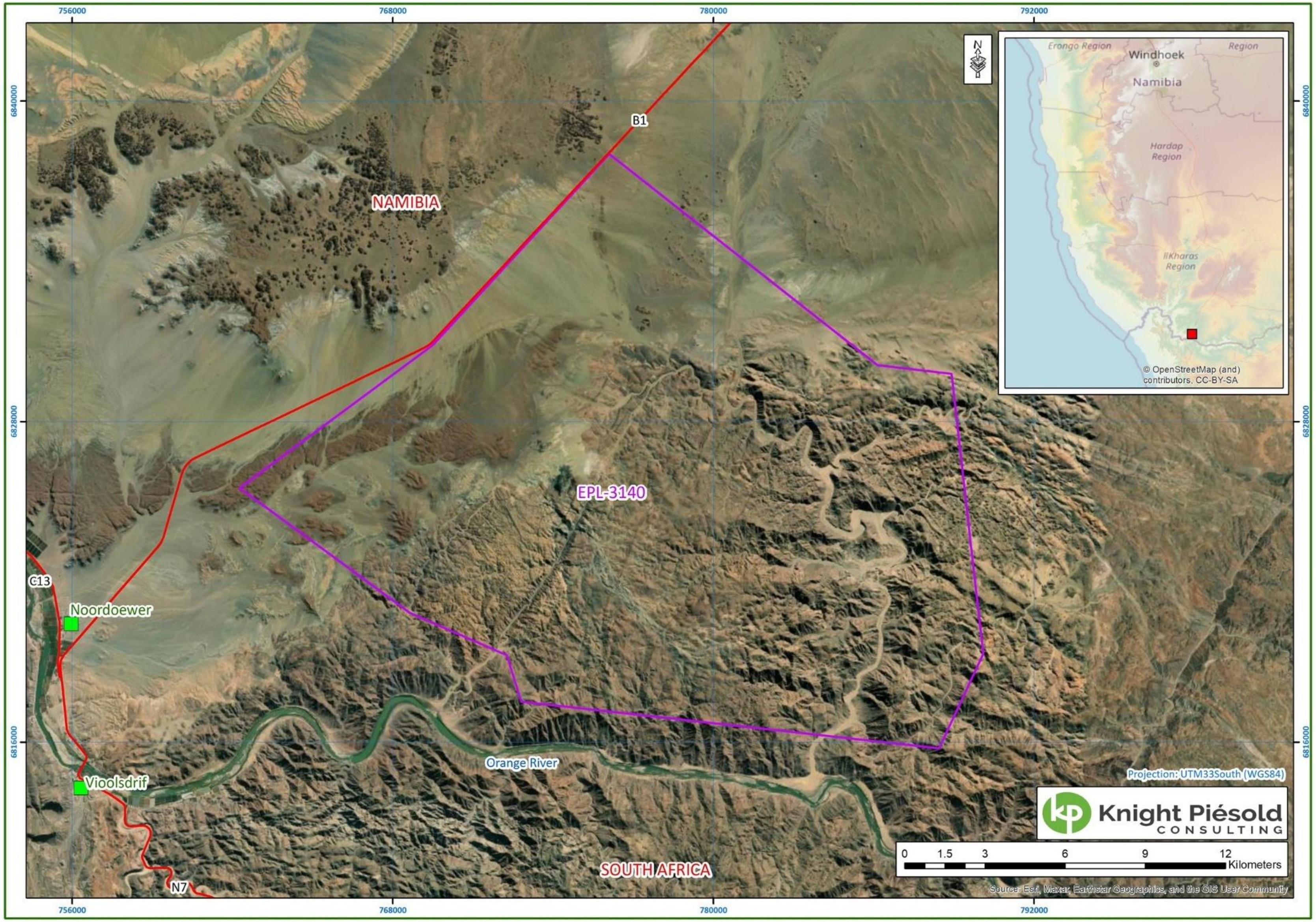
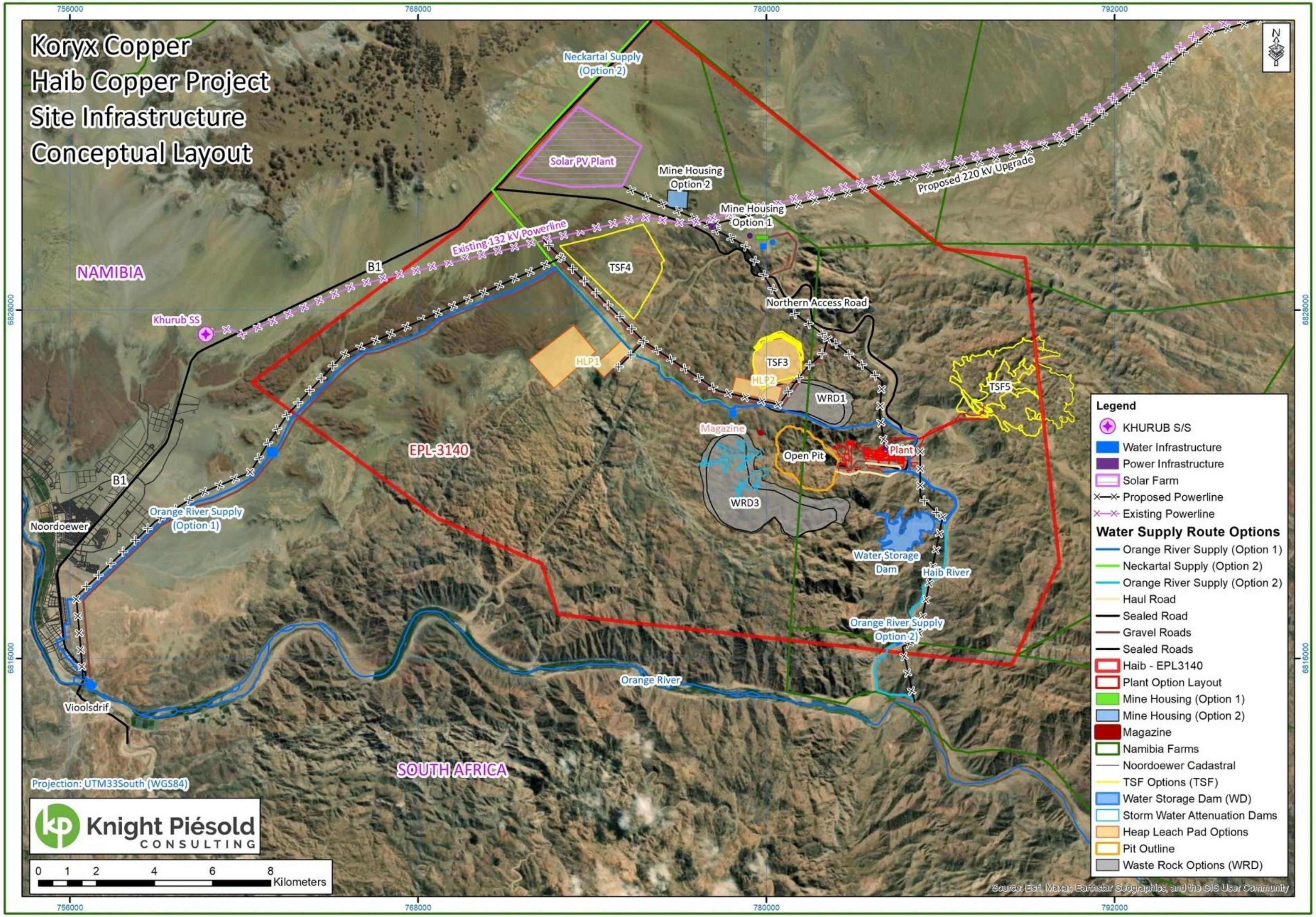


Figure 2-2 – Site Layout (inclusive of alternatives)



3 Ambient Air Quality Standards

This section presents the relevant local and international air quality regulations and guidelines applicable to the Project.

3.1 National Legislation

In Namibia, there are no formally promulgated national ambient air quality standards (AAQS). The country has historically applied the provisions of the South African Atmospheric Pollution Prevention Act (Act 45 of 1965), which addresses smoke, dust, noxious gases, and vehicle emissions. South Africa has since replaced this Act with the National Environmental Management: Air Quality Act (Act 39 of 2004), which introduced specific ambient air quality standards based on the South African National Standards.

Because Namibia has not adopted its own AAQS, it is common practice for air quality assessments in the country to refer to the South African AQA standards, supplemented where appropriate by World Health Organisation (WHO) or European Union (EU) limits to reflect international best practice. For the purpose of this assessment, the WBG International Finance Coporation (IFC) Environmental Health and Safety (EHS) guidelines and the referenced EU Directive AAQS [1] were considered for the assessment of the Project.

3.2 International Guidelines

According to the IFC EHS Guidelines [2], projects with significant sources of air emissions, and potential for significant impacts to ambient air quality, should prevent or minimise impacts by ensuring that:

- Emissions do not result in pollutant concentrations that reach or exceed relevant ambient quality guidelines and standards by applying national legislated standards, or in their absence, the current WHO Air Quality Guidelines, or other internationally recognised guidelines such as the EU Directive [1];
- Emissions do not contribute a significant portion to the attainment of relevant ambient air quality guidelines or standards. As a general rule, this Guideline suggests 25% of the applicable air quality standards to allow additional, future sustainable development in the same airshed.

The IFC guidelines make reference to alternative international guidelines and standards such as the EU standards (European Council Directives [1]) that were recently update in 2024, providing interim targets in-line with the previous 2008 Directive, and providing new and revised targets for 2030, aligning more closely with the the WHO Air Quality Guidelines [3]. For the purpose of this assessment, the EU Directive AAQS for the year 2030 onwards have been adopted as the applicable international AAQS aligning with the IFC General EHS guidelines for air quality [2].

Table 3-1 – EU Directive AAQS

Pollutant	Averaging Period	EU Directive 2024 AAQS			
		2026 Limit Values (µg/m³)	Allowable Exceedances	2030 Limit Values (µg/m³)	Allowable Exceedances
PM_{10}	24-hour	50	35	45	18
	Annual	40	-	20	-
$PM_{2.5}$	24-hour	-	-	25	18
	Annual	25	-	10	-

3.3 Impact Assessment Criteria

The criteria used to guide the prediction of air quality impact magnitude are based on a combination of the DEFRA guidance [4] and the IFC General EHS Air Quality Guidelines [2], categorising Project contributions as well as cumulative GLCs based on their relative percentage of the applicable AAQS. The detailed impact magnitude criteria are presented in Table 3-2.

Table 3-2 – Definition of Impact Intensity

Impact Intensity Category	Rating of Intensity	Ground Level Concentration as a Percentage of the AAQS	Description
Minor	1	Short-term concentrations <10% of the AAQS, and long-term concentrations less than 1% of the AAQS	Project contributions are considered to be negligible, and can be screened from cumulative impact assessments.
Low	2	<25% of the AAQS	Project contributions are considered to be low, meeting the IFC general EHS air quality guidelines for the prevention of significant deterioration to airsheds (PSD) (i.e. <25% of the AAQS)
Moderate	3	<50% of the AAQS	Project contributions are less than 50% of the applicable AAQS, but exceed the 25% PSD requirement of the IFC general EHS air quality guidelines
High	4	<100% of the AAQS	Project contributions are below the AAQS, but contribute to significantly to the airshed, with significant potential for cumulative exceedances of the AAQS.
Very High	5	>100% of the AAQS	Project contributions results in exceedances of the applicable AAQS

The criteria for the assessment of air quality impact significance arising at SRs from the Project operations were assessed using the KP assessment criteria, which defines impact significance as the product of an impact's consequence and probability, where the consequence is the sum of the impact severity, reversibility, duration, and spatial extent.

The KP Impact Assessment Criteria used to guide the approach in determining the impact significance of air quality impacts from is detailed in Appendix A.

4 Background Ambient Air Quality

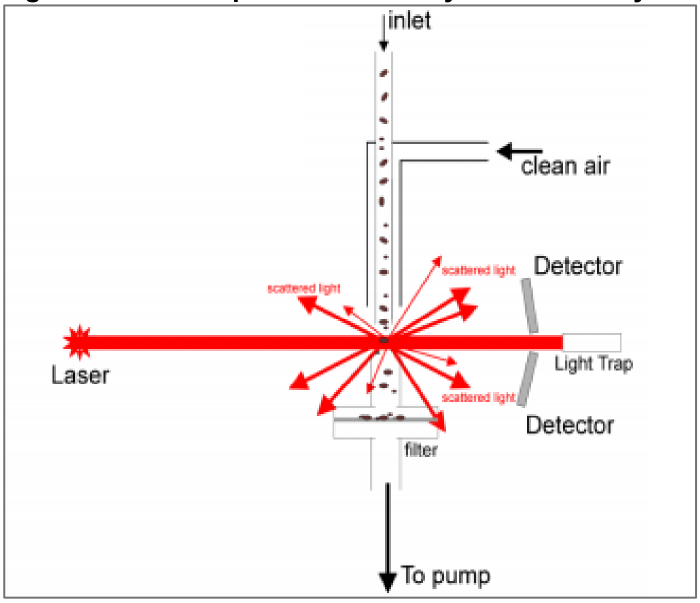
A baseline air quality (AQ) monitoring survey was undertaken in July of 2025 in order to establish the pre-development baseline conditions at the Project site, perimeter and on-site monitoring locations.

4.1 Air Monitoring Survey Methodology

The ambient air concentrations of PM_{10} and $PM_{2.5}$ were determined using a continuous PM analyser (Turnkey Osiris dust monitor) during an overall survey period of four days (approximately 8-hours per location).

The Osiris uses a photometer to continuously measure PM_{10} and $PM_{2.5}$, and it is based on the principle of light diffraction caused by the presence of particles in the sampled air stream. An illustration of the photometer functionality is illustrated in Figure 4-1.

Figure 4-1 – Principle of Photometry in the Turnkey Osiris [5]



The light scattering technique used can determine concentration of airborne particles and dust in the size range from about 0.4 microns (1 micron = 10^{-6} metre) to about 20 microns in diameter. Above 20 microns, all particles are sized as 20 microns.

The light scattered by the individual particles of dust is converted into an electrical pulse which is proportional the size of the particle. The intensity of the light pulse is therefore used to calculate of particle size and mass of the particle.

4.2 Monitoring Locations

Active sampling of PM (including PM_{10} and $PM_{2.5}$) was undertaken at four boundary locations within the mine concession area. The PM measurement locations are illustrated in Figure 4-2. A summary of the monitoring is provided in Table 4-1.

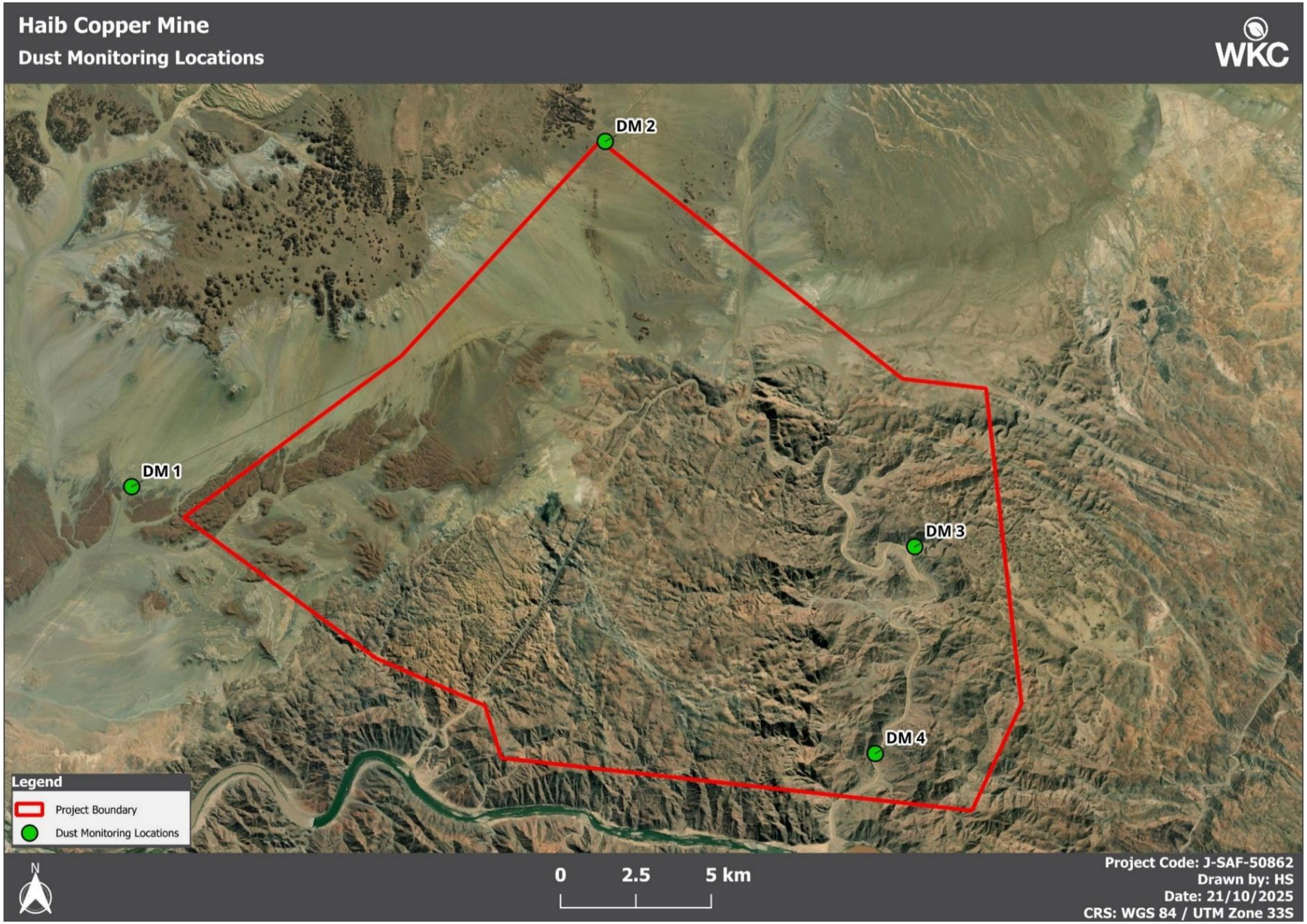
Four boundary monitoring locations (approximately north, south, east and west) were selected to provide full spatial representation of ambient PM concentrations around the proposed mining site and to capture variability under different prevailing wind conditions. Given that mining activities are dominated by wind-dependent fugitive dust sources, monitoring in all cardinal directions ensures that both upwind (background) and downwind conditions are characterised, providing a defensible baseline dataset for impact assessment and future comparison.

The monitoring duration is short-term (spot measurements), which is acknowledged as a limitation; however, this approach is justified due to the remote and undeveloped nature of the site, including the absence of permanent power supply and security infrastructure required for long-term continuous monitoring equipment. Despite its limited duration, the snapshot data provide useful baseline insight into existing PM levels and spatial variability, and will be supplemented by routine monitoring during construction and operational phases once site infrastructure is established.

Table 4-1 – Summary of Air Quality Monitoring Locations

Site ID	Site Description	UTM Co-ordinates	
		m E	m S
DM1	Western boundary	760,435	6,826,561
DM2	Northern boundary	776,168	6,838,031
DM3	Eastern boundary	786,448	6,824,565
DM4	Southern boundary	785,138	6,817,694

Figure 4-2 – Dust Monitoring Locations



4.3 Survey Results

The results of the survey are presented in Table 4-2 (PM_{10}) and Table 4-3 ($PM_{2.5}$). The measured levels of around the Project site were generally low, with level ranging between 4 and 15 μg/m^3 for PM_{10}, and between 1 and 3 μg/m^3 for $PM_{2.5}$. In terms of the 24-hour averaging period, none of the measurements exceeded the EU AAQS [2] stipulated for PM_{10} and $PM_{2.5}$.

Table 4-2 – PM_{10} Results for July 2025

Site ID	Survey Date	Duration of Sampling Period	PM_{10} Result (μg/m^3)	EU 24-hour AAQS (μg/m^3)	Exceedance of the Standard
DM1	10th July	~8 hours	14.7	45	No
DM2	7th July	~8 hours	2.7	45	No
DM3	8th July	~8 hours	3.8	45	No
DM4	9th July	~8 hours	6.1	45	No

Table 4-3 – $PM_{2.5}$ Results for July 2025

Site ID	Survey Date	Duration of Sampling Period	$PM_{2.5}$ Result (μg/m^3)	EU 24-hour AAQS (μg/m^3)	Exceedance of the Standard
DM1	10th July	~8 hours	3.2	25	No
DM2	7th July	~8 hours	1.2	25	No
DM3	8th July	~8 hours	1.1	25	No
DM4	9th July	~8 hours	1.4	25	No

The results of the ambient air quality monitoring indicate that PM concentrations in the area were consistently low for both PM_{10} and $PM_{2.5}$. Across all four monitoring sites, PM_{10} concentrations ranged from 2.7 to 14.7 μg/m^3, representing approximately 6% to 33% of the EU standard of 45 μg/m^3. Similarly, $PM_{2.5}$ levels ranged from 1.1 to 3.2 μg/m^3, equivalent to 4% to 13% of the EU standard of 25 μg/m^3.

These low concentrations are characteristic of remote arid regions such as the southern Namibian landscape, where natural dust emissions dominate PM levels and anthropogenic activities are limited. The terrain in the area is rocky and sparsely vegetated, and the survey period (July 2025) corresponds to the dry winter season, typically marked by low humidity and minimal rainfall. Under such conditions, dust generation can occur from exposed soils and unpaved surfaces; however, the absence of strong winds and limited human activity likely contributed to the relatively low readings observed.

The slight variability between sites may reflect localised influences, such as proximity to disturbed ground, gravel access tracks, or minor vehicle movement. However, the measured values remain below international thresholds. The dominance of coarse particles (PM_{10}) over fine particles ($PM_{2.5}$) suggests that emissions are primarily from natural sources rather than combustion or industrial processes.

Overall, the monitoring results demonstrate that the baseline air quality within the survey area is good, with no evidence of significant pollution sources. The findings are consistent with expected background conditions for a dry, sparsely populated environment. These data provide a reliable reference point for the impact assessment, particularly in evaluating potential changes associated with new developments or seasonal dust variations.

4.4 Background Data Used for Cumulative Assessment

An important aspect of cumulative impact assessment entails combining modelled concentrations with monitored background concentrations to determine the potential cumulative ambient air quality impacts. The use of a single uniform monitored background contribution is the simplest approach to implement as it can be applied outside of the modelling system.

In determining a suitable background value for short-term periods however, it is acknowledged that use of the overall highest hourly background concentration is overly conservative in many cases, as the maximum process contribution and maximum background concentration may be separated both temporally and spatially, so that the addition of the two "worst case" concentrations together may not represent a likely event. In order to be able to provide a comparison of the short-term average regulatory standard in conjunction with short-term average model outputs, the approach advocated by the UK Environmental Agency has been adopted [4]. When assessing short-term effects, it is reasonable to consider the maximum short-term modelled output in an additive context with a background concentration equal to two times (double) the long-term background value [4].

The recorded PM levels are considered more consistent with short-term PM levels. The resulting background concentrations used for the cumulative impact assessment is shown in Table 4-4.

Table 4-4 – Background Concentrations for Cumulative Assessment

Pollutant	Long-Term Concentration (µg/m^3)	Short-Term Concentration (µg/m^3)
PM_{10}	3.4	6.8
$PM_{2.5}$	0.9	1.7

Based on international guidance [4], pollutant contributions from a Project can be screened from an assessment when Project contributions are less than 10% of the short-term standard, and less than 1% of the long-term standard. Therefore, the cumulative assessment considers pollutants for which Project contributions exceeded these thresholds.

5 Identified Emission Sources

5.1 Sequence of Activities

Activities will occur in three sections of the site, namely open-pit mining, concentrator plant, heap leaching, and waste rock dump (WRD), in addition to the movement of haul trucks across the Project site between these three sections. The sequence of activities (in line with the process description in Section 1.3) is:

- Open-Pit Mining:
  - Stripping topsoil
  - Drilling and Blasting;
  - Material collection, transportation and stockpiling to run-of-mine (ROM) area;
  - Material collection, transportation and stockpiling from ROM to conveyors, HPGR and concentrator plant; and,
  - Material collection, transportation and stockpiling from concentrator plant to heap leaching.
- Concentrator Plant:
  - Loading of primary and crushers;
  - Primary and secondary crushing and screening;
  - Transfer to conveyors;
  - HPGR (tertiary crusher); and,
  - Transfer to Mill Feed stockpile for use in concentrators.
- Heap Leaching:
  - Loading trucks from concentrator plant;
  - Transportation and transfer to heap leaching; and,
  - Transfer and movement of stockpiles within heap leaching areas.
- Waste Rock and WRD:
  - Loading waste rock in pit;

- Hauling and transfer from waste rock in pit to WRD; and,
- Transfer and movement of stockpiles in WRD.

5.2 Modelled Scenarios

The mining activities across the site will remain the same across the operating years, however, will change in scale as ore throughput and production increases until it reaches the life of mine maximum. This is operational Year 8 – 20, where the total material mined is projected to remain almost consistent at approximately 120 Mtpa. The assessment therefore considered peak mining operations, for three potential TSF layouts as follows:

- **Scenario 1A:** Peak mining operations (Year 8 – 20) with TSF option 3 (TSF3)
- **Scenario 2A:** Peak mining operations (Year 8 – 20) with TSF option 4 (TSF4)
- **Scenario 3A:** Peak mining operations (Year 8 – 20) with TSF option 5 (TSF5)

In order to assess the efficacy of potential mitigation options, additional mitigation scenarios were carried out. These scenarios assessed sealed haul roads with the aim of eliminating fugitive dust from haul roads and reducing anticipated high impacts at the nearest SRs. These scenarios were based on Scenario 1A, 2A and 3A as follows:

- **Scenario 1B:** Peak mining operations – TSF3 – sealed haul roads
- **Scenario 2B:** Peak mining operations – TSF4 – sealed haul roads
- **Scenario 3B:** Peak mining operations – TSF5 – sealed haul roads

5.3 Identified Air Emission Sources

Emission sources were identified based on the sequence of mining activities. An emissions inventory was prepared to quantify the emissions attributed to the key emission sources in accordance with the US EPA [6] and National Pollutant Inventory (NPI guidance) [7].

The emission factors were obtained from US EPA AP42 Chapters 11 and 13 [6] [8] [9] [10], and NPI Emission Estimation Technique Manual Version 3.1, Table 2 [7]. The ADM emission inventory was developed using the ore throughput together with key relevant inputs summarised in Table 5-1.

Table 5-1 – Key Emissions Inventory Parameters

Parameter	Model Input
Annual Ore Throughput (Mtpa)	120
Concentrator Capacity (Mtpa)	28
Heap Leaching Capacity (Mtpa)	7
Strip Ratio	3.5
Waste Rock (Mtpa)	93
Maximum Ore Moisture Content (%)	5

The emissions inventory can be found in Appendix B. Further details are presented in Section 6.6.

6 Construction Phase Impact Assessment

6.1 Construction Phase Overview

Fugitive dust emissions are expected to arise from a range of activities during the construction phase of the Project. These emissions will primarily result from the disturbance and movement of soil and other fine materials during site preparation and from vehicle activity across unpaved areas. The principal sources of dust generation are anticipated to include:

- Earthworks and site preparation, including excavation, grading, and material stockpiling;
- General construction activities, such as material handling, cutting, and onsite vehicle movement; and,
- Track-out, where dust is carried offsite by construction vehicles onto paved public roads.

The potential for dust impacts were assessed in accordance with the IAQM Guidance on the Assessment of Dust from Demolition and Construction [11], which provides a risk-based methodology for evaluating the likelihood and significance of construction-related dust impacts.

Past project experience of assessing the exhaust emissions from on-site and surrounding traffic suggests that these emissions are unlikely to significantly impact the local air quality and have therefore been considered to have a '**Minor**' impact magnitude, resulting in a '**Low**' impact significance [11].

6.2 Magnitude of Dust Impacts

Based on the IAQM criteria, the impact magnitudes for earthworks, construction and track-out were 'Large', 'Medium' and 'Medium' respectively, as detailed in Table 6-1.

Table 6-1 - Construction Impact Magnitude Assessment

Phase / Activity	Magnitude of Impact	Condition
Earthworks	Large	Total site area >110,000 m^2, potentially dusty soil type (e.g. clay, which will be prone to suspension when dry due to small particle size), >10 heavy earth moving vehicles active at any one time, formation of bunds >6 m in height.
Construction	Large	Total building volume 75,000 m^3, potentially dusty construction material (e.g. concrete), on site concrete batching.

Phase / Activity	Magnitude of Impact	Condition
Track-out	**Medium**	20 – 50 HDV (>3.5 t) outward movements in any one day moderately dusty surface material (e.g. high clay content), unpaved road length 50 m – 100 m.

6.3 Receptor Sensitivity

Based on the receptor sensitivity criteria, the nearby residential receptors are considered to have a 'High' sensitivity. When taking their proximity to the Project site, and baseline air quality into consideration, and density of receptors, the resulting sensitivity is 'Low' (Table 6-2).

Table 6-2 – Receptor Sensitivity Analysis

SR	Receptor Sensitivity Description	Baseline Air Quality	Distance (m)	Number of Receptor	Resulting Sensitivity
Closest SRs	High	<60% of standard	>250	>100	Low

6.4 Determination of Impact Intensity

Based on the impact magnitudes and the receptors sensitivities, the overall construction dust impact risks were evaluated to be 'Low'. This impact risk was mapped to the EIA impact assessment impact intensity of 'Low' (2) (Table 6-3).

Table 6-3 – Construction Phase Impact Magnitude

SR	Classification	Sensitivity	Phase / Activity	Magnitude	Risk of Impact / Impact Intensity
Closest SRs	Residential	Low	Earthworks	Large	Low (2)
			Construction	Large	Low (2)
			Track-out	Medium	Low (2)

6.5 Determination of Impact Significance

Based on the IAQM assessment methodology, the dust impact intensity for at all SR's is predicted to be '**Low**', which corresponds to a rating of '**2**'. The Reversibility, Duration and Spatial Extent are allocated a rating of '**1**', '**1**' and '**2**' respectively, which leads to a Consequence of '**6**' for all SRs. Given that the Probability is allocated a rating of '**1**', the Impact Significance is classified as '**Low**'.

Table 6-4 – Construction Phase Impact Assessment Summary

		Severity / Magnitude (M)	Reversibility (R)	Duration	Spatial Extent	Probability	Significance	Nature of Impact	
								+ / -	D / I / C
Construction Impacts Prior to Mitigation									
Increase in fugitive dust / PM_{10} emissions from earthworks, material handling, construction and track-out with the potential to impact on human health	Without Mitigation	**2**	**1**	**1**	**2**	**1**	**Low**	**(-)**	**D**
Increase in exhaust emissions (gaseous and PM emissions) from vehicles with the potential to impact on human health	Without Mitigation	**1**	**1**	**1**	**2**	**3**	**Low**	**(-)**	**D**
• Refer to the recommended mitigation measures section									
Construction Impacts Post-Mitigation									
Increase in fugitive dust / PM_{10} emissions from earthworks, material handling, construction and track-out with the potential to impact on human health	With Mitigation	**2**	**1**	**1**	**2**	**1**	**Low**	**(-)**	**D**
Increase in exhaust emissions (gaseous and PM emissions) from vehicles with the potential to impact on human health	With Mitigation	**1**	**1**	**1**	**2**	**3**	**Low**	**(-)**	**D**

6.6 Typical Dust Control Measures

The IAQM guidance provides mitigation measures divided into general measures applicable to all site and measures applicable specifically to earthworks, construction and track-out, for consistency with the assessment methodology. The recommended mitigation measures are as follows:

Mitigation for all sites: Communications

- Display the name and contact details of person(s) account- able for air quality and dust issues on the site boundary. This may be the environment manager/engineer or the site manager.
- Display the head or regional office contact information

Mitigation for all sites: Dust Management

- Develop and implement a Dust Management Plan (DMP), which may include measures to control other emissions (including these measures).

Site Management

- Record all dust and air quality complaints, identify cause(s), take appropriate measures to reduce emissions in a timely manner, and record the measures taken.
- Record any exceptional incidents that cause dust and/or air emissions, either on- or off-site, and the action taken to resolve the situation in the log book.

Monitoring

- Undertake daily on-site and off-site inspection, where receptors (including roads) are nearby, to monitor dust, record inspection results.
- Carry out regular site inspections to monitor compliance with the DMP, record inspection results.
- Increase the frequency of site inspections by the person accountable for air quality and dust issues on site when activities with a high potential to produce dust are being carried out and during prolonged dry or windy conditions.

Preparing and maintaining the site

- Plan site layout so that machinery and dust causing activities are located away from receptors, as far as is possible.
- Erect solid screens or barriers around dusty activities or the site boundary that are at least as high as any stockpiles on site.
- Fully enclose site or specific operations where there is a high potential for dust production and the site is active for an extensive period
- Contain site runoff in an appropriate manner.
- Keep site fencing, barriers and scaffolding clean using wet methods. During periods of water scarcity, use dry cleaning methods such as brushing, vacuuming with filtered equipment, or low-pressure compressed air with appropriate dust suppression/collection systems as alternatives.

- Remove materials that have a potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover as described below.

- Cover, seed or fence stockpiles to prevent wind whipping.

Operating vehicle/machinery and sustainable travel

- Ensure all vehicles switch off engines when stationary - no idling vehicles.

- Avoid the use of diesel or petrol powered generators and use mains electricity or battery powered equipment where practicable.

- Impose and signpost a maximum-speed-limit of 15 mph / 25 km/h on surfaced and 10 mph / 15 km/h on un-surfaced haul roads and work areas.

Operations

- Only use cutting, grinding or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g. suitable local exhaust ventilation systems.

- Ensure an adequate water supply on the site for effective dust/particulate matter suppression/mitigation, using non-potable water where possible and appropriate.

- Use enclosed chutes and conveyors and covered skips.

- Minimise drop heights from conveyors, loading shovels, hoppers and other loading or handling equipment and use fine water sprays on such equipment wherever appropriate.

- Ensure equipment is readily available on site to clean any dry spillages, and clean up spillages as soon as reasonably practicable after the event using wet cleaning methods.

Waste management

- Avoid bonfires and burning of waste materials

<u>Measures Specific to Construction</u>

- Avoid scabbling (roughening of concrete surfaces) if possible

- Ensure sand and other aggregates are stored in bunded areas and are not allowed to dry out, unless this is required for a particular process, in which case ensure that appropriate additional control measures are in place.

<u>Measures Specific to Track-out</u>

- Use water-assisted dust sweeper(s) on the access and local roads, to remove, as necessary, any material tracked out of the site. This may require the sweeper being continuously in use.

- Avoid dry sweeping of large areas.

- Ensure vehicles entering and leaving sites are covered to prevent escape of materials during transport.

- Record all inspections of haul routes and any subsequent action in a site log book.

- Implement a wheel washing system (with rumble grids to dislodge accumulated dust and mud prior to leaving the site where reasonably practicable).

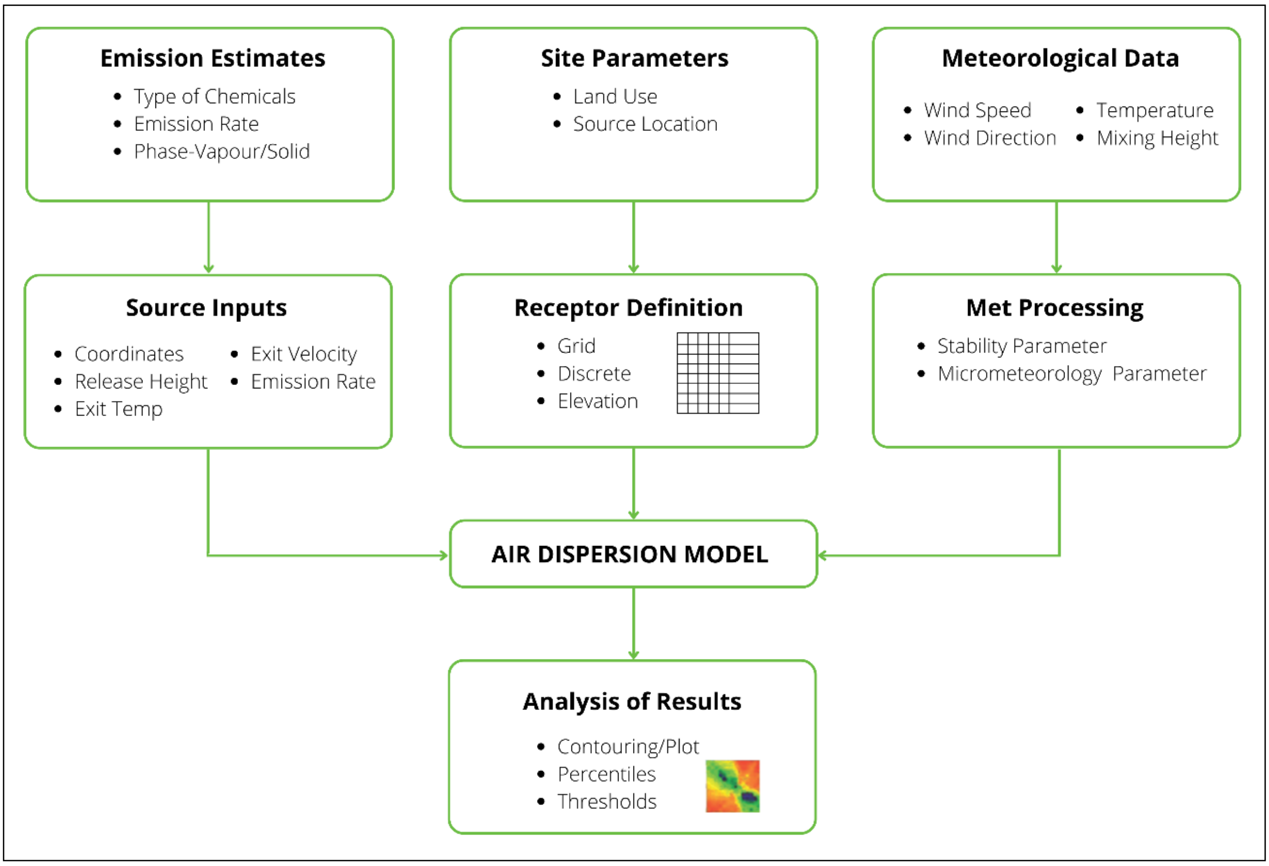
7 Air Dispersion Modelling Methodology and Assumptions

7.1 Introduction

Dispersion models compute ambient concentrations as a function of source configurations, emission strengths and meteorological characteristics, thus providing a useful tool to ascertain the spatial and temporal patterns in the GLCs arising from the given emission sources.

A general overview of the process typically involved in air dispersion modelling assessment is presented in Figure 7-1.

Figure 7-1 – Generic Process for Air Dispersion Modelling



Increasing reliance has been placed on concentration estimates from models as the primary basis for environmental and health impact assessments, risk assessments and emission control requirements. It is therefore important to carefully select and customise a dispersion model for the purpose.

Specifics pertaining to the model selection and all model input parameters, including meteorological data, terrain data, receptors, sources, etc. are described in detail in the following sections.

7.2 Air Dispersion Modelling Software

In order to estimate the GLCs of each pollutant, an ADM study was conducted using the latest version of the US EPA AERMOD software (Lakes AERMOD View, Version 13.0.0). AERMOD is a straight-line, steady-state Gaussian plume model designed to simulate pollutant dispersion over both rural and urban settings, in flat and complex terrain. It can account for surface and elevated releases from multiple source types (point, area, and volume), and calculates ground-level concentrations at defined receptor points.

Developed jointly by the US EPA and the American Meteorological Society under the Regulatory Model Improvement Committee (AERMIC), AERMOD represents a new generation of air quality models. It incorporates improved algorithms for convective and stable boundary layers, vertical wind and turbulence profiles, and temperature structure, resulting in more realistic characterization of atmospheric dispersion. A key advancement is its ability to construct vertical profiles of meteorological parameters, significantly improving the representation of vertical pollutant transport.

The AERMOD modelling system consists of two pre-processors:

- AERMET – the meteorological pre-processor, which computes boundary layer parameters and other required atmospheric inputs for AERMOD, using both on-site and off-site surface and upper-air data.
- AERMAP – the terrain pre-processor, which determines receptor elevations and effective hill heights from digital terrain data to account for topographic influences on dispersion.

Together, these modules allow AERMOD to incorporate detailed meteorology and site-specific topography, making it applicable to a wide range of environmental conditions and source configurations.

7.3 Summary of Model Options and Settings

The model version, domain setup, terrain and land use information used for the Project is presented in Table 7-1. Each of the model parameters and setting are covered in more detail in the following sections.

Table 7-1 – Model Parameters

Model / Parameter	Details
AERMOD	Version 13.0.0
Meteorological Data	3 years (2022 – 2024) of Prognostic WRF data
Terrain	SRTM1 – 30m resolution
Receptor Grid and Modelling Domain	Size: 50km x 50km Resolution: 1km Grid Receptors: 2,500 Discrete Receptors: 19

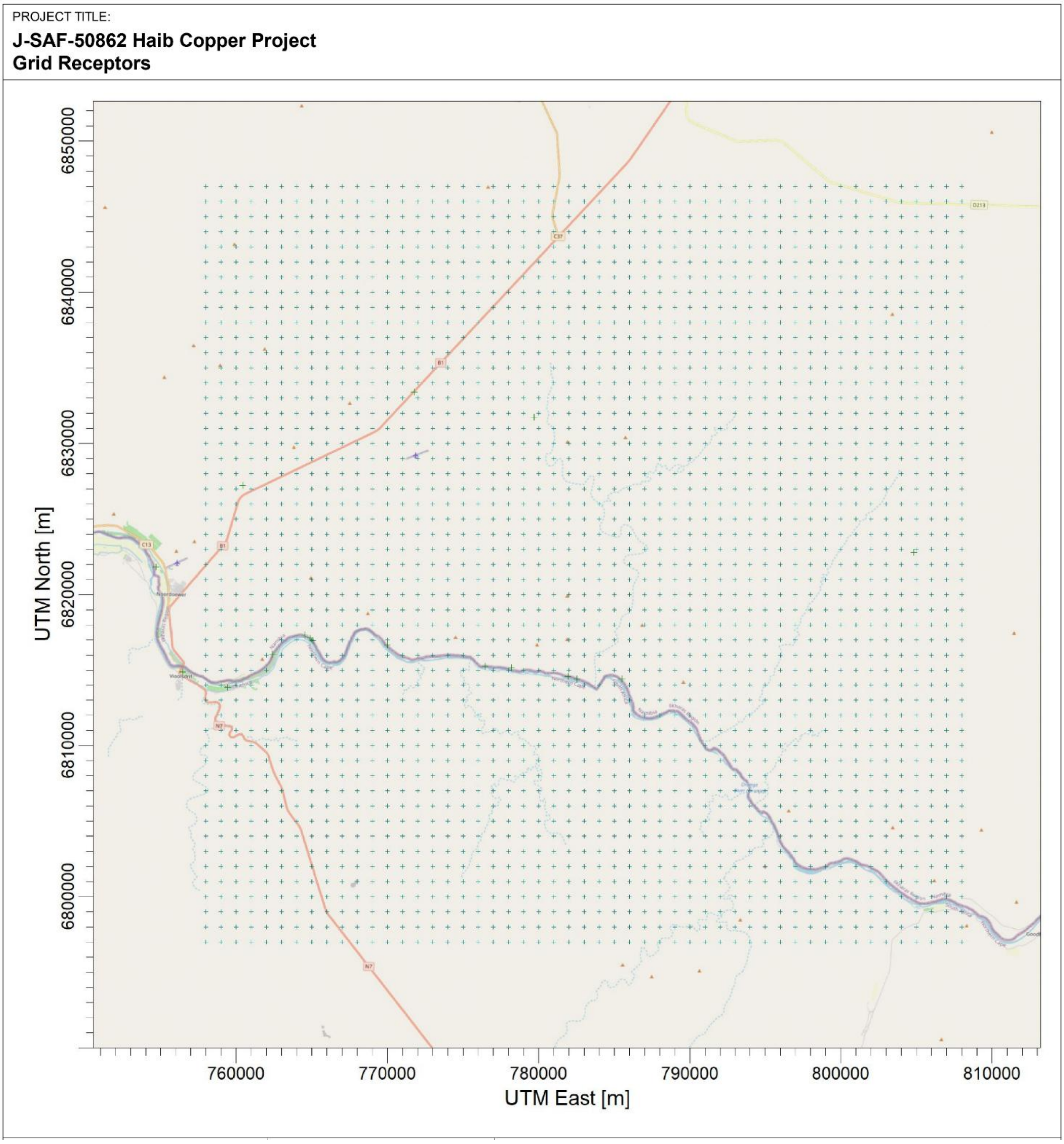
7.4 Model Domain

7.4.1 Receptor Grid

Initial model runs were undertaken to determine the geographical extent of plume dispersion. This subsequently allowed the domain over which modelling was undertaken to be refined accordingly. This is deemed a sensitivity analysis and has been undertaken to determine the optimal grid layout for the model set up. During the process of model setup, the model needs to be optimised by appropriate refinement of the model grid while encompassing the limitations of processing power and the time required for modelling. After undertaking initial runs and determining the most useful and reasonable extent of the modelling domain. In the case of this assessment, primary focus is the assessment of Project contributions at SRs within close proximity to the mine along the southern EPL boundary and represent the critical discreet locations for assessment of maximum GLCs.

Due to the remote location and specific locations of sensitive receptors within 25 km of the nearest boundary, and the model maximum located at the SRs, a coarse grid with 1km spacing was used over the entire modelling area for the purposes of generating the isopleths. The receptor grid is illustrated in Figure 7-2.

Figure 7-2 – Receptor Grid



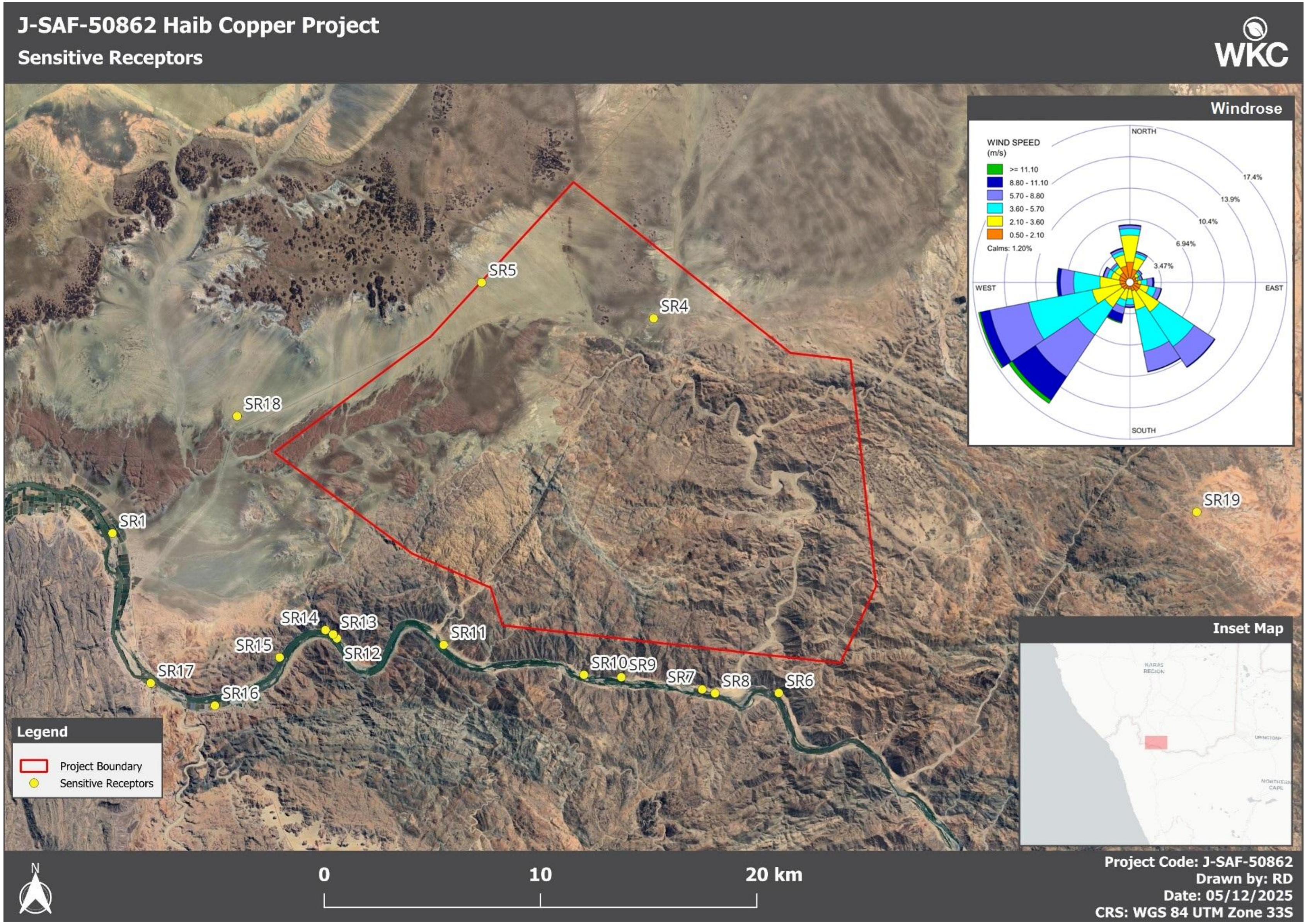
7.4.2 Sensitive Receptors

The Project is located approximately 18 km northeast of Noordoewer (20 km by road), in the south of Namibia, just north of the border with South Africa along the Orange River. The immediate area has several small farms but is largely uninhabited. For the purposes of this assessment, sensitive receptors (SRs) are defined as locations where human exposure may occur (e.g. residences, farmsteads or occupied buildings), as these form the basis of the quantitative air quality assessment criteria. Sensitive ecological receptors, such as agricultural land, livestock and the Orange River to the south of the mine, are also recognised; however, the quantitative assessment has been limited to discrete human SRs. The spatial outputs of the assessment (e.g. concentration isopleths) will be used to support evaluation of potential impacts on ecological and other environmental receptors as required in the ESIA. Details of the identified sensitive receptors are shown in Table 7-2, and the locations relative to the Project site are illustrated in Table 7-2.

Table 7-2 – Sensitive Receptors

SR ID	SR Description	UTM Coordinates		Site Classification	Distance from Boundary (km)
		m E	m N		
SR1	Noordoever	754,670	6,821,807	Residential	8.38
SR2	Aussenkehr	737,918	6,856,724	Residential	39.51
SR3	Haklesdoorn	814,905	6,799,191	Residential	31.32
SR4	Withoek Farmer	779,706	6,831,742	Residential	0
SR5	B1 Highway	771,752	6,833,403	Commercial	0
SR6	OR Livestock Farmers	771,752	6,833,403	Residential	1.69
SR7	OR Livestock Farmers 2	785,495	6,814,419	Residential	1.92
SR8	OR Livestock Farmers 3	781,954	6,814,585	Residential	2.03
SR9	OR Livestock Farmers 4	782,549	6,814,406	Residential	1.77
SR10	OR Livestock Farmers 5	778,212	6,815,149	Residential	1.85
SR11	OR Livestock Farmers 6	776,482	6,815,259	Residential	2.87
SR12	OR Farmers 7	769,989	6,816,647	Residential	5.22
SR13	OR Farmers 8	765,056	6,816,946	Residential	5.18
SR14	OR Farmers 9	764,879	6,817,130	Residential	5.23
SR15	OR Farmers 10	764,520	6,817,331	Residential	7.50
SR16	Irrigation Agriculture Area	762,402	6,816,066	Residential	11.07
SR17	Border Post	759,409	6,813,835	Commercial	11.99
SR18	Police Compound	756,435	6,814,874	Commercial	2.42
SR19	Farmer	760,438	6,827,223	Residential	15.13

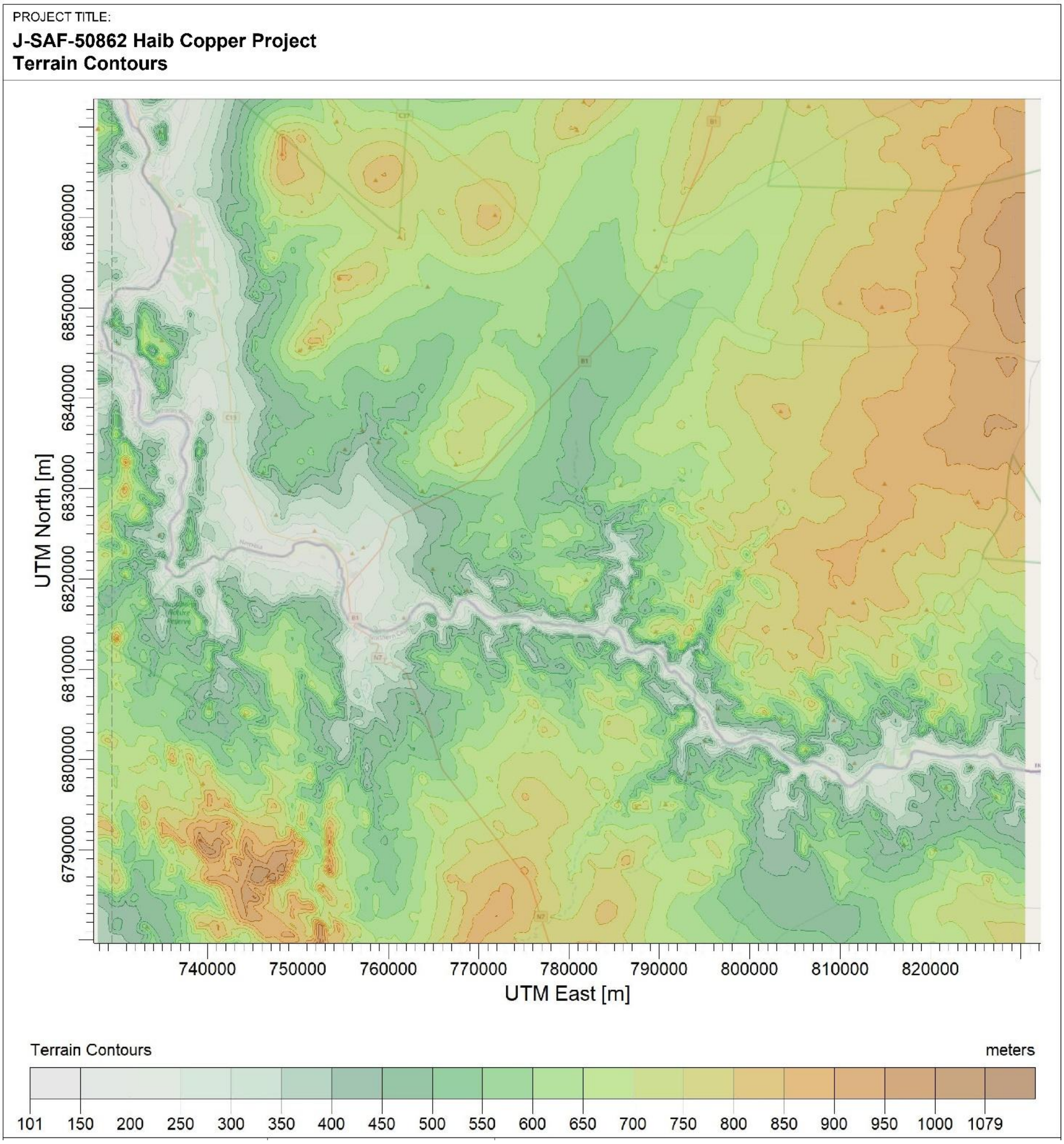
Figure 7-3 – Sensitive Receptors



7.5 Terrain

Terrain data plays a crucial role in ADM studies as concentrations are influenced by the height of the plume relative to the local ground level. The area is characterised by gently undulating to moderately rugged terrain, with elevations ranging from approximately 100 m above sea level in the north-western and central portions of the area along the Orange River. Elevations increase gradually eastward and north-eastward, reaching typical elevations of 400 – 700 m across much of the central area. More pronounced topographic relief is observed toward the eastern and north-eastern margins, where elevations rise to approximately 900 – 1,100 m. The terrain is dissected by the Orange River, creating localised valleys and steeper slopes, particularly to the south of the EPL and the across the modelling domain from the north-west to the south-east. The Satellite Radar Topography Mission (SRTM 1) Global Terrain Data with a resolution of 30 m was imported using the Lakes AERMOD View WebGIS interface and incorporated into the model. Base elevations were extracted from this dataset and assigned to the general receptor grids and sources within the model. The AERMOD generated terrain contour map is presented in Figure 7-4.

Figure 7-4 – Terrain Contours



7.6 Meteorological Data

Local meteorological conditions affect the plume dispersion of emissions, with plumes being largely transported in the direction of the wind. GLCs are modelled for each hour of meteorological data for specified averaging periods and receptor points. The AERMOD air dispersion also utilises hourly sequential upper atmospheric meteorological data for the calculation of vertical profiles of wind turbulence and temperature.

The ADM was carried out using the Weather Research and Forecasting (WRF) prognostic weather data. The WRF model is an advanced prognostic meteorological model which can be executed for any location in the world. Lakes Environmental uses the Mesoscale Model Interface Program (MMIF) to convert WRF model output into a format recognized by the AERMET model (meteorological pre-processor for the AERMOD model).

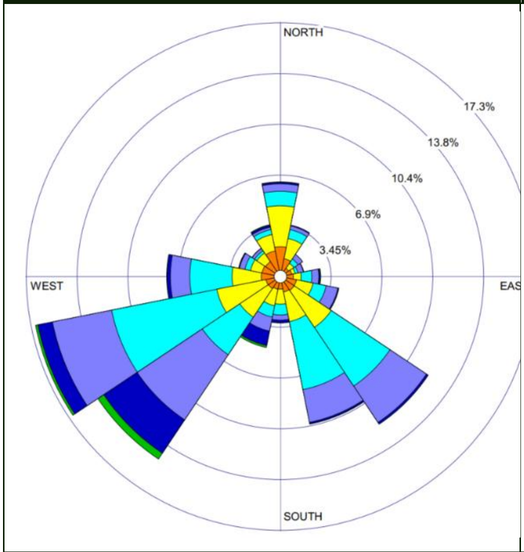
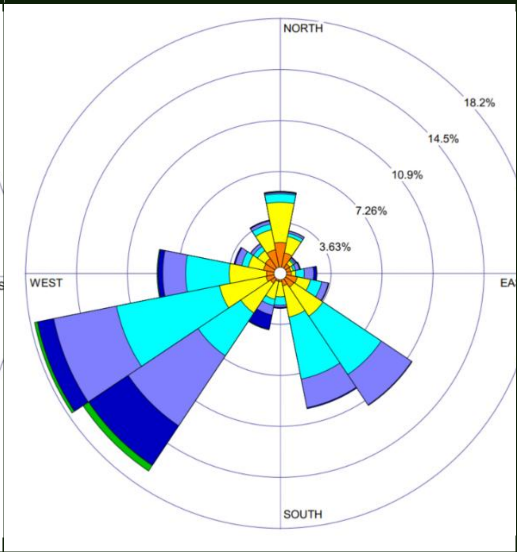
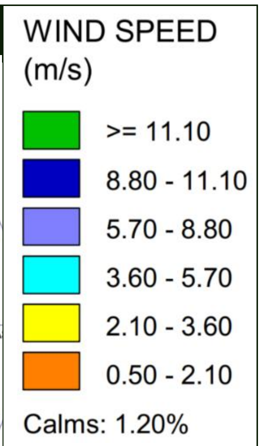
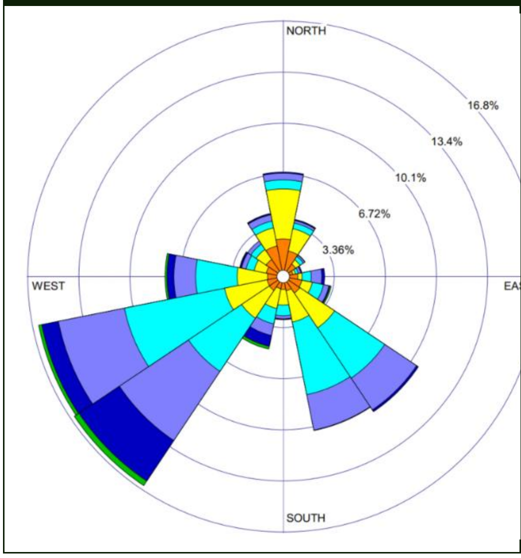
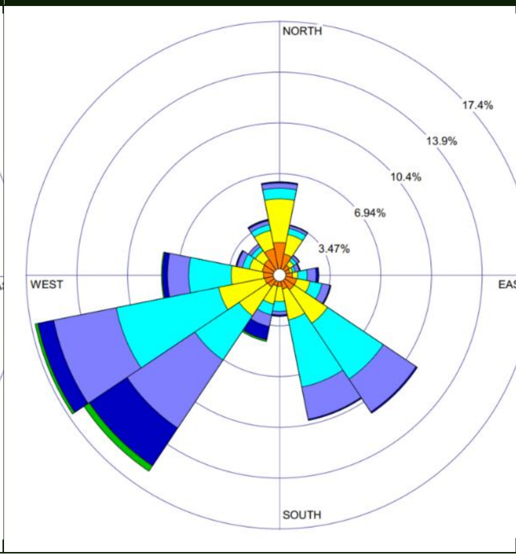
Table 7-3 – Met Data Summary

Met Data Type:	AERMET-Ready WRF-MMIF (Prognostic & Upper Air Met Data) AERMOD-Ready WRF-MMIF (SFC & PFL Met Data)
Start-End Date:	Jan 01, 2022, Hour 00 - Dec 31, 2024, Hour 23
Centre Point:	Latitude: 28.653353 S - Longitude: 17.858136 E
Datum and UTM Zone:	World Geodetic System (WGS) 84 (UTM Zone 33S)
WRF Domain Size and Resolution:	50 x 50 km (Resolution of 4 km)
Site Time Zone:	Coordinated Universal Time (UTC) +0200
Location:	Noordoewer, Namibia

7.6.1 Annual Average Wind Roses

Wind roses were created from the meteorological data used in the model for each year between 2022 – 2024 to illustrate surface wind patterns and are presented in Table 7-4. For all years in the meteorological period, the dominant wind direction is from the west-south-west, with majority of high wind speeds emanating from that direction. Low wind speeds emanate from the north, with little variation between the years.

Table 7-4 – Project Site Wind Roses

2022	2023	
		
2024	**2022 – 2024**	
		

7.7 Modelling Assumptions

The following assumptions were considered within the modelling assessment, and wherever possible, a conservative approach was taken:

- UTM coordinates of sources are based on the provided plot plan;
- The emissions inventory was compiled based upon the emission factors and activity sequences detailed in Section 5;
- The maximum GLC values corresponding to the relevant standards / guidelines are based on a three-year meteorological data set (2022 - 2024) and are considered conservative;

- Model results are presented at the relevant EU AAQS percentiles based on the allowable exceedances per year.
- Dry and wet deposition were modelled, and particle size distributions were based on representative data from similar mining projects, ensuring realistic treatment of settling and removal processes in the dispersion modelling.

7.7.1 Uncertainty

Air quality models attempt to predict concentrations at a specific point and time based on “known” or measured values of various parameters input into the model, such as wind speed, temperature profiles, solar radiation. There are, however, variations in the “unknown” parameters that are not measured, as well as unresolved details of atmospheric turbulent flow. Variations in these “unknown” parameters can result in deviations of the predicted concentrations of the same event, even though the “known” parameters are fixed. As a result of the deviations of the “unknown” parameters, a “perfect” model may be able to predict an average of identical events well, while each repetition of that event will provide marginally different results. The statistics of these concentration residuals are termed ‘‘inherent’’ uncertainty of a model.

In addition, there are “reducible” uncertainties due to inaccuracies in the model, errors in input values and errors in the measured concentrations. “Reducible” uncertainties include inaccuracies in the input values of the known conditions (for example, poor quality or unrepresentative meteorological, geophysical and source emission data); errors in the measured concentrations that are used to compare with model predictions and inadequate model physics and formulation used to predict the concentrations. As the term indicates, “reducible” uncertainties can be controlled or minimised by collecting accurate input data, preparing the input files correctly, checking and re-checking for errors, correcting for unexpected model behaviour, ensuring that the errors in the measured data are minimised and applying better model physics.

It is acknowledged that there will always be some error in any geophysical model, however notwithstanding the limitations and assumptions detailed, the structure of the modelling approach has been prepared in such a way as to minimise the total error.

8 Air Dispersion Modelling Results

The following sections presents the model results for both model maximums concentrations at SRs. Selected isopleths are presented in Appendix C.

8.1 Overview of Dispersion Patterns

The dispersion of particulate matter from the project operations and fugitive sources are influenced by several key factors incorporated within the AERMOD model, including meteorology (wind speed and direction, atmospheric stability, mixing height), terrain, emission source characteristics, and receptor placement. These factors interact to produce the observed GLC patterns and influence the spatial distribution of impacts.

The wind rose for the modelling period shows a bimodal wind pattern, with dominant winds from the west-southwest (WSW) and east-southeast (ESE) sectors. Under a simplified scenario, for example with flat terrain and uniform surface characteristics, relatively symmetric, bidirectional plume alignment along these axes would be expected. However, in this case where terrain is not flat, the dispersion isopleth plots indicate that the highest predicted concentrations are not fully aligned with the prevailing wind directions. Instead, they form an extended southern dispersion pattern, suggesting that other factors, particularly complex terrain and receptor topography, are influencing plume behaviour.

In areas with elevated terrain, enhanced vertical mixing and gravitational settling may result in earlier plume depletion and reduced downwind concentrations. Conversely, topographic depressions such as valleys where dust remains ambient due to the lower terrain elevations, resulting in elevated concentrations even in directions not strongly aligned with prevailing winds. This effect may be particularly relevant to south of the project area, where modelled concentrations remain elevated beyond what would be expected from simple upwind-downwind transport.

Furthermore, proximity to the mine remains a key determinant of impact magnitude. Receptors located near primary sources, such as the haul roads and material handling areas, are expected to experience the highest concentrations, as reflected in the red and orange contours on the isopleth map. While prevailing winds shape the broader extent of the plume, the interaction of wind with terrain, particularly along slopes, produces complex dispersion patterns that may deviate from the dominant wind axis.

In summary, while wind direction remains a primary driver of dispersion, the observed concentration patterns are shaped by a combination of terrain influence dispersion, particularly plume depletion over ridges.

8.2 Maximum Project Contributions – Standard Mitigation Scenarios

The model maximum results for standard mitigation measures across all assessed SRs are presented in Table 8-1 for Scenario 1A (TSF3), for Scenario 2A (TSF4) and Scenario 3A (TSF5), and capture the overall maximum potential impact from the Project under standard operating conditions including minimum standard mitigation such as road wetting and sprays at material handling locations.

Based on these model results, most SRs are expected to experience 'Low' and 'Minor' impacts given the distance between the mining operations and these SRs. These SRs include SR1 – SR3 and SR12 – SR19 located south-west, north-west and west of the mining infrastructure and haul roads. For the closest SRs located to the north of the Project (within the EPL boundary), and to the South along the Orange River, the maximum Project impacts in isolation and cumulatively, are expected to range from 'Moderate' and 'High' (SR4 – SR6 and SR9 – SR11) to 'Very High' (SR7 and SR8).

These results indicate that under standard mitigation, the closest SRs within and near the EPL boundary are expected to experience 'Moderate' to 'Very-High' impact magnitudes over the long-term. The complete SR assessments are provided in Table 8-3 (Scenario 1A), Table 8-4 (Scenario 2A) and Table 8-5 (Scenario 3A).

8.3 Mitigation Scenario – Sealed Haul Roads

Based on previous Project experience, source group analysis, and as shown by the empirical data consolidated in the development of various emission factors from mining operations, the most significant fugitive dust emission sources are generally haul roads where heavy and large vehicle movements are frequent and constant. In these mitigation scenarios, the aim was to assess the potential reduction and suitability of implementing sealed roads that effectively eliminate fugitive dust emissions from haul roads.

The model maximum results across all assessed SRs for specific additional mitigation of haul roads are presented in Table 8-2. Based on the model results of the haul road mitigation scenarios, the most significant impacts at the closest SRs are reduced significantly, where the resulting maximum contributions are expected to be below the EU AAQS. Although contributions at the closes SRs are expected to range between 50% and 100% of the standard at SR7 – SR8, the impacts at all other SRs are expected to 'Minor', 'Low' or 'Moderate'.

The results indicate that SRs in close proximity to the mining operations particularly SRs located within the EPL and along the Orange River to the south of the mining operations, are likely to experience 'Moderate' impacts over the long-term. The complete SR assessments are provided in Table 8-6 (Scenario 1B), Table 8-7 (Scenario 2B) and Table 8-8 (Scenario 3B).

8.4 Determination of Impact Significance

8.4.1 Standard Mitigation Scenarios 1A – TSF3, 2A – TSF4 and 3A – TSF5

Nearby SRs within the EPL and along EPL Boundary Along the Orange River (SR4 – SR11)

In terms of the EIA impact assessment methodology, the short-term contributions expected for the normal operations of the Project are expected to be 'Very-High' (5) at the nearest SRs (within the EPL boundary and along the EPL boundary along the Orange River to the south of the mine including SR4 – SR11), where Project contributions are expected to be within 50% - 100% of the AAQS, and exceed the AAQS at two SRs. In terms of the EIA impact assessment criteria, the impact is reversible (1), temporary (1), local (2), and the likelihood over the life of the Project is highly probable (4). The corresponding impact significance is therefore "**Moderate**" (36).

When considering the long-term averages and long-term impacts, the Project is expected to have a "High" (4) impact magnitude that is reversible (1), long term (4), local (2) and highly probable (4). The resulting impact magnitude is also "**Moderate**" (44).

SRs Located Away from the EPL Boundary

For SRs further away from the EPL boundary, including SR1 – SR3, and SR12 – SR19, maximum Project impact magnitude over the short-term is expected to be ‘Low’ (2), reversible (1), temporary (1), local (2) and highly probable (4). The resulting impact magnitude is also “**Low**” (24).

For SRs further away from the EPL boundary, including SR1 – SR3, and SR12 – SR19, maximum Project impact magnitude is expected to be ‘Low’ (2), reversible (1), long term (3), local (2) and highly probable (4). The resulting impact magnitude is also “**Moderate**” (32).

8.4.2 Special Mitigation – Sealed Haul Roads – Scenarios 1B – TSF3, 2A – TSF4 and 3A – TSF5

Nearby SRs within the EPL and along EPL Boundary Along the Orange River (SR4 – SR11)

In terms of the EIA impact assessment methodology, the short-term contributions expected for the normal operations of the Project with special mitigation of seal haul roads are expected to be ‘High’ (4) at the nearest SRs. In terms of the EIA impact assessment criteria, the impact is reversible (1), temporary (1), local (2), and the likelihood over the life of the Project is medium (3). The corresponding impact significance is therefore “**Low**” (24).

When considering the long-term averages and long-term impacts, the Project is expected to have a “Moderate” (3) impact magnitude that is reversible (1), medium term (3), local (2) and of medium probability (3). The resulting impact magnitude is also “**Low**” (27).

SRs Located Away from the EPL Boundary

For SRs further away from the EPL boundary, including SR1 – SR3, and SR12 – SR19, maximum Project impact magnitude over the short-term is expected to be ‘Low’ (2), reversible (1), temporary (1), local (2) and of medium probability (3). The resulting impact magnitude is also “**Low**” (18).

When considering the long-term averages and long-term impacts, SRs further away from the EPL boundary, including SR1 – SR3, and SR12 – SR19, the maximum Project impact magnitude is expected to be ‘Low’ (2), reversible (1), long term (3), local (2) and of medium probability (3). The resulting impact magnitude is also “**Low**” (24).

Table 8-1 – Scenario 1A – TSF3, 2A – TSF4 and 3A – TSF5 – Standard Mitigation Scenario

Pollutant	Averaging Period	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
Scenario 1A									
PM_{10}	24-hour	45	49.2	109%	Very High	6.8	56.0	124%	Very High
	Annual	20	11.0	55%	High	3.4	14.4	72%	High
$PM_{2.5}$	24-hour	25	20.2	81%	High	1.7	21.9	88%	High
	Annual	10	4.4	44%	Moderate	0.9	5.2	52%	High
Scenario 2A									
PM_{10}	24-hour	45	48.9	109%	Very High	6.8	55.7	124%	Very High
	Annual	20	11.0	55%	High	3.4	14.4	72%	High
$PM_{2.5}$	24-hour	25	20.2	81%	High	1.7	22.0	88%	High
	Annual	10	4.4	44%	Moderate	0.9	5.2	52%	High
Scenario 3A									
PM_{10}	24-hour	45	48.4	108%	Very High	6.8	55.2	123%	Very High
	Annual	20	11.1	55%	High	3.4	14.5	73%	High
$PM_{2.5}$	24-hour	25	20.3	81%	High	1.7	22.0	88%	High
	Annual	10	4.4	44%	Moderate	0.9	5.3	53%	High

Table 8-2 – Scenario 1B – TSF3, 2B – TSF4 and 3B – TSF5 – Sealed Roads Mitigation Scenarios

Pollutant	EU AAQS (µg/m³)	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
Scenario 1B									
PM_{10}	24-hour	45	24.8	55%	High	6.8	31.6	70%	High
	Annual	20	5.9	30%	Moderate	3.4	9.3	47%	Moderate
$PM_{2.5}$	24-hour	25	9.8	39%	Moderate	1.7	11.6	46%	Moderate
	Annual	10	2.1	21%	Low	0.9	3.0	30%	Moderate
Scenario 2B									
PM_{10}	24-hour	45	23.7	53%	High	6.8	30.5	68%	High
	Annual	20	5.4	27%	Moderate	3.4	8.8	44%	Moderate
$PM_{2.5}$	24-hour	25	9.7	39%	Moderate	1.7	11.4	46%	Moderate
	Annual	10	2.1	21%	Low	0.9	3.0	30%	Moderate
Scenario 3B									
PM_{10}	24-hour	45	23.5	52%	High	6.8	30.4	67%	High
	Annual	20	5.5	27%	Moderate	3.4	8.9	44%	Moderate
$PM_{2.5}$	24-hour	25	9.7	39%	Moderate	1.7	11.4	46%	Moderate
	Annual	10	2.1	21%	Low	0.9	3.0	30%	Moderate

Table 8-3 – Scenario 1A – TSF3 Standard Mitigation – SR Assessment

SR	EU AAQS ($\mu g/m^3$)	Model Result ($\mu g/m^3$)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level ($\mu g/m^3$)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
PM_{10} 24-hour Averaging Period								
SR1	45	2.7	6%	Minor	6.8	9.5	21%	Low
SR2	45	1.4	3%	Minor	6.8	8.2	18%	Low
SR3	45	1.9	4%	Minor	6.8	8.7	19%	Low
SR4	45	21.0	47%	Moderate	6.8	27.8	62%	High
SR5	45	11.3	25%	Moderate	6.8	18.1	40%	Moderate
SR6	45	25.3	56%	High	6.8	32.1	71%	High
SR7	45	49.2	109%	Very High	6.8	56.0	124%	Very High
SR8	45	45.2	100%	Very High	6.8	52.0	116%	Very High
SR9	45	32.5	72%	High	6.8	39.3	87%	High
SR10	45	21.9	49%	Moderate	6.8	28.7	64%	High
SR11	45	7.4	16%	Low	6.8	14.2	31%	Moderate
SR12	45	4.6	10%	Low	6.8	11.4	25%	Moderate
SR13	45	4.3	10%	Minor	6.8	11.1	25%	Low
SR14	45	4.3	10%	Minor	6.8	11.1	25%	Low
SR15	45	3.2	7%	Minor	6.8	10.0	22%	Low
SR16	45	2.6	6%	Minor	6.8	9.4	21%	Low
SR17	45	2.0	5%	Minor	6.8	8.8	20%	Low
SR18	45	4.4	10%	Minor	6.8	11.2	25%	Low
SR19	45	1.3	3%	Minor	6.8	8.1	18%	Low
PM_{10} Annual Averaging Period								
SR1	20	0.4	2%	Low	3.4	3.8	19%	Low
SR2	20	0.3	1%	Low	3.4	3.7	18%	Low
SR3	20	0.3	1%	Low	3.4	3.7	18%	Low
SR4	20	5.0	25%	Low	3.4	8.4	42%	Moderate
SR5	20	3.0	15%	Low	3.4	6.4	32%	Moderate
SR6	20	5.2	26%	Moderate	3.4	8.6	43%	Moderate
SR7	20	11.0	55%	High	3.4	14.4	72%	High
SR8	20	10.0	50%	Moderate	3.4	13.4	67%	High
SR9	20	7.9	39%	Moderate	3.4	11.3	56%	High
SR10	20	4.9	24%	Low	3.4	8.3	41%	Moderate
SR11	20	1.2	6%	Low	3.4	4.6	23%	Low

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR12	20	0.7	4%	Low	3.4	4.1	21%	Low
SR13	20	0.7	4%	Low	3.4	4.1	21%	Low
SR14	20	0.7	4%	Low	3.4	4.1	21%	Low
SR15	20	0.5	3%	Low	3.4	3.9	20%	Low
SR16	20	0.4	2%	Low	3.4	3.8	19%	Low
SR17	20	0.4	2%	Low	3.4	3.8	19%	Low
SR18	20	0.7	4%	Low	3.4	4.1	21%	Low
SR19	20	0.3	2%	Low	3.4	3.7	19%	Low
$PM_{2.5}$ 24-hour Averaging Period								
SR1	25	1.2	5%	Minor	1.7	2.9	12%	Low
SR2	25	0.6	2%	Minor	1.7	2.3	9%	Minor
SR3	25	0.9	4%	Minor	1.7	2.6	10%	Low
SR4	25	8.3	33%	Moderate	1.7	10.0	40%	Moderate
SR5	25	3.7	15%	Low	1.7	5.4	22%	Low
SR6	25	10.8	43%	Moderate	1.7	12.5	50%	Moderate
SR7	25	20.2	81%	High	1.7	21.9	88%	High
SR8	25	18.3	73%	High	1.7	20.0	80%	High
SR9	25	14.1	56%	High	1.7	15.8	63%	High
SR10	25	9.8	39%	Moderate	1.7	11.5	46%	Moderate
SR11	25	3.3	13%	Low	1.7	5.0	20%	Low
SR12	25	2.3	9%	Minor	1.7	4.0	16%	Low
SR13	25	2.2	9%	Minor	1.7	3.9	16%	Low
SR14	25	2.0	8%	Minor	1.7	3.7	15%	Low
SR15	25	1.6	6%	Minor	1.7	3.3	13%	Low
SR16	25	1.2	5%	Minor	1.7	2.9	11%	Low
SR17	25	0.9	4%	Minor	1.7	2.6	10%	Low
SR18	25	1.9	7%	Minor	1.7	3.6	14%	Low
SR19	25	0.4	2%	Minor	1.7	2.1	8%	Minor
$PM_{2.5}$ Annual Averaging Period								
SR1	10	0.2	2%	Low	0.9	1.1	11%	Low
SR2	10	0.1	1%	Low	0.9	1.0	10%	Low
SR3	10	0.1	1%	Low	0.9	1.0	10%	Low
SR4	10	1.8	18%	Low	0.9	2.7	27%	Moderate
SR5	10	1.0	10%	Low	0.9	1.9	19%	Low

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR6	10	2.1	21%	Low	0.9	3.0	30%	Moderate
SR7	10	4.4	44%	Moderate	0.9	5.3	53%	High
SR8	10	4.0	40%	Moderate	0.9	4.9	49%	Moderate
SR9	10	3.2	32%	Moderate	0.9	4.1	41%	Moderate
SR10	10	2.0	20%	Low	0.9	2.9	29%	Moderate
SR11	10	0.5	5%	Low	0.9	1.4	14%	Low
SR12	10	0.3	3%	Low	0.9	1.2	12%	Low
SR13	10	0.3	3%	Low	0.9	1.2	12%	Low
SR14	10	0.3	3%	Low	0.9	1.2	12%	Low
SR15	10	0.3	3%	Low	0.9	1.2	12%	Low
SR16	10	0.2	2%	Low	0.9	1.1	11%	Low
SR17	10	0.2	2%	Low	0.9	1.1	11%	Low
SR18	10	0.3	3%	Low	0.9	1.2	12%	Low
SR19	10	0.1	1%	Low	0.9	1.0	10%	Low

Table 8-4 – Scenario 2A – TSF4 Standard Mitigation – SR Assessment

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
PM_{10} 24-hour Averaging Period								
SR1	45	2.7	6%	Minor	6.8	9.5	21%	Low
SR2	45	1.5	3%	Minor	6.8	8.3	18%	Low
SR3	45	2.1	5%	Minor	6.8	8.9	20%	Low
SR4	45	21.2	47%	Moderate	6.8	28.0	62%	High
SR5	45	13.7	31%	Moderate	6.8	20.5	46%	Moderate
SR6	45	24.8	55%	High	6.8	31.6	70%	High
SR7	45	48.9	109%	Very High	6.8	55.7	124%	Very High
SR8	45	44.7	99%	High	6.8	51.5	114%	Very High
SR9	45	32.7	73%	High	6.8	39.5	88%	High
SR10	45	22.0	49%	Moderate	6.8	28.8	64%	High
SR11	45	7.5	17%	Low	6.8	14.3	32%	Moderate
SR12	45	4.7	10%	Low	6.8	11.5	25%	Moderate
SR13	45	4.3	10%	Minor	6.8	11.1	25%	Low
SR14	45	4.3	10%	Minor	6.8	11.1	25%	Low
SR15	45	3.2	7%	Minor	6.8	10.0	22%	Low
SR16	45	2.7	6%	Minor	6.8	9.5	21%	Low
SR17	45	2.0	5%	Minor	6.8	8.8	20%	Low
SR18	45	4.6	10%	Low	6.8	11.4	25%	Moderate
SR19	45	1.4	3%	Minor	6.8	8.2	18%	Low
PM_{10} Annual Averaging Period								
SR1	20	0.4	2%	Low	3.4	3.8	19%	Low
SR2	20	0.3	1%	Low	3.4	3.7	18%	Low
SR3	20	0.3	1%	Low	3.4	3.7	18%	Low
SR4	20	5.9	30%	Moderate	3.4	9.3	47%	Moderate
SR5	20	3.7	18%	Low	3.4	7.1	35%	Moderate
SR6	20	5.2	26%	Moderate	3.4	8.6	43%	Moderate
SR7	20	11.0	55%	High	3.4	14.4	72%	High
SR8	20	9.9	50%	Moderate	3.4	13.3	67%	High
SR9	20	7.9	40%	Moderate	3.4	11.3	57%	High
SR10	20	5.0	25%	Moderate	3.4	8.4	42%	Moderate
SR11	20	1.4	7%	Low	3.4	4.8	24%	Low
SR12	20	0.8	4%	Low	3.4	4.2	21%	Low

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR13	20	0.8	4%	Low	3.4	4.2	21%	Low
SR14	20	0.8	4%	Low	3.4	4.2	21%	Low
SR15	20	0.6	3%	Low	3.4	4.0	20%	Low
SR16	20	0.4	2%	Low	3.4	3.8	19%	Low
SR17	20	0.4	2%	Low	3.4	3.8	19%	Low
SR18	20	0.8	4%	Low	3.4	4.2	21%	Low
SR19	20	0.3	2%	Low	3.4	3.7	19%	Low
$PM_{2.5}$ 24-hour Averaging Period								
SR1	25	1.2	5%	Minor	1.7	2.9	12%	Low
SR2	25	0.6	2%	Minor	1.7	2.3	9%	Minor
SR3	25	0.9	4%	Minor	1.7	2.6	10%	Low
SR4	25	8.0	32%	Moderate	1.7	9.7	39%	Moderate
SR5	25	4.5	18%	Low	1.7	6.2	25%	Low
SR6	25	10.8	43%	Moderate	1.7	12.5	50%	High
SR7	25	20.2	81%	High	1.7	21.9	88%	High
SR8	25	18.2	73%	High	1.7	19.9	80%	High
SR9	25	14.0	56%	High	1.7	15.7	63%	High
SR10	25	9.7	39%	Moderate	1.7	11.4	46%	Moderate
SR11	25	3.4	13%	Low	1.7	5.1	20%	Low
SR12	25	2.3	9%	Minor	1.7	4.0	16%	Low
SR13	25	2.2	9%	Minor	1.7	3.9	16%	Low
SR14	25	2.0	8%	Minor	1.7	3.7	15%	Low
SR15	25	1.6	6%	Minor	1.7	3.3	13%	Low
SR16	25	1.2	5%	Minor	1.7	2.9	12%	Low
SR17	25	0.9	4%	Minor	1.7	2.6	10%	Low
SR18	25	1.9	8%	Minor	1.7	3.6	15%	Low
SR19	25	0.4	2%	Minor	1.7	2.1	8%	Minor
$PM_{2.5}$ Annual Averaging Period								
SR1	10	0.2	2%	Low	0.9	1.1	11%	Low
SR2	10	0.1	1%	Low	0.9	1.0	10%	Low
SR3	10	0.1	1%	Low	0.9	1.0	10%	Low
SR4	10	2.1	21%	Low	0.9	3.0	30%	Moderate
SR5	10	1.2	12%	Low	0.9	2.1	21%	Low
SR6	10	2.1	21%	Low	0.9	3.0	30%	Moderate

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR7	10	4.4	44%	Moderate	0.9	5.3	53%	High
SR8	10	4.0	40%	Moderate	0.9	4.9	49%	Moderate
SR9	10	3.2	32%	Moderate	0.9	4.1	41%	Moderate
SR10	10	2.1	21%	Low	0.9	3.0	30%	Moderate
SR11	10	0.6	6%	Low	0.9	1.5	15%	Low
SR12	10	0.4	4%	Low	0.9	1.3	13%	Low
SR13	10	0.4	4%	Low	0.9	1.3	13%	Low
SR14	10	0.3	3%	Low	0.9	1.2	12%	Low
SR15	10	0.3	3%	Low	0.9	1.2	12%	Low
SR16	10	0.2	2%	Low	0.9	1.1	11%	Low
SR17	10	0.2	2%	Low	0.9	1.1	11%	Low
SR18	10	0.3	3%	Low	0.9	1.2	12%	Low
SR19	10	0.1	1%	Low	0.9	1.0	10%	Low

Table 8-5 – Scenario 3A – TSF5 Standard Mitigation – SR Assessment

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
PM_{10} 24-hour Averaging Period								
SR1	45	3.0	7%	Minor	6.8	9.8	22%	Low
SR2	45	1.4	3%	Minor	6.8	8.2	18%	Low
SR3	45	2.0	4%	Minor	6.8	8.8	20%	Low
SR4	45	20.3	45%	Moderate	6.8	27.1	60%	High
SR5	45	10.9	24%	Low	6.8	17.7	39%	Moderate
SR6	45	25.5	57%	High	6.8	32.3	72%	High
SR7	45	48.4	108%	Very High	6.8	55.2	123%	Very High
SR8	45	44.6	99%	High	6.8	51.4	114%	Very High
SR9	45	32.8	73%	High	6.8	39.6	88%	High
SR10	45	21.6	48%	Moderate	6.8	28.4	63%	High
SR11	45	7.6	17%	Low	6.8	14.4	32%	Moderate
SR12	45	4.5	10%	Low	6.8	11.3	25%	Moderate
SR13	45	4.5	10%	Minor	6.8	11.3	25%	Moderate
SR14	45	4.4	10%	Minor	6.8	11.2	25%	Low
SR15	45	3.3	7%	Minor	6.8	10.1	22%	Low
SR16	45	2.6	6%	Minor	6.8	9.4	21%	Low
SR17	45	2.2	5%	Minor	6.8	9.0	20%	Low
SR18	45	4.6	10%	Low	6.8	11.4	25%	Moderate
SR19	45	1.4	3%	Minor	6.8	8.2	18%	Low
PM_{10} Annual Averaging Period								
SR1	20	0.4	2%	Low	3.4	3.8	19%	Low
SR2	20	0.3	1%	Low	3.4	3.7	18%	Low
SR3	20	0.3	2%	Low	3.4	3.7	19%	Low
SR4	20	4.9	24%	Low	3.4	8.3	41%	Moderate
SR5	20	2.9	15%	Low	3.4	6.3	32%	Moderate
SR6	20	5.5	28%	Moderate	3.4	8.9	45%	Moderate
SR7	20	11.1	55%	High	3.4	14.5	72%	High
SR8	20	10.1	50%	High	3.4	13.5	67%	High
SR9	20	7.8	39%	Moderate	3.4	11.2	56%	High
SR10	20	4.9	24%	Low	3.4	8.3	41%	Moderate
SR11	20	1.3	6%	Low	3.4	4.7	23%	Low
SR12	20	0.7	4%	Low	3.4	4.1	21%	Low

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR13	20	0.7	4%	Low	3.4	4.1	21%	Low
SR14	20	0.7	4%	Low	3.4	4.1	21%	Low
SR15	20	0.6	3%	Low	3.4	4.0	20%	Low
SR16	20	0.4	2%	Low	3.4	3.8	19%	Low
SR17	20	0.4	2%	Low	3.4	3.8	19%	Low
SR18	20	0.7	4%	Low	3.4	4.1	21%	Low
SR19	20	0.3	2%	Low	3.4	3.7	19%	Low
$PM_{2.5}$ 24-hour Averaging Period								
SR1	25	1.3	5%	Minor	1.7	3.0	12%	Low
SR2	25	0.6	2%	Minor	1.7	2.3	9%	Minor
SR3	25	0.9	4%	Minor	1.7	2.6	10%	Low
SR4	25	7.9	32%	Moderate	1.7	9.6	39%	Moderate
SR5	25	3.6	14%	Low	1.7	5.3	21%	Low
SR6	25	10.9	44%	Moderate	1.7	12.6	51%	High
SR7	25	20.3	81%	High	1.7	22.0	88%	High
SR8	25	18.3	73%	High	1.7	20.0	80%	High
SR9	25	13.9	56%	High	1.7	15.6	62%	High
SR10	25	9.7	39%	Moderate	1.7	11.4	46%	Moderate
SR11	25	3.4	13%	Low	1.7	5.1	20%	Low
SR12	25	2.3	9%	Minor	1.7	4.0	16%	Low
SR13	25	2.2	9%	Minor	1.7	3.9	16%	Low
SR14	25	1.9	8%	Minor	1.7	3.6	15%	Low
SR15	25	1.5	6%	Minor	1.7	3.2	13%	Low
SR16	25	1.2	5%	Minor	1.7	2.9	11%	Low
SR17	25	0.9	4%	Minor	1.7	2.6	10%	Low
SR18	25	1.9	8%	Minor	1.7	3.6	14%	Low
SR19	25	0.4	2%	Minor	1.7	2.1	9%	Minor
$PM_{2.5}$ Annual Averaging Period								
SR1	10	0.2	2%	Low	0.9	1.1	11%	Low
SR2	10	0.1	1%	Low	0.9	1.0	10%	Low
SR3	10	0.2	2%	Low	0.9	1.1	11%	Low
SR4	10	1.8	18%	Low	0.9	2.7	27%	Moderate
SR5	10	1.0	10%	Low	0.9	1.9	19%	Low
SR6	10	2.3	23%	Low	0.9	3.2	32%	Moderate

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR7	10	4.4	44%	Moderate	0.9	5.3	53%	High
SR8	10	4.0	40%	Moderate	0.9	4.9	49%	Moderate
SR9	10	3.2	32%	Moderate	0.9	4.1	41%	Moderate
SR10	10	2.0	20%	Low	0.9	2.9	29%	Moderate
SR11	10	0.6	6%	Low	0.9	1.5	15%	Low
SR12	10	0.3	3%	Low	0.9	1.2	12%	Low
SR13	10	0.3	3%	Low	0.9	1.2	12%	Low
SR14	10	0.3	3%	Low	0.9	1.2	12%	Low
SR15	10	0.3	3%	Low	0.9	1.2	12%	Low
SR16	10	0.2	2%	Low	0.9	1.1	11%	Low
SR17	10	0.2	2%	Low	0.9	1.1	11%	Low
SR18	10	0.3	3%	Low	0.9	1.2	12%	Low
SR19	10	0.1	1%	Low	0.9	1.0	10%	Low

Table 8-6 – Scenario 1B – TSF3 Sealed Haul Roads Mitigation – SR Assessment

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
PM_{10} 24-hour Averaging Period								
SR1	45	1.5	3%	Minor	6.8	8.3	18%	Low
SR2	45	0.8	2%	Minor	6.8	7.6	17%	Low
SR3	45	1.1	2%	Minor	6.8	7.9	17%	Low
SR4	45	10.9	24%	Low	6.8	17.7	39%	Moderate
SR5	45	6.5	14%	Low	6.8	13.3	30%	Moderate
SR6	45	11.6	26%	Moderate	6.8	18.4	41%	Moderate
SR7	45	23.9	53%	High	6.8	30.7	68%	High
SR8	45	21.3	47%	Moderate	6.8	28.1	63%	High
SR9	45	19.2	43%	Moderate	6.8	26.0	58%	High
SR10	45	13.6	30%	Moderate	6.8	20.4	45%	Moderate
SR11	45	4.5	10%	Low	6.8	11.3	25%	Moderate
SR12	45	2.7	6%	Minor	6.8	9.5	21%	Low
SR13	45	2.7	6%	Minor	6.8	9.5	21%	Low
SR14	45	2.4	5%	Minor	6.8	9.2	21%	Low
SR15	45	1.9	4%	Minor	6.8	8.7	19%	Low
SR16	45	1.3	3%	Minor	6.8	8.1	18%	Low
SR17	45	1.1	2%	Minor	6.8	7.9	18%	Low
SR18	45	2.4	5%	Minor	6.8	9.2	20%	Low
SR19	45	0.8	2%	Minor	6.8	7.6	17%	Low
PM_{10} Annual Averaging Period								
SR1	20	0.2	1%	Low	3.4	3.6	18%	Low
SR2	20	0.1	1%	Minor	3.4	3.5	18%	Low
SR3	20	0.1	1%	Minor	3.4	3.5	18%	Low
SR4	20	2.4	12%	Low	3.4	5.8	29%	Moderate
SR5	20	1.8	9%	Low	3.4	5.2	26%	Moderate
SR6	20	2.5	12%	Low	3.4	5.9	29%	Moderate
SR7	20	5.4	27%	Moderate	3.4	8.8	44%	Moderate
SR8	20	4.8	24%	Low	3.4	8.2	41%	Moderate
SR9	20	4.8	24%	Low	3.4	8.2	41%	Moderate
SR10	20	3.0	15%	Low	3.4	6.4	32%	Moderate
SR11	20	0.7	3%	Low	3.4	4.1	20%	Low
SR12	20	0.4	2%	Low	3.4	3.8	19%	Low

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR13	20	0.4	2%	Low	3.4	3.8	19%	Low
SR14	20	0.4	2%	Low	3.4	3.8	19%	Low
SR15	20	0.3	1%	Low	3.4	3.7	18%	Low
SR16	20	0.2	1%	Minor	3.4	3.6	18%	Low
SR17	20	0.2	1%	Minor	3.4	3.6	18%	Low
SR18	20	0.4	2%	Low	3.4	3.8	19%	Low
SR19	20	0.2	1%	Minor	3.4	3.6	18%	Low
$PM_{2.5}$ 24-hour Averaging Period								
SR1	25	0.6	2%	Minor	1.7	2.3	9%	Minor
SR2	25	0.3	1%	Minor	1.7	2.0	8%	Minor
SR3	25	0.5	2%	Minor	1.7	2.2	9%	Minor
SR4	25	3.9	16%	Low	1.7	5.6	22%	Low
SR5	25	2.1	8%	Minor	1.7	3.8	15%	Low
SR6	25	5.2	21%	Low	1.7	6.9	27%	Moderate
SR7	25	9.8	39%	Moderate	1.7	11.5	46%	Moderate
SR8	25	8.6	34%	Moderate	1.7	10.3	41%	Moderate
SR9	25	8.0	32%	Moderate	1.7	9.7	39%	Moderate
SR10	25	5.7	23%	Low	1.7	7.4	30%	Moderate
SR11	25	1.8	7%	Minor	1.7	3.5	14%	Low
SR12	25	1.2	5%	Minor	1.7	2.9	12%	Low
SR13	25	1.2	5%	Minor	1.7	2.9	11%	Low
SR14	25	1.1	4%	Minor	1.7	2.8	11%	Low
SR15	25	0.9	3%	Minor	1.7	2.6	10%	Low
SR16	25	0.6	2%	Minor	1.7	2.3	9%	Minor
SR17	25	0.4	2%	Minor	1.7	2.1	8%	Minor
SR18	25	0.9	4%	Minor	1.7	2.6	11%	Low
SR19	25	0.2	1%	Minor	1.7	1.9	8%	Minor
$PM_{2.5}$ Annual Averaging Period								
SR1	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR2	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR3	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR4	10	0.9	9%	Low	0.9	1.8	18%	Low
SR5	10	0.6	6%	Low	0.9	1.5	15%	Low
SR6	10	1.0	10%	Low	0.9	1.9	19%	Low

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR7	10	2.1	21%	Low	0.9	3.0	30%	Moderate
SR8	10	1.9	19%	Low	0.9	2.8	28%	Moderate
SR9	10	1.9	19%	Low	0.9	2.8	28%	Moderate
SR10	10	1.2	12%	Low	0.9	2.1	21%	Low
SR11	10	0.3	3%	Low	0.9	1.2	12%	Low
SR12	10	0.2	2%	Low	0.9	1.1	11%	Low
SR13	10	0.2	2%	Low	0.9	1.1	11%	Low
SR14	10	0.2	2%	Low	0.9	1.1	11%	Low
SR15	10	0.1	1%	Low	0.9	1.0	10%	Low
SR16	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR17	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR18	10	0.1	1%	Low	0.9	1.0	10%	Low
SR19	10	0.1	1%	Minor	0.9	1.0	10%	Low

Table 8-7 – Scenario 2B – TSF4 Sealed Haul Roads Mitigation – SR Assessment

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
PM_{10} 24-hour Averaging Period								
SR1	45	1.6	4%	Minor	6.8	8.4	19%	Low
SR2	45	0.8	2%	Minor	6.8	7.6	17%	Low
SR3	45	1.1	3%	Minor	6.8	7.9	18%	Low
SR4	45	10.7	24%	Low	6.8	17.5	39%	Moderate
SR5	45	9.1	20%	Low	6.8	15.9	35%	Moderate
SR6	45	11.5	26%	Moderate	6.8	18.3	41%	Moderate
SR7	45	23.7	53%	High	6.8	30.5	68%	High
SR8	45	20.7	46%	Moderate	6.8	27.5	61%	High
SR9	45	19.0	42%	Moderate	6.8	25.8	57%	High
SR10	45	13.5	30%	Moderate	6.8	20.3	45%	Moderate
SR11	45	4.7	10%	Low	6.8	11.5	25%	Moderate
SR12	45	2.8	6%	Minor	6.8	9.6	21%	Low
SR13	45	2.7	6%	Minor	6.8	9.5	21%	Low
SR14	45	2.6	6%	Minor	6.8	9.4	21%	Low
SR15	45	1.9	4%	Minor	6.8	8.7	19%	Low
SR16	45	1.4	3%	Minor	6.8	8.2	18%	Low
SR17	45	1.1	3%	Minor	6.8	7.9	18%	Low
SR18	45	2.5	6%	Minor	6.8	9.3	21%	Low
SR19	45	0.8	2%	Minor	6.8	7.6	17%	Low
PM_{10} Annual Averaging Period								
SR1	20	0.2	1%	Low	3.4	3.6	18%	Low
SR2	20	0.1	1%	Minor	3.4	3.5	18%	Low
SR3	20	0.1	1%	Minor	3.4	3.5	18%	Low
SR4	20	3.4	17%	Low	3.4	6.8	34%	Moderate
SR5	20	2.5	13%	Low	3.4	5.9	30%	Moderate
SR6	20	2.5	12%	Low	3.4	5.9	29%	Moderate
SR7	20	5.4	27%	Moderate	3.4	8.8	44%	Moderate
SR8	20	4.8	24%	Low	3.4	8.2	41%	Moderate
SR9	20	4.9	24%	Low	3.4	8.3	41%	Moderate
SR10	20	3.1	15%	Low	3.4	6.5	32%	Moderate
SR11	20	0.8	4%	Low	3.4	4.2	21%	Low
SR12	20	0.4	2%	Low	3.4	3.8	19%	Low

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR13	20	0.4	2%	Low	3.4	3.8	19%	Low
SR14	20	0.4	2%	Low	3.4	3.8	19%	Low
SR15	20	0.3	2%	Low	3.4	3.7	19%	Low
SR16	20	0.2	1%	Low	3.4	3.6	18%	Low
SR17	20	0.2	1%	Minor	3.4	3.6	18%	Low
SR18	20	0.4	2%	Low	3.4	3.8	19%	Low
SR19	20	0.2	1%	Minor	3.4	3.6	18%	Low
$PM_{2.5}$ 24-hour Averaging Period								
SR1	25	0.6	3%	Minor	1.7	2.3	9%	Minor
SR2	25	0.3	1%	Minor	1.7	2.0	8%	Minor
SR3	25	0.5	2%	Minor	1.7	2.2	9%	Minor
SR4	25	4.0	16%	Low	1.7	5.7	23%	Low
SR5	25	2.9	12%	Low	1.7	4.6	18%	Low
SR6	25	5.0	20%	Low	1.7	6.7	27%	Moderate
SR7	25	9.7	39%	Moderate	1.7	11.4	46%	Moderate
SR8	25	8.6	34%	Moderate	1.7	10.3	41%	Moderate
SR9	25	8.0	32%	Moderate	1.7	9.7	39%	Moderate
SR10	25	5.6	23%	Low	1.7	7.3	29%	Moderate
SR11	25	1.9	8%	Minor	1.7	3.6	15%	Low
SR12	25	1.3	5%	Minor	1.7	3.0	12%	Low
SR13	25	1.2	5%	Minor	1.7	2.9	12%	Low
SR14	25	1.2	5%	Minor	1.7	2.9	11%	Low
SR15	25	0.8	3%	Minor	1.7	2.5	10%	Low
SR16	25	0.6	2%	Minor	1.7	2.3	9%	Minor
SR17	25	0.5	2%	Minor	1.7	2.2	9%	Minor
SR18	25	1.0	4%	Minor	1.7	2.7	11%	Low
SR19	25	0.2	1%	Minor	1.7	1.9	8%	Minor
$PM_{2.5}$ Annual Averaging Period								
SR1	10	0.1	1%	Low	0.9	1.0	10%	Low
SR2	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR3	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR4	10	1.2	12%	Low	0.9	2.1	21%	Low
SR5	10	0.8	8%	Low	0.9	1.7	17%	Low
SR6	10	1.0	10%	Low	0.9	1.9	19%	Low

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR7	10	2.1	21%	Low	0.9	3.0	30%	Moderate
SR8	10	1.9	19%	Low	0.9	2.8	28%	Moderate
SR9	10	1.9	19%	Low	0.9	2.8	28%	Moderate
SR10	10	1.3	13%	Low	0.9	2.2	22%	Low
SR11	10	0.3	3%	Low	0.9	1.2	12%	Low
SR12	10	0.2	2%	Low	0.9	1.1	11%	Low
SR13	10	0.2	2%	Low	0.9	1.1	11%	Low
SR14	10	0.2	2%	Low	0.9	1.1	11%	Low
SR15	10	0.1	1%	Low	0.9	1.0	10%	Low
SR16	10	0.1	1%	Low	0.9	1.0	10%	Low
SR17	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR18	10	0.2	2%	Low	0.9	1.1	11%	Low
SR19	10	0.1	1%	Minor	0.9	1.0	10%	Low

Table 8-8 – Scenario 3B – TSF5 Sealed Haul Roads Mitigation – SR Assessment

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
PM10 24-hour Averaging Period								
SR1	45	1.7	4%	Minor	6.8	8.5	19%	Low
SR2	45	0.8	2%	Minor	6.8	7.6	17%	Low
SR3	45	1.1	2%	Minor	6.8	7.9	17%	Low
SR4	45	9.8	22%	Low	6.8	16.6	37%	Moderate
SR5	45	6.4	14%	Low	6.8	13.2	29%	Moderate
SR6	45	12.1	27%	Moderate	6.8	18.9	42%	Moderate
SR7	45	23.5	52%	High	6.8	30.3	67%	High
SR8	45	21.0	47%	Moderate	6.8	27.8	62%	High
SR9	45	18.9	42%	Moderate	6.8	25.7	57%	High
SR10	45	13.2	29%	Moderate	6.8	20.0	45%	Moderate
SR11	45	4.6	10%	Low	6.8	11.4	25%	Moderate
SR12	45	2.7	6%	Minor	6.8	9.5	21%	Low
SR13	45	2.7	6%	Minor	6.8	9.5	21%	Low
SR14	45	2.4	5%	Minor	6.8	9.2	21%	Low
SR15	45	1.9	4%	Minor	6.8	8.7	19%	Low
SR16	45	1.3	3%	Minor	6.8	8.1	18%	Low
SR17	45	1.2	3%	Minor	6.8	8.0	18%	Low
SR18	45	2.4	5%	Minor	6.8	9.2	21%	Low
SR19	45	0.8	2%	Minor	6.8	7.6	17%	Low
PM10 Annual Averaging Period								
SR1	20	0.2	1%	Low	3.4	3.6	18%	Low
SR2	20	0.1	1%	Minor	3.4	3.5	18%	Low
SR3	20	0.2	1%	Minor	3.4	3.6	18%	Low
SR4	20	2.3	12%	Low	3.4	5.7	29%	Moderate
SR5	20	1.8	9%	Low	3.4	5.2	26%	Moderate
SR6	20	2.8	14%	Low	3.4	6.2	31%	Moderate
SR7	20	5.5	27%	Moderate	3.4	8.9	44%	Moderate
SR8	20	4.9	25%	Low	3.4	8.3	42%	Moderate
SR9	20	4.8	24%	Low	3.4	8.2	41%	Moderate
SR10	20	2.9	15%	Low	3.4	6.3	32%	Moderate
SR11	20	0.7	3%	Low	3.4	4.1	20%	Low
SR12	20	0.4	2%	Low	3.4	3.8	19%	Low

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR13	20	0.4	2%	Low	3.4	3.8	19%	Low
SR14	20	0.4	2%	Low	3.4	3.8	19%	Low
SR15	20	0.3	1%	Low	3.4	3.7	18%	Low
SR16	20	0.2	1%	Low	3.4	3.6	18%	Low
SR17	20	0.2	1%	Minor	3.4	3.6	18%	Low
SR18	20	0.4	2%	Low	3.4	3.8	19%	Low
SR19	20	0.2	1%	Minor	3.4	3.6	18%	Low
$PM_{2.5}$ 24-hour Averaging Period								
SR1	25	0.7	3%	Minor	1.7	2.4	10%	Minor
SR2	25	0.3	1%	Minor	1.7	2.0	8%	Minor
SR3	25	0.5	2%	Minor	1.7	2.2	9%	Minor
SR4	25	3.6	14%	Low	1.7	5.3	21%	Low
SR5	25	2.0	8%	Minor	1.7	3.7	15%	Low
SR6	25	5.2	21%	Low	1.7	6.9	27%	Moderate
SR7	25	9.7	39%	Moderate	1.7	11.4	46%	Moderate
SR8	25	8.6	34%	Moderate	1.7	10.3	41%	Moderate
SR9	25	8.1	33%	Moderate	1.7	9.8	39%	Moderate
SR10	25	5.6	22%	Low	1.7	7.3	29%	Moderate
SR11	25	1.9	7%	Minor	1.7	3.6	14%	Low
SR12	25	1.2	5%	Minor	1.7	2.9	12%	Low
SR13	25	1.2	5%	Minor	1.7	2.9	11%	Low
SR14	25	1.0	4%	Minor	1.7	2.7	11%	Low
SR15	25	0.8	3%	Minor	1.7	2.5	10%	Low
SR16	25	0.6	2%	Minor	1.7	2.3	9%	Minor
SR17	25	0.4	2%	Minor	1.7	2.1	8%	Minor
SR18	25	1.0	4%	Minor	1.7	2.7	11%	Low
SR19	25	0.3	1%	Minor	1.7	2.0	8%	Minor
$PM_{2.5}$ Annual Averaging Period								
SR1	10	0.1	1%	Low	0.9	1.0	10%	Low
SR2	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR3	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR4	10	0.8	8%	Low	0.9	1.7	17%	Low
SR5	10	0.6	6%	Low	0.9	1.5	15%	Low
SR6	10	1.1	11%	Low	0.9	2.0	20%	Low

SR	EU AAQS (µg/m³)	Model Result (µg/m³)	Percentage of Project Standard (%)	Impact Magnitude	Baseline Level (µg/m³)	Cumulative Level	Percentage of Project Standard (%)	Impact Magnitude
SR7	10	2.1	21%	Low	0.9	3.0	30%	Moderate
SR8	10	1.9	19%	Low	0.9	2.8	28%	Moderate
SR9	10	1.9	19%	Low	0.9	2.8	28%	Moderate
SR10	10	1.2	12%	Low	0.9	2.1	21%	Low
SR11	10	0.3	3%	Low	0.9	1.2	12%	Low
SR12	10	0.2	2%	Low	0.9	1.1	11%	Low
SR13	10	0.2	2%	Low	0.9	1.1	11%	Low
SR14	10	0.2	2%	Low	0.9	1.1	11%	Low
SR15	10	0.1	1%	Low	0.9	1.0	10%	Low
SR16	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR17	10	0.1	1%	Minor	0.9	1.0	10%	Low
SR18	10	0.2	2%	Low	0.9	1.1	11%	Low
SR19	10	0.1	1%	Minor	0.9	1.0	10%	Low

Table 8-9 – Assessment of Impact Significance

Impact	Mitigation	Severity / Magnitude (M)	Reversibility (R)	Duration	Spatial Extent	Probability	Significance	Nature of Impact	
								+ / -	D / I / C
Increase in ambient PM levels at SRs within and along the EPL boundary during normal operations due to mining operations related material handling and vehicle movements on un-paved haul roads.	Without Mitigation	4	1	4	2	4	**Moderate (44)**	(-)	D
Increase in ambient PM levels at SRs located outside the EPL boundary (approximately 2 – 3 km away) during normal operations due to mining operations related material handling and vehicle movements on un-paved haul roads.	Without Mitigation	2	1	3	2	4	**Moderate (32)**	(-)	D
Recommendations: The "without mitigation" scenario included standard mitigation measures that will need to be incorporated in the OEMP including: • Watering of haul roads (as an alternative to sealed roads) – 70% emission reduction for 2 litres/m²/h [7] • Water sprays for stockpile loading, unloading and stockpile storage – 50% reduction [7] The special mitigation scenario included sealed roads (see Table 9-1): • Sealed roads – 100% reduction in fugitive emissions anticipated for sealed or salt-encrusted roads [7]									
Operational Phase AQ Impacts Post-Mitigation									
Increase in ambient PM levels at SRs within and along the EPL boundary during normal operations due to mining operations related material handling and vehicle movements on un-paved haul roads.	With Mitigation – Sealed haul roads	3	1	3	2	3	**Low (27)**	(-)	D

Impact	Mitigation	Severity / Magnitude (M)	Reversibility (R)	Duration	Spatial Extent	Probability	Significance	Nature of Impact	
								+ / -	D / I / C
Increase in ambient PM levels at SRs located outside the EPL boundary (approximately 2 – 3 km away) during normal operations due to mining operations related material handling and vehicle movements on un-paved haul roads.	With Mitigation – Sealed haul roads	**2**	**1**	**3**	**2**	**3**	**Low (24)**	**(-)**	**D**

9 Mitigation Measures and Recommendations

9.1 Fugitive Dust Mitigation

According to the International Finance Corporation (IFC) guidelines [12], fugitive dust emissions from the dry surfaces of tailings facilities, waste dumps, stockpiles and other exposed areas should be minimised using the following recommended dust management strategies:

- Dust suppression techniques (e.g., wetting down, use of all-weather surfaces, use of agglomeration additives) for roads and work areas, optimisation of traffic patterns, and reduction of travel speeds;
- Exposed soils and other erodible materials should be revegetated or covered promptly;
- New areas should be cleared and opened-up only when absolutely necessary;
- Surfaces should be re-vegetated or otherwise rendered non-dust forming when inactive;
- Storage for dusty materials should be enclosed or operated with efficient dust suppressing measures;
- Loading, transfer, and discharge of materials should take place with a minimum height of fall, and be shielded against the wind, and consider use of dust suppression spray systems; and,
- Conveyor systems for dusty materials should be covered and equipped with measures for cleaning return belts.

The NPI Emission Estimation Technique Manual for Mining provides potential dust control measures for each of the sources included in the manual. The NPI manual is more detailed, covering the same control measures recommended in the IFC sector guidelines, but providing several control levels or options with varying efficacy for each method, with the approximate percentage reduction in emissions that can be expected when applied effectively. The different potential dust control measures are provided in Table 9-1 below.

Table 9-1 – NPI Dust Control Methods and Factors

Source Type:	Control Method and Factor:
Scrapers on topsoil	50% control when soil is naturally or artificially moist
Dozers on coal or other material	No control
Drilling	99% for fabric filters
	70% for water sprays

Source Type:	Control Method and Factor:
Blasting coal or overburden	No control
Loading trucks	No control
Hauling	50% for level 1 watering (2 litres/m^2/h)
	75% for level 2 watering (> 2 litres/m^2/h)
	100% for sealed or salt-encrusted roads
Unloading trucks	70% for water sprays
Loading stockpiles	50% for water sprays
	25% for variable height stacker
	75% for telescopic chute with water sprays
	99% for total enclosure
Unloading from stockpiles	50% for water sprays
Wind erosion from stockpiles	50% for water sprays
	30% for primary earthworks (reshaping/profiling, drainage structures installed)
	30% for rock armour and/or topsoil applied
Miscellaneous transfer and conveying	90% control allowed for water sprays with chemicals
	70% for enclosure
	99% for enclosure and use of fabric filters
Wind erosion	30% for primary rehabilitation
	40% for vegetation established but not demonstrated to be self-sustaining. Weed control and grazing control.
	60% for secondary rehabilitation
	90% for revegetation
	100% for fully rehabilitated (release) vegetation
Metalliferous Mines	30% for windbreaks
Pit retention	50% for TSP
	5% for PM_{10}

9.2 Recommendations for Additional Monitoring and Testing

The ADM study undertaken for the mine primarily assessed ground-level ambient air concentrations for compliance with applicable air quality standards. Quantification of chemical composition of dust and direct estimation of dust loads to surface water bodies, including the Orange River, do not form part of the standard outcomes of an ADM study.

It is acknowledged that PM emissions from mining activities will result in some degree of atmospheric deposition. Depending on prevailing wind conditions, topography, and proximity to the Orange River, a fraction of emitted particulates may deposit within the broader river catchment area. While dispersion modelling can estimate dustfall rates (if specifically included), it does not determine the chemical composition of deposited material nor directly quantify resulting mass loadings to the aquatic environment without further site-specific analysis.

To address the potential linkage between air emissions and water quality, it is recommended that:

- A dustfall monitoring programme be implemented (if not already in place) at strategically selected locations, including sites between the mining area and the Orange River.
- Chemical analysis of collected dustfall samples be undertaken to characterise constituents of concern (e.g. metals or other site-specific contaminants).
- Where warranted, results be used to perform a screening-level mass loading assessment to estimate potential dust-derived inputs to the Orange River.
- Findings be considered in conjunction with existing surface water monitoring data to evaluate any cumulative or incremental impacts.

10 Conclusion

An air quality impact assessment was undertaken to evaluate the potential impacts associated with the proposed Haib Copper Mine. A qualitative assessment of construction-phase dust impacts was completed in accordance with the UK IAQM guidance for construction sites, and a quantitative operational-phase assessment was conducted using internationally recognised air dispersion modelling software.

10.1 Construction Phase Assessment

During the construction phase, the primary emissions of concern are related to fugitive dust from earthworks, material handling, and vehicle movement. Based on the IAQM risk-based methodology, the overall dust impact risk across all sensitive receptors was determined to be 'Low', resulting in a 'Low' impact significance. Appropriate mitigation measures have been identified, based on the IAQM guidance, which are expected to effectively manage and minimise potential dust impacts.

10.2 Operation Phase Assessment

The ADM assessment was undertaken using AERMOD to evaluate the potential air quality impacts associated with peak mining operations at the proposed Project. The assessment considered three tailings storage facility (TSF) layout scenarios, including TSF3 (Scenario 1A), TSF4 (Scenario 2A), and TSF5 (Scenario 3A), to capture the range of potential impacts under standard mitigation measures. In addition, targeted mitigation scenarios were assessed to quantify the benefit of sealing haul roads, a significant source of fugitive dust emissions.

Under standard operating conditions, the modelling results indicate that the majority of sensitive receptors (SRs) are expected to experience 'Minor' to 'Low' impacts, remaining below applicable air quality limits. Elevated impacts were observed at SRs in closest proximity to the mining infrastructure, to the north within the EPL boundary, and SRs along the Orange River to the south where predicted concentrations ranged from 'Moderate' to 'Very High' relative to EU Ambient Air Quality Standards (AAQS). These locations are in direct proximity to the haul roads and primary material handling zones, where dust emissions are most concentrated.

When additional mitigation of sealing of haul roads was assessed, significant reductions in modelled concentrations were achieved across all SRs. At the most significantly impacted SRs, peak 24-hour PM_{10} concentrations fell below the EU AAQS or were reduced to within the 50% - 100% range, while concentrations at all remaining SRs decreased to levels classified as 'Low' or 'Moderate'.

Overall, the modelling demonstrates that, while enhanced mitigation, particularly the sealing of haul roads results in substantial reductions in predicted particulate matter concentrations and ensures compliance with the applicable EU AAQS, the IFC 25% guideline for new source contributions is not consistently achieved at the closest SRs. As such, SRs located in close proximity to the mining operations, specifically those located along the Orange River to the south, are expected to experience persistent 'Moderate' air quality impacts over the long term should these receptors be permanent and / or remain in place. Nevertheless, the impacts are localised, with the majority of assessed SRs experiencing ‘Low’ or ‘Minor’ impacts, indicating that air quality effects are spatially constrained and primarily driven by proximity to mining activities. Continued application of best practice dust control measures, together with consideration of land-use planning and receptor management near the Project footprint, will be critical in managing long-term air quality risks.

10.3 Closure / Decommissioning

Dust generation and vehicle-related emissions associated with the closure and decommissioning phase are expected to be broadly comparable to those assessed for the construction phase, as activities will similarly involve earthworks, demolition, material handling, and associated vehicle movement. As such, the nature, magnitude, and spatial extent of impacts are anticipated to align with those identified for construction.

11 References

[1] The European Parliament, "Directive 2024/2881 of The European Parliament and of the Eurpean Parliament and the Council of 23 October 2024 on Ambient Air Quality And Cleaner Air For Europe (recast)," The European Parliament, 2024.

[2] World Bank Group (WBG), "International Finance Corporation (IFC, Environmental, Health, and Safety Guidelines, Air Emissions And Ambient Air Quality," IFC, 2007.

[3] World Health Organisation (WHO), "WHO global air quality guidelines," WHO, 2021.

[4] Environment Agency and Department for Environment, Food & Rural Affairs (DEFRA), *Guidance - Air emissions risk assessment for your environmental permit,* DEFRA, 2025.

[5] Turnkey Instruments Ltd, *Topaz & Osiris Environmental Monitoring Training Manual,* Northwich: Turnkey Instruments Ltd.

[6] US EPA, "11.9 Western Surface Coal Mining," 1998.

[7] NPI, "Emission estimation technique manual for Mining Version 3.1.," 2012.

[8] US EPA, "13.2.1 Paved Roads," 2011.

[9] US EPA, "13.2.2 Unpaved Roads," 2006.

[10] US EPA, "13.2.4 Aggregate Handling And Storage Piles," 2006.

[11] Institute of Air Quality Management, "Guidance on the assessment of dust from demolition and construction," IAQM, 2024.

[12] World Bank Group, "Environmental, Health, and Safety Guidelines for Mining," International Financial Corporation, 2007.

Appendix A – KP Impact Assessment Criteria

Table A- 1 – Nature of Impact

Term	Definition
Positive (+)	An impact that is considered to represent an improvement on the baseline or introduces a positive change.
Negative (-)	An impact that is considered to represent an adverse change from the baseline or introduces a new undesirable factor.
Direct impact (D)	Impacts that result from a direct interaction between a planned project activity and the receiving environment/receptors (e.g. between occupation of a site and the pre-existing habitats or between an effluent discharge and receiving water quality).
Indirect impact (I)	Impacts that result from other activities that are encouraged to happen as a consequence of the Project (e.g. in-migration for employment placing a demand on resources).
Cumulative impact (C)	Impacts that act together with other impacts (including those from concurrent or planned future third party activities) to affect the same resources and/or receptors as the Project.

Table A- 2 – Ranking Criteria

Severity / magnitude (M)	Reversibility (R)	Duration (D)	Spatial extent (S)	Probability (P)
5 – Very high – The impact causes the characteristics of the receiving environment/ social receptor to be altered by a factor of 80 – 100 %	**5 – Irreversible** – *Environmental* - where natural functions or ecological processes are altered to the extent that it will permanently cease. *Social* - Those affected will not be able to adapt to changes and continue to maintain-pre impact livelihoods.	**5 – Permanent** - Impacts that cause a permanent change in the affected receptor or resource (e.g. removal or destruction of ecological habitat) that endures substantially beyond the Project lifetime.	**5 – International** - Impacts that affect internationally important resources such as areas protected by international conventions, international waters etc.	**5 – Definite** - The impact will occur.
4 – High – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 60 – 80 %		**4 – Long term** - impacts that will continue for the life of the Project, but ceases when the Project stops operating.	**4 – National** - Impacts that affect nationally important environmental resources or affect an area that is nationally important/ or have macro-economic consequences.	**4 – High probability** – 80% likelihood that the impact will occur
3 – Moderate – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 40 – 60 %	**3 – Recoverable** *Environmental* - where the affected environment is altered but natural functions and ecological processes may continue or recover with human input. *Social* - Able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support or intervention.	**3 – Medium term** - Impacts are predicted to be of medium duration (5 – 15 years)	**3 – Regional** - Impacts that affect regionally important environmental resources or are experienced at a regional scale as determined by administrative boundaries, habitat type/ecosystem.	**3 – Medium probability** – 60% likelihood that the impact will occur
2 – Low – The impact alters the characteristics of the receiving environment/ social receptor by a factor of 20 – 40 %		**2 – Short term** - Impacts are predicted to be of short duration (0 – 5 years)	**2 – Local** - Impacts that affect an area in a radius of 2 km around the site.	**2 – Low probability** - 40% likelihood that the impact will occur
1 – Minor – The impact causes very little change to the characteristics of the receiving environment/ social receptor and the alteration is less than 20 %	**1 – Reversible** *Environmental* - The impact affects the environment in such a way that natural functions and ecological processes are able to regenerate naturally. *Social* - People/ communities are able to adapt with relative ease and maintain pre-impact livelihoods.	**1 – Temporary** - Impacts are predicted to intermittent/ occasional over a short period.	**1 – Site only** - Impacts that are limited to the site boundaries.	**1 – Improbable** - 20% likelihood that the impact will occur

Table A- 3 – Impact Significance

Score According to Impact Assessment Matrix	Colour Scale Ratings	
	Negative Ratings	Positive Ratings
Between 0 and 29 significance points indicate **Low Significance**	**Low**	**Low**
Between 30 and 59 significance points indicate **Moderate Significance**	**Moderate**	**Moderate**
60 to 100 significance points indicate **High Significance**	**High**	**High**
Significance = Consequence (Severity + Reversibility + Duration + Spatial Scale) x Probability		

Appendix B – Emissions Inventory

Table B- 1 – Operations Phase - Air Emissions Inventory

Operation / Activity	Parameter	Description of Parameter	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Units	Reference / Comment
Dust Emissions from In-Pit and ROM Operations						
Blasting	Blasting		US EPA AP-42: CHAPTER 11.9 Western Surface Coal Mining			
	Input:	A - horizontal area (m^2), with blasting depth < 21 m. Not for vertical face of a bench.	100	100	m^2	
	Emission Rate:	EF	0.11	0.01	kg/blast	
	Input:	Scaling for number of blasts over the total area	0.29	0.29	No. blasts/ day	2 blasts per week
	Emission Rate:	Unmitigated	3.74E-04	2.16E-05	g/s	
Bulldozing – in pit	Bulldozing		US EPA AP-42: CHAPTER 11.9 Western Surface Coal Mining - Bulldozing Overburden			
	Input:	M - Material Moisture Content (%)	5.0	5.0	%	
	Input:	s - Material silt content (%)	8.6	8.6	%	Assumed from US EPA Ch11.9, table 11.9-3
	Emission Rate:	Unmitigated	0.25	0.12	g/s	
	Emission Rate:	Mitigated	0.12	0.06	g/s	NPI mitigation measures for scraping of topsoil, 50% reduction for moist material
Grading – in pit	Grading		US EPA AP-42: CHAPTER 11.9 Western Surface Coal Mining - Grading			
	Input:	S - mean vehicle speed (km/hr)	11.4	11.4	km/hr	CAT 18M. Speed assumed based US EPA Ch119, Table 11.9-3
	Input:	Distance travelled by vehicle	98,770	98,770	km/year	Assumption based on operating hours in one year for the mine
	Emission Rate:	Unmitigated	1.38	0.15	g/s	
	Emission Rate:	Mitigated	0.69	0.07	g/s	NPI mitigation measures for scraping of topsoil, 50% reduction for moist material
Loading Ore	Transfer Point - Loading Ore onto Trucks		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	1.48	0.22	g/s	
	Emission Rate:	Mitigated	0.74	0.11	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Wind Erosion of pit	Wind erosion		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			
	Emission Rate:	EF	5.56E-06	1.67E-06	g/m^{2}s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD
	Emission Rate:	Mitigated	5.28E-06	1.58E-06	g/m^{2}s	NPI mitigation measures for pit retention, 5% reduction
Wind Erosion of TSF	Wind erosion		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			
	Emission Rate:	EF	1.11E-06	3.33E-07	g/m^{2}s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD. 20% of the total area will experience erosion based on the TSF uncovered area
Hauling in pit	Vehicles travelling on unpaved roads to ROM area		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			
	Input:	Material to be transferred	120,000,000	-	kg/year	
	Input:	Truck Traffic	500,000	-	trips/year	Truck is 793 CAT, with 240 t nominal payload). Trip = 1 return trip
	Input:	Length of road	2.17	-	km	Length of haul route, one way trip
	Emission Rate:	Unmitigated	86.9	26.1	g/s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD
	Emission Rate:	Mitigated	20.6	6.2	g/s	NPI mitigation measures for pit retention (5% reduction) and water sprays on pit roads (75% reduction for > 2 litres/m2/h)
Hauling from pit to ROM	Vehicles travelling on unpaved roads to ROM area		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			

Operation / Activity	Parameter	Description of Parameter	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Units	Reference / Comment
	Input:	Material to be transferred	35,000,000	-	kg/year	
	Input:	Truck Traffic	145,833	--	trips/year	Truck is 793 CAT, with 240 t nominal payload). Trip = 1 return trip
	Input:	Length of road	0.91	-	km	Length of haul route, one way trip
	Emission Rate:	Unmitigated	10.6	3.2	g/s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD
	Emission Rate:	Mitigated	2.7	0.80	g/s	NPI mitigation measures for water sprays on roads (75% reduction for > 2 litres/m2/h)
Dumping Ore at ROM	Transfer Point - Dumping Ore at ROM		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Dumping in Crusher at ROM	Transfer Point - Dumping Ore into ROM Crusher		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Crusher 1 at ROM	Crusher 1		US EPA AP-42: CHAPTER 11.24 Metallic Minerals Processing			
	Input:	Ore Throughout (tonnes/s)	0.052	-	t/s	Based on 6,044 crusher operational hours a year for total ore throughput
	Emission Rate:	Unmitigated	0.206	0.062	g/s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD
Transfer from Crusher to Stockpile	Transfer Point - Transfer ore to crushed ore stockpile		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Wind Erosion of crushed ore stockpile	Wind erosion		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			
	Emission Rate:	EF	2.78E-06	8.33E-07	g/m^2s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD. 50% reduction from water sprays
Loading Conveyor	Transfer Point - Loading Conveyor		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Transfer from Conveyor to stockpile at Crusher 2	Transfer Point - Transfer ore to stockpile at conveyor area		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Wind Erosion of ROM area	Wind erosion - ROM area		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			
	Emission Rate:	EF	4.17E-06	1.25E-06	g/m^2s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD. 25% of the total area will experience erosion based on average size of uncovered area
Dust Emissions from Concentrator and Transportation						
	Wind erosion - Crusher 2 Stockpile		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			

Operation / Activity	Parameter	Description of Parameter	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Units	Reference / Comment
Wind Erosion of stockpile at crusher 2	Emission Rate:	EF	2.78E-06	8.33E-07	g/m²s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD. 50% reduction from water sprays
Dumping in Secondary Crusher	Transfer Point - Dumping Ore into Secondary Crusher		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Secondary Crusher at Concentrator	Secondary Crusher		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 3			
	Input:	Ore Throughout (tonnes/s)	0.052	-	t/s	Based on 6,044 crusher operational hours a year for total ore throughput
	Emission Rate:	Unmitigated	0.62	0.19	g/s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD
Transfer from Secondary Crusher to HPRG Stockpile	Transfer Point - Transfer ore to crushed ore stockpile		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Wind Erosion of crushed ore stockpile at Concentrator	Wind erosion		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			
	Emission Rate:	EF	2.78E-06	8.33E-07	g/m²s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD. 50% reduction from water sprays
Dumping on conveyor	Transfer Point - Dumping Ore onto conveyor		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Loading HPRG from conveyor	Transfer Point - Dumping Ore into HPRG		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
HPRG Crusher at Concentrator	HPRG Crusher		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 3			
	Input:	Ore Throughout (tonnes/s)	0.052	-	t/s	Based on 6044 crusher operational hours a year for total ore throughput
	Emission Rate:	Unmitigated	0.52	0.15	g/s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD
Transfer from HPRG Crusher to conveyor	Transfer Point - Transfer ore to conveyor		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Transfer from conveyor to M/F stockpile	Transfer Point - Transfer ore from conveyor to stockpile		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.43	0.07	g/s	
	Emission Rate:	Mitigated	0.22	0.03	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
	Wind erosion		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			

Operation / Activity	Parameter	Description of Parameter	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Units	Reference / Comment
Wind Erosion of Mill Feed crushed ore stockpile	Emission Rate:	EF	2.78E-06	8.33E-07	g/m^{2}s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD. 50% reduction from water sprays
Loading Ore into Trucks for Heap Leaching	Transfer Point - Loading Ore onto Trucks		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.09	0.01	g/s	
	Emission Rate:	Mitigated	0.04	0.007	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Hauling from Concentrator to Heap Leaching	Vehicles travelling on unpaved roads to Heap Leaching area		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			
	Input:	Material to be transferred	7,000,000	-	kg/year	
	Input:	Truck Traffic	29,167	-	trips/year	Truck is 793 CAT, with 240 t nominal payload). Trip = 1 return trip
	Input:	Length of road	19.4	-	km	Length of haul route, one way trip
	Emission Rate:	Unmitigated	45.4	13.6	g/s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD
	Emission Rate:	Mitigated	11.4	3.4	g/s	NPI mitigation measures for water sprays on roads (75% reduction for > 2 litres/m2/h)
Transfer from truck to Heap Leaching area	Transfer Point - Transfer ore to heap leach		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	0.09	0.01	g/s	
	Emission Rate:	Mitigated	0.04	0.007	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Grading – Heap Leaching area	Grading - movement of material at Heap Leaching area		US EPA AP-42: CHAPTER 11.9 Western Surface Coal Mining - Grading			
	Input:	S - mean vehicle speed (km/hr)	11.4	11.4	km/hr	CAT 18M. Speed assumed based US EPA Ch119, Table 11.9-3
	Input:	Distance travelled by vehicle	98,770	98,770	km/year	Assumption based on operating hours in one year for the mine
	Emission Rate:	Unmitigated	1.38	0.15	g/s	
	Emission Rate:	Mitigated	0.69	0.07	g/s	NPI mitigation measures for scraping of topsoil, 50% reduction for moist material
Dust Emissions from WRD and Haul Operations						
Loading Waste Rock in Pit	Transfer Point - Loading WR onto Trucks in pit		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	1.15	0.17	g/s	
	Emission Rate:	Mitigated	0.58	0.087	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Hauling from pit to WRD3	Vehicles travelling on unpaved roads to ROM area		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			
	Input:	Material to be transferred	46,651,835	-	kg/year	Half of total waste rock transported and stored at WRD3
	Input:	Truck Traffic	194,383	-	trips/year	Truck is 793 CAT, with 240 t nominal payload). Trip = 1 return trip
	Input:	Length of road	2.94	-	km	Length of haul route, one way trip
	Emission Rate:	Unmitigated	45.9	13.8	g/s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD
	Emission Rate:	Mitigated	11.5	34	g/s	NPI mitigation measures for water sprays on roads (75% reduction for > 2 litres/m2/h)
Hauling from pit to WRD1	Vehicles travelling on unpaved roads to ROM area		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			
	Input:	Material to be transferred	46,651,835	-	kg/year	Half of total waste rock transported and stored at WRD1
	Input:	Truck Traffic	194,383	-	trips/year	Truck is 793 CAT, with 240 t nominal payload). Trip = 1 return trip
	Input:	Length of road	3.41	-	km	Length of haul route, one way trip

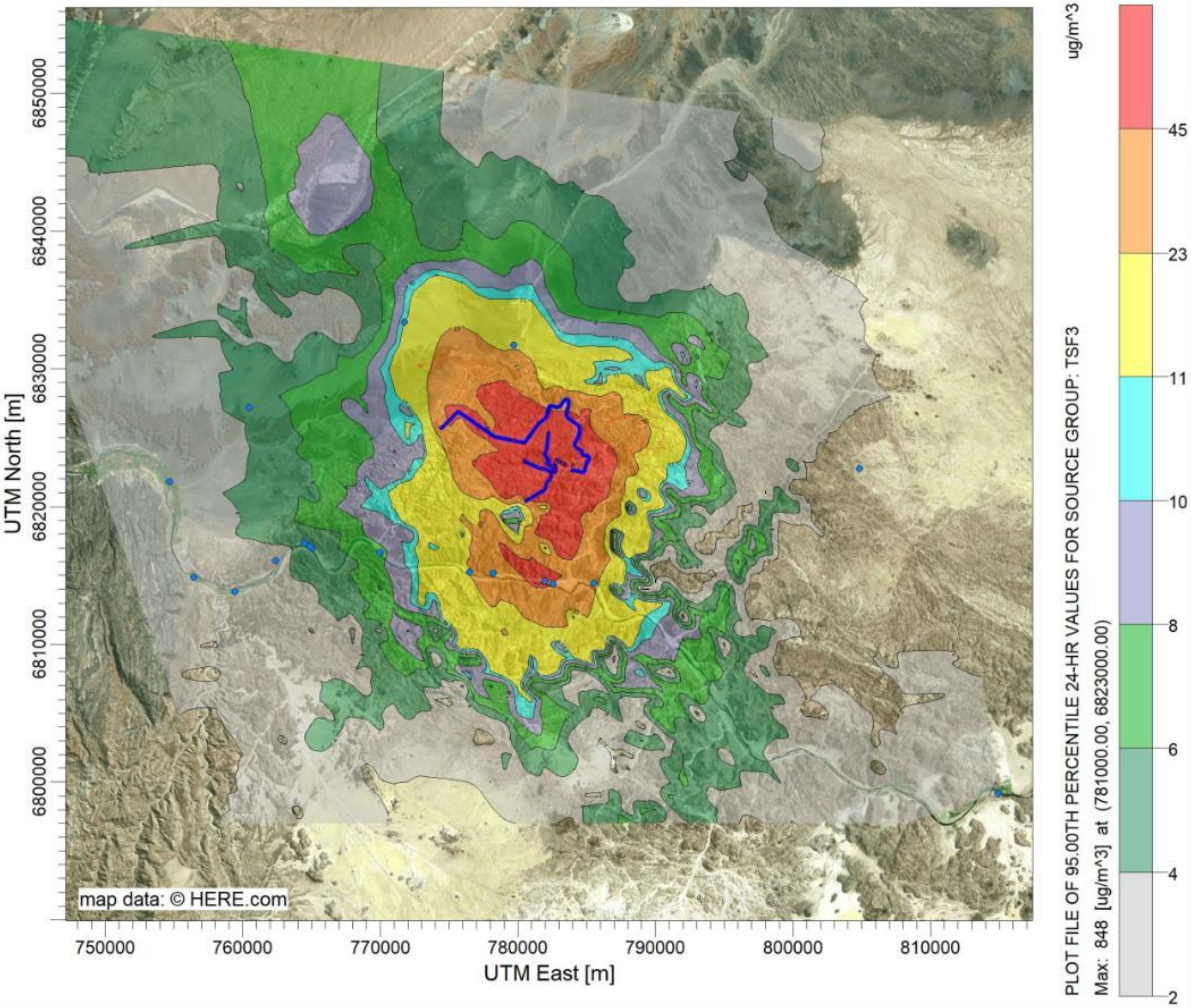
Operation / Activity	Parameter	Description of Parameter	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Units	Reference / Comment
	Emission Rate:	Unmitigated	53.1	15.9	g/s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD
	Emission Rate:	Mitigated	13.3	4.0	g/s	NPI mitigation measures for water sprays on roads (75% reduction for > 2 litres/m2/h)
Dumping WR at WRD	Transfer Point - Dumping Waste Rock at WRD		US EPA AP-42: Chapter 13.2.4 Aggregate Handling and Storage Piles			
	Input:	Wind Speed (m/s)	4.42	4.42	m/s	Average wind speed from meteorological data
	Emission Rate:	Unmitigated	1.15	0.17	g/s	
	Emission Rate:	Mitigated	0.58	0.087	g/s	NPI mitigation measures for loading stockpiles, 50% reduction for water sprays
Bulldozing – material movement at WRD	Bulldozing		US EPA AP-42: CHAPTER 11.9 Western Surface Coal Mining - Bulldozing Overburden			
	Input:	M - Material Moisture Content (%)	5.0	5.0	%	
	Input:	s - Material silt content (%)	8.6	8.6	%	Assumed from US EPA Ch11.9, table 11.9-3
	Emission Rate:	Unmitigated	0.25	0.12	g/s	
	Emission Rate:	Mitigated	0.12	0.06	g/s	NPI mitigation measures for scraping of topsoil, 50% reduction for moist material
Grading – material movement at WRD	Grading		US EPA AP-42: CHAPTER 11.9 Western Surface Coal Mining - Grading			
	Input:	S - mean vehicle speed (km/hr)	11.4	11.4	km/hr	CAT 18M. Speed assumed based US EPA Ch119, Table 11.9-3
	Input:	Distance travelled by vehicle	98,770	98,770	km/year	Assumption based on operating hours in one year for the mine
	Emission Rate:	Unmitigated	1.38	0.15	g/s	
	Emission Rate:	Mitigated	0.69	0.07	g/s	NPI mitigation measures for scraping of topsoil, 50% reduction for moist material
Wind Erosion of stockpile	Wind erosion		NPI EMISSION ESTIMATION TECHNIQUE MANUAL for mining, version 3.1, January 2012, Table 2			
	Emission Rate:	EF	2.78E-06	8.33E-07	g/m^2s	30% average ratio of PM2.5 to PM10, based on US EPA and consistent with PSD. 50% reduction from water sprays

Appendix C – Selected Isopleths

PROJECT TITLE:

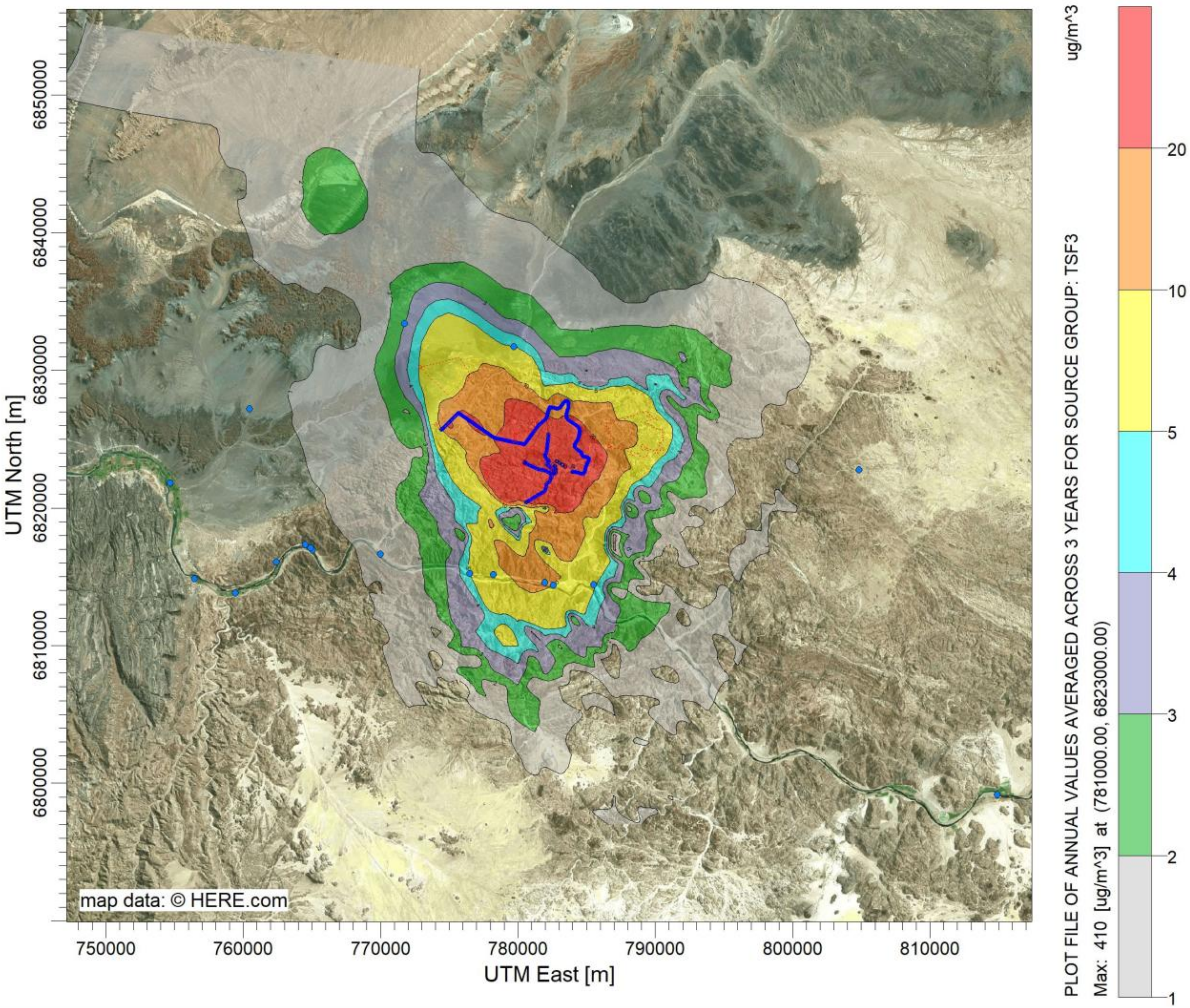
J-SAF-50862 Haib Copper Project

Scenario 1A - PM10 24-hour Averaging Period Isopleth



PROJECT TITLE:

J-SAF-50862 Haib Copper Project
Scenario 1A - PM10 Annual Averaging Period Isopleth



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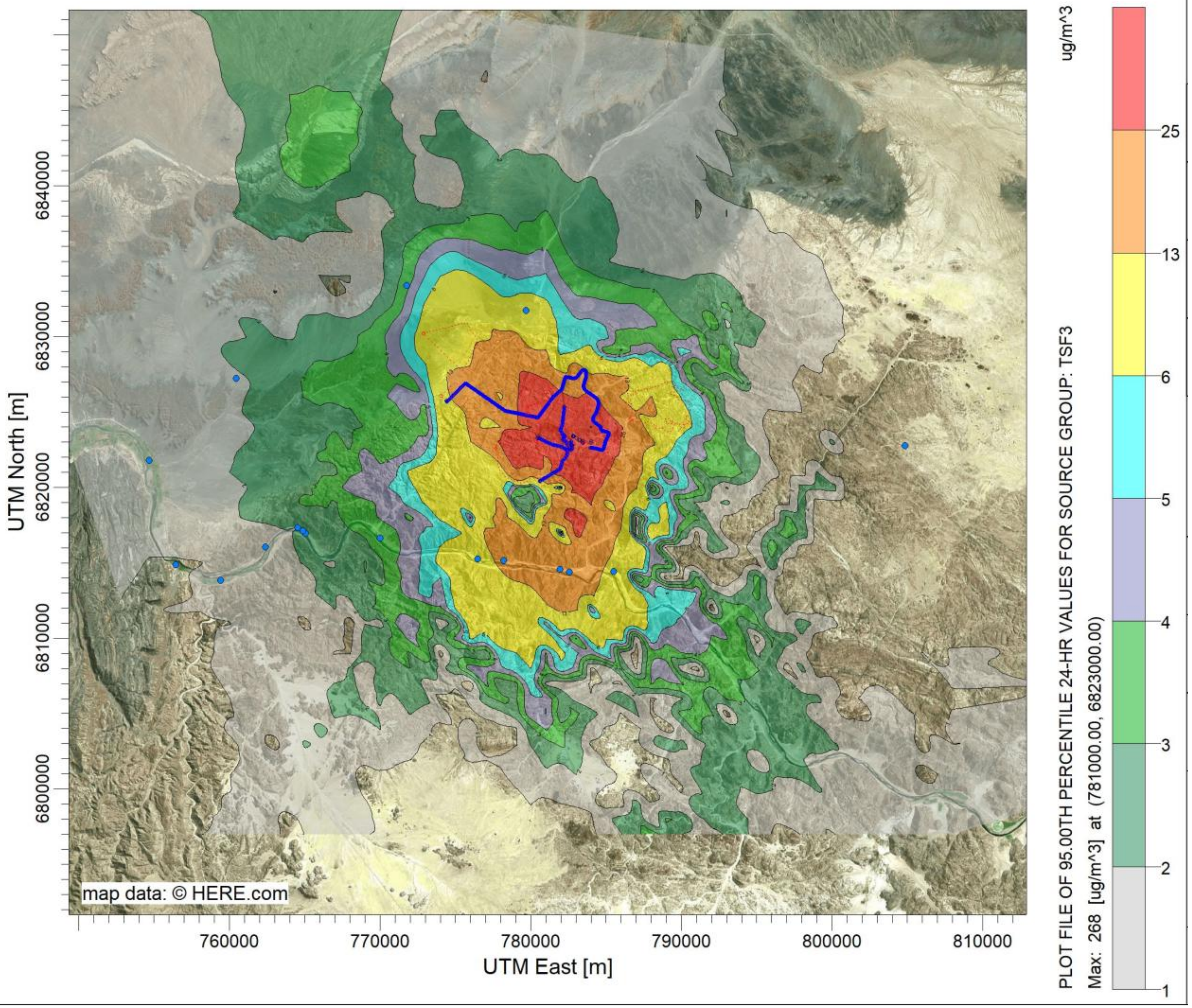
J-SAF-50862 Haib Copper Project
Scenario 1A - PM2.5 24-hour Averaging Period Isopleth



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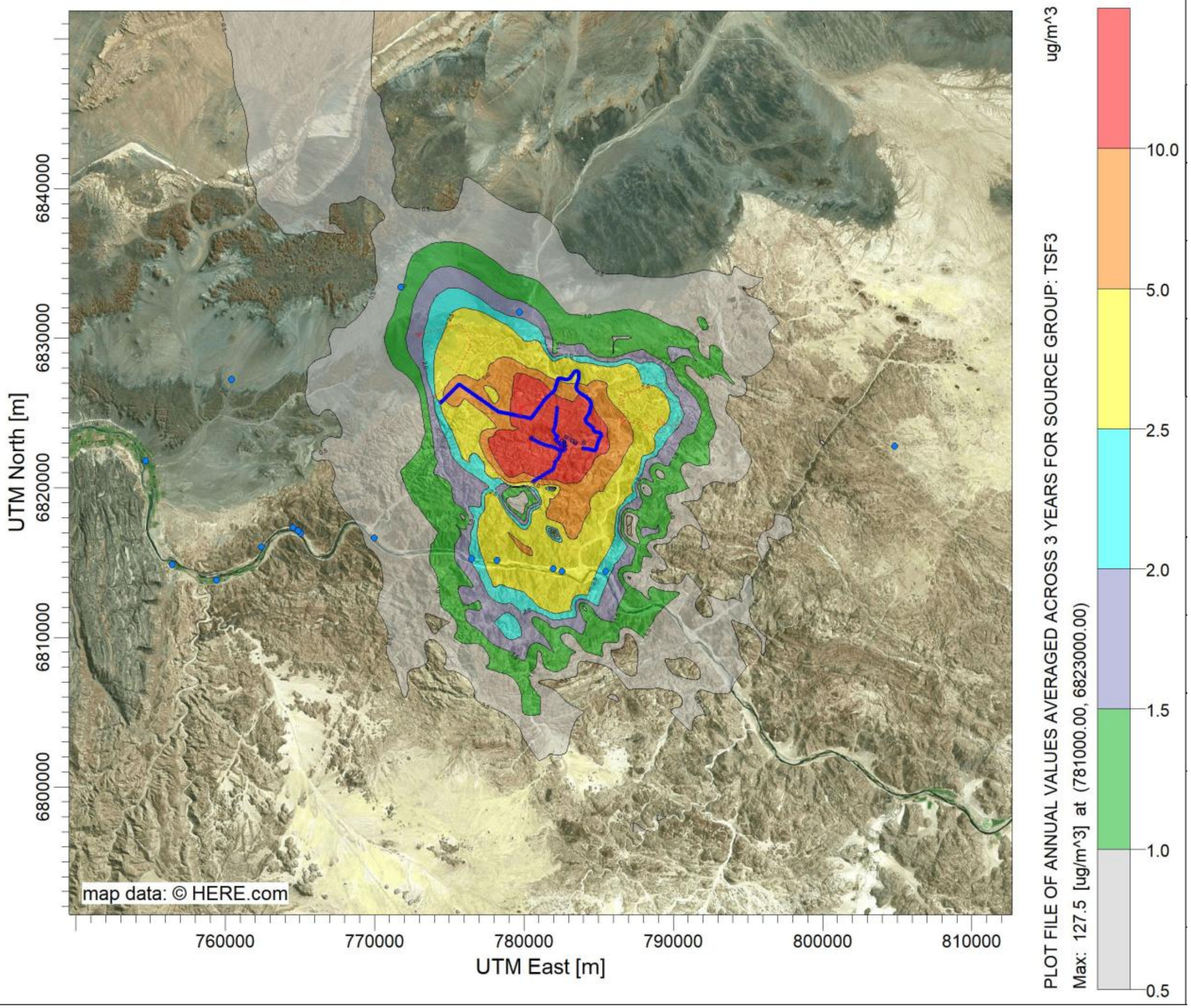
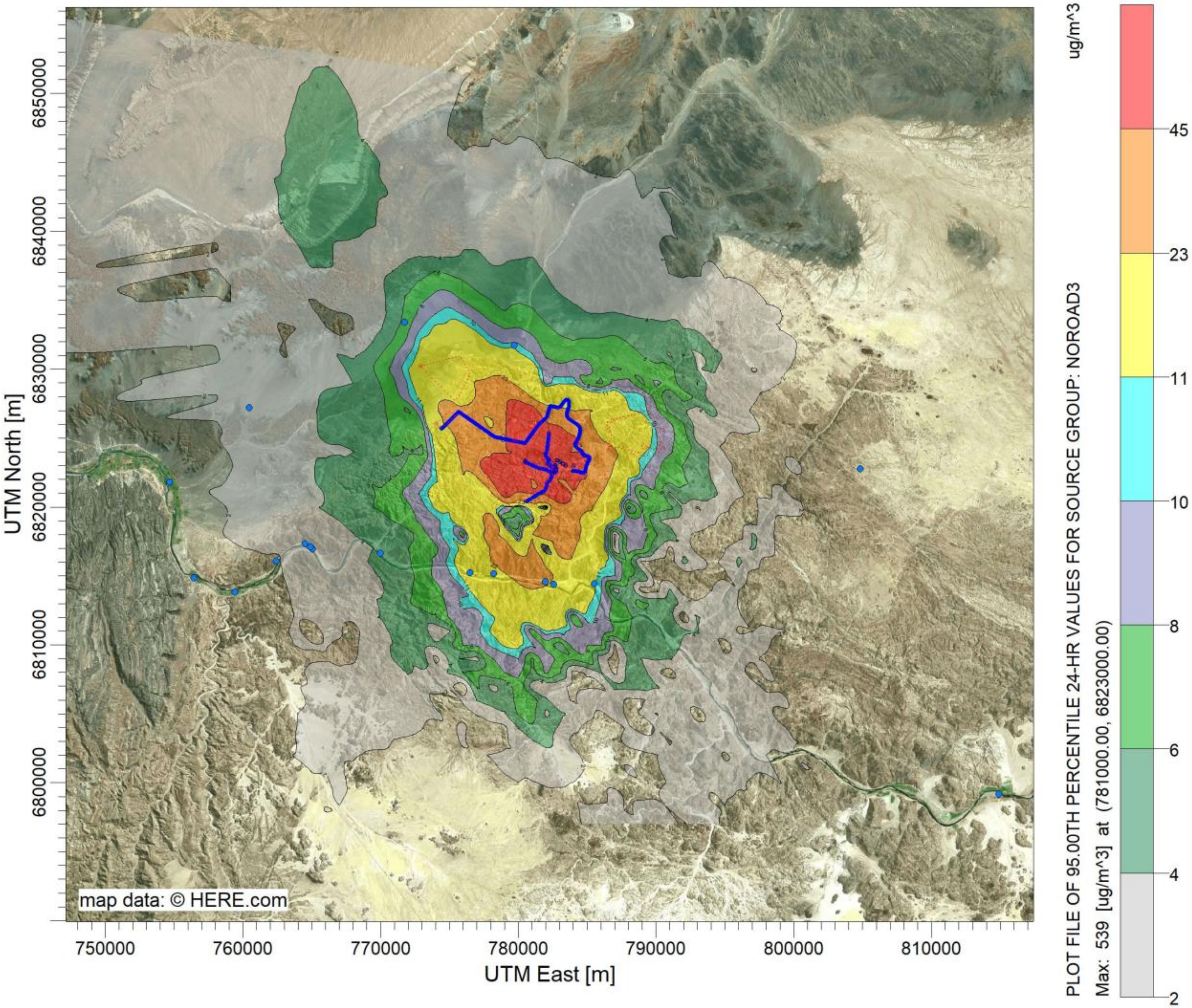


PROJECT TITLE:

J-SAF-50862 Haib Copper Project

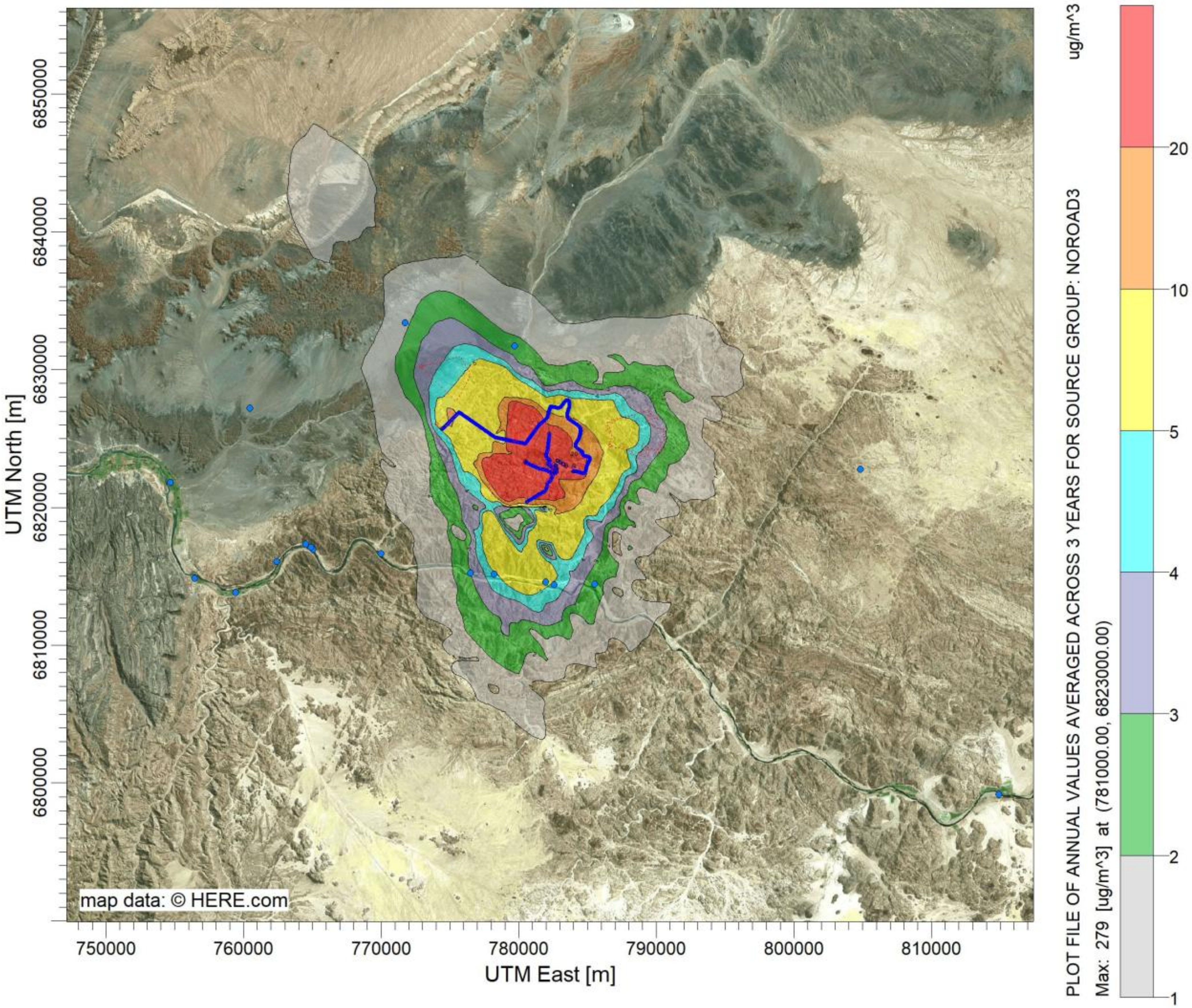
Scenario 1B - PM10 24-hour Averaging Period Isopleth



PROJECT TITLE:

J-SAF-50862 Haib Copper Project

Scenario 1B - PM10 Annual Averaging Period Isopleth



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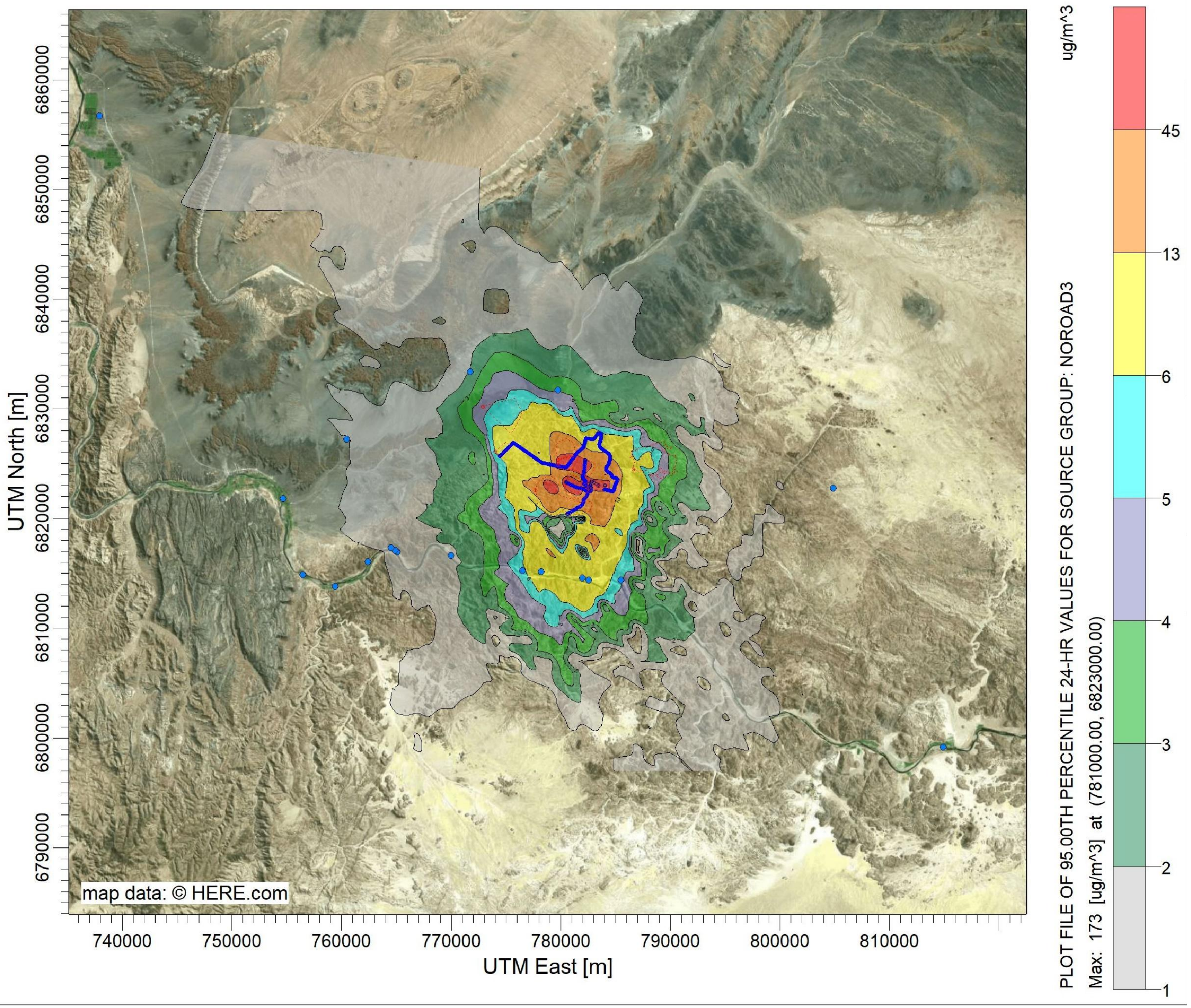
Scenario 1B - PM2.5 24-hour Averaging Period Isopleth



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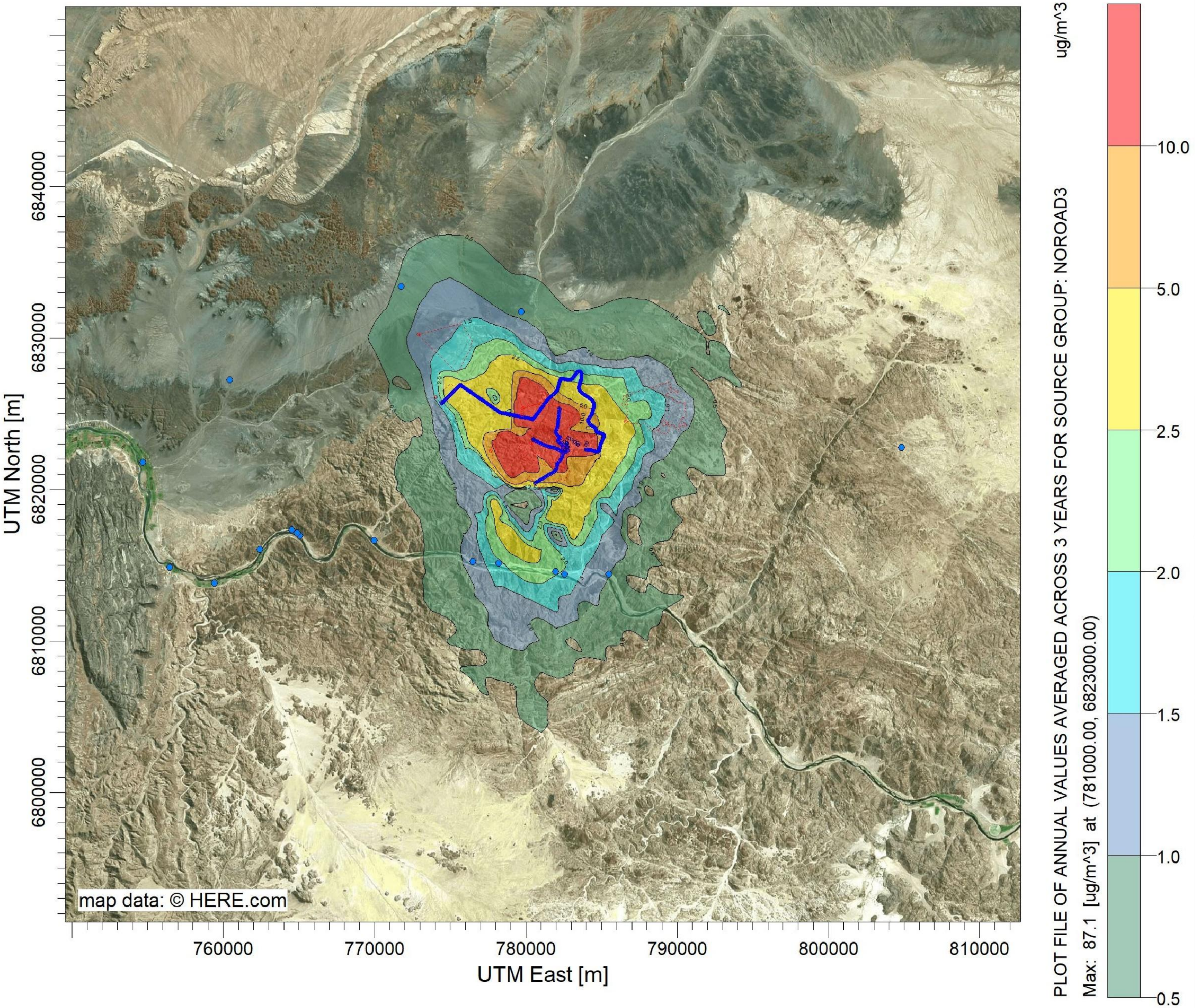
J-SAF-50862 Haib Copper Project
Scenario 1B - PM2.5 Annual Averaging Period Isopleth



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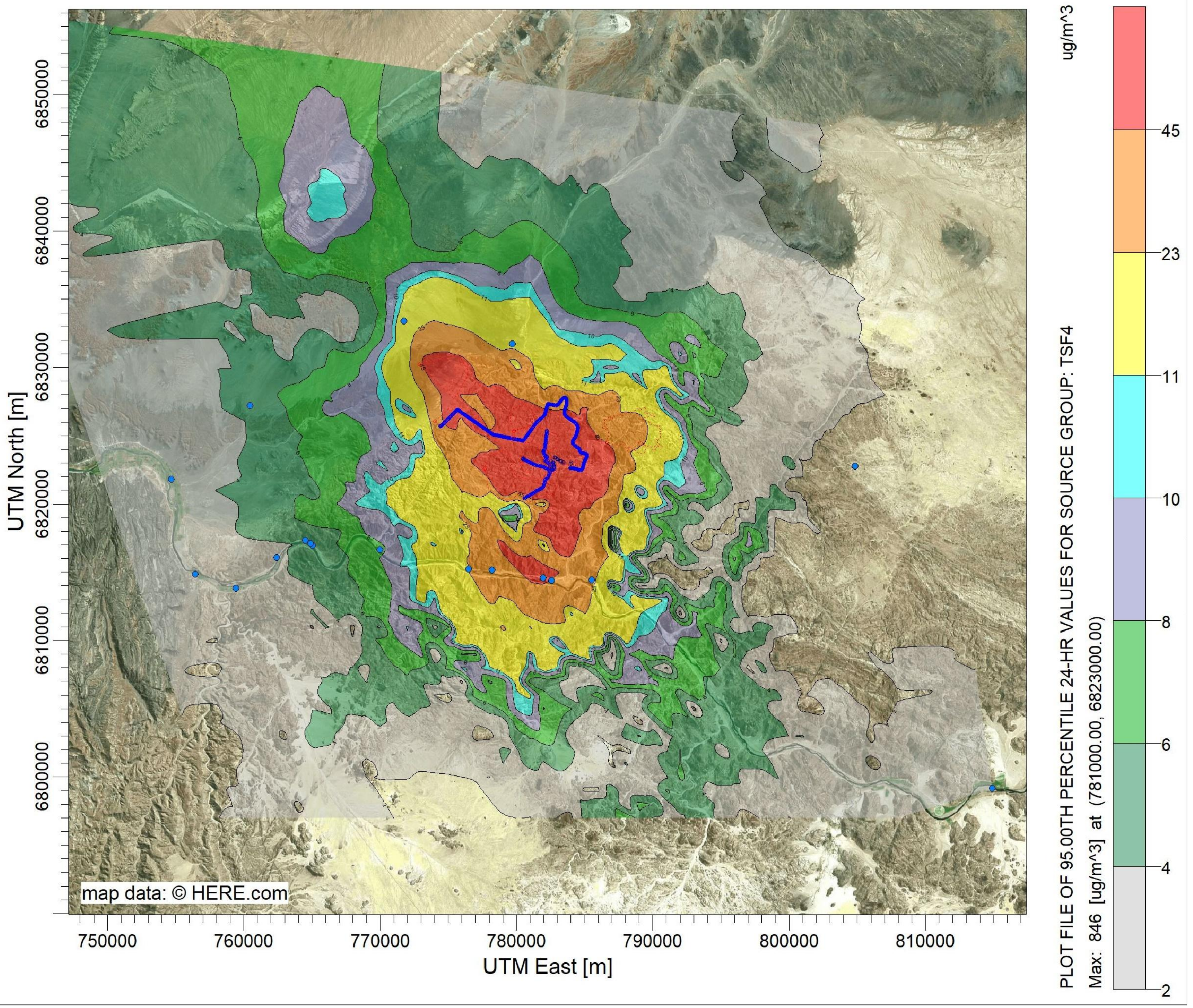
J-SAF-50862 Haib Copper Project
Scenario 2A - PM10 24-hour Averaging Period Isopleth



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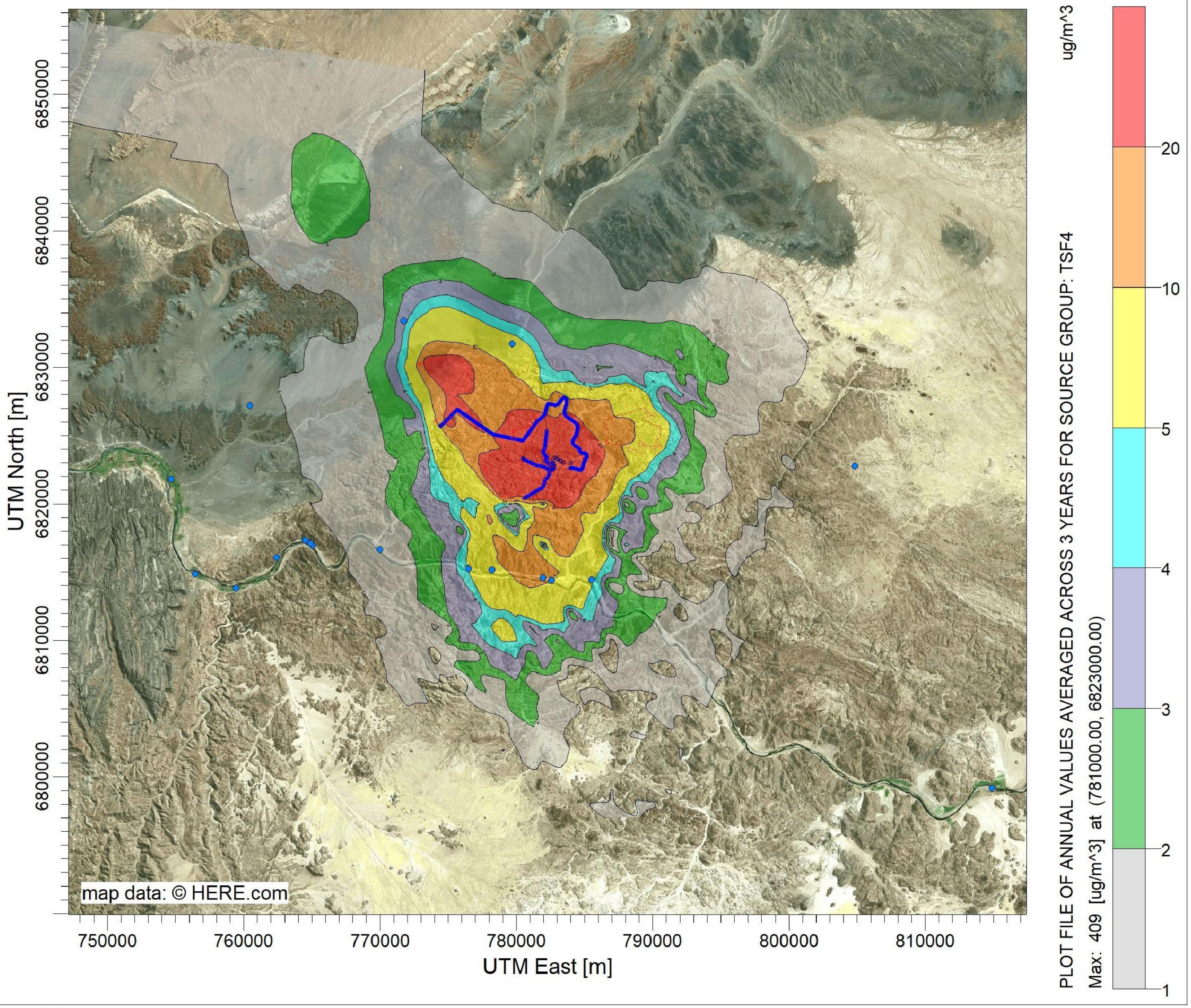
Scenario 2A - PM10 Annual Averaging Period Isopleth



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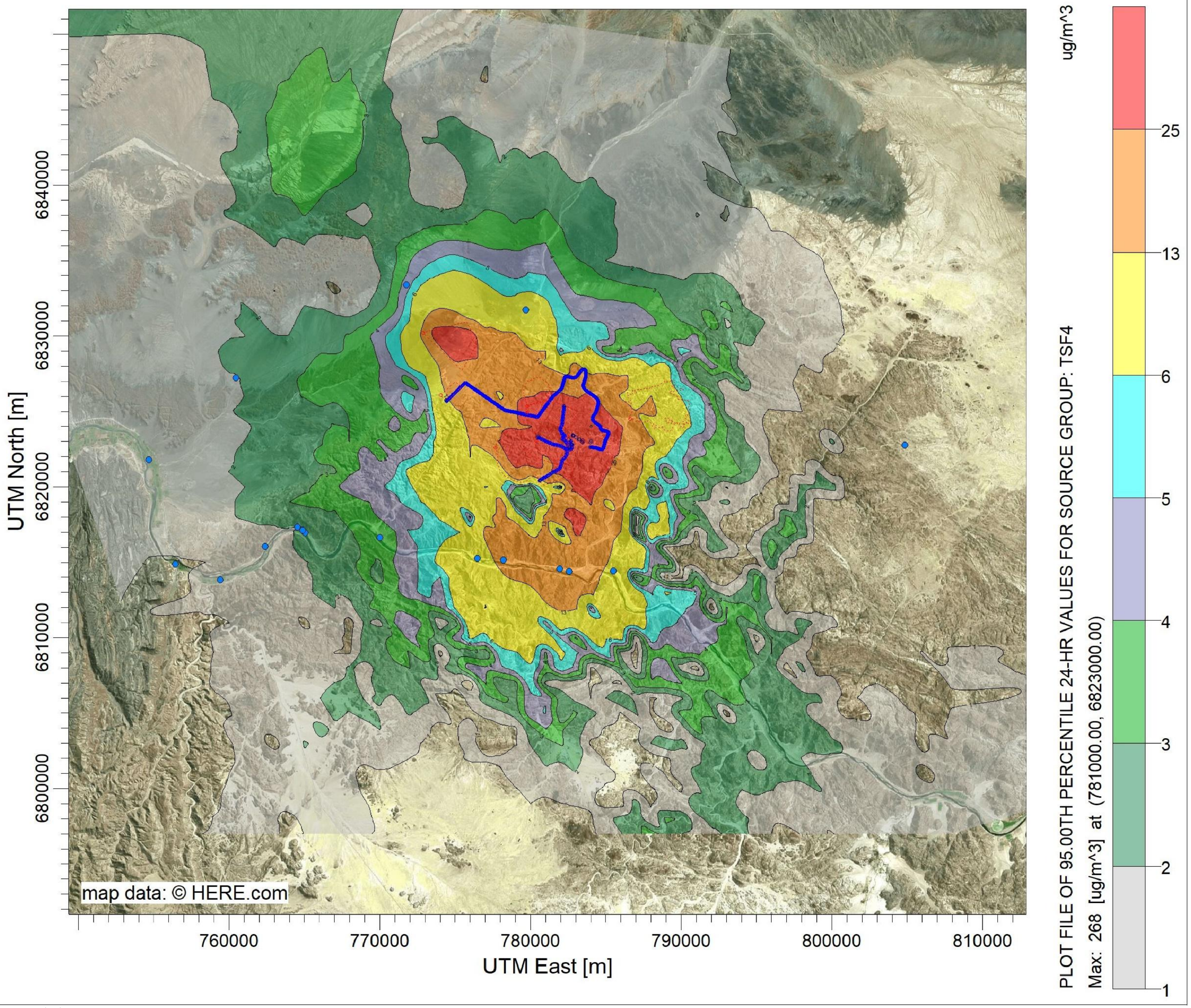

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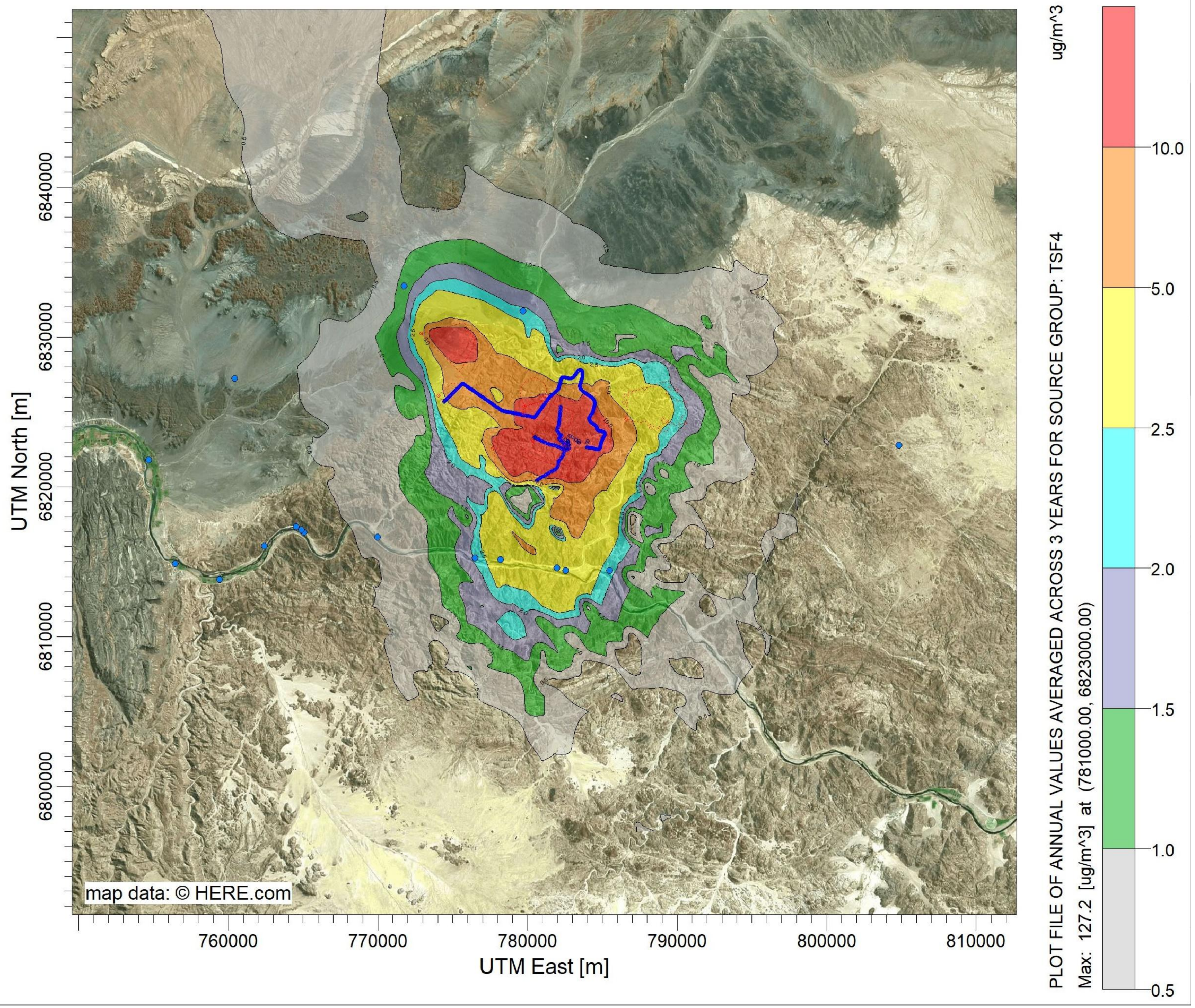
Scenario 2A - PM2.5 Annual Averaging Period Isopleth



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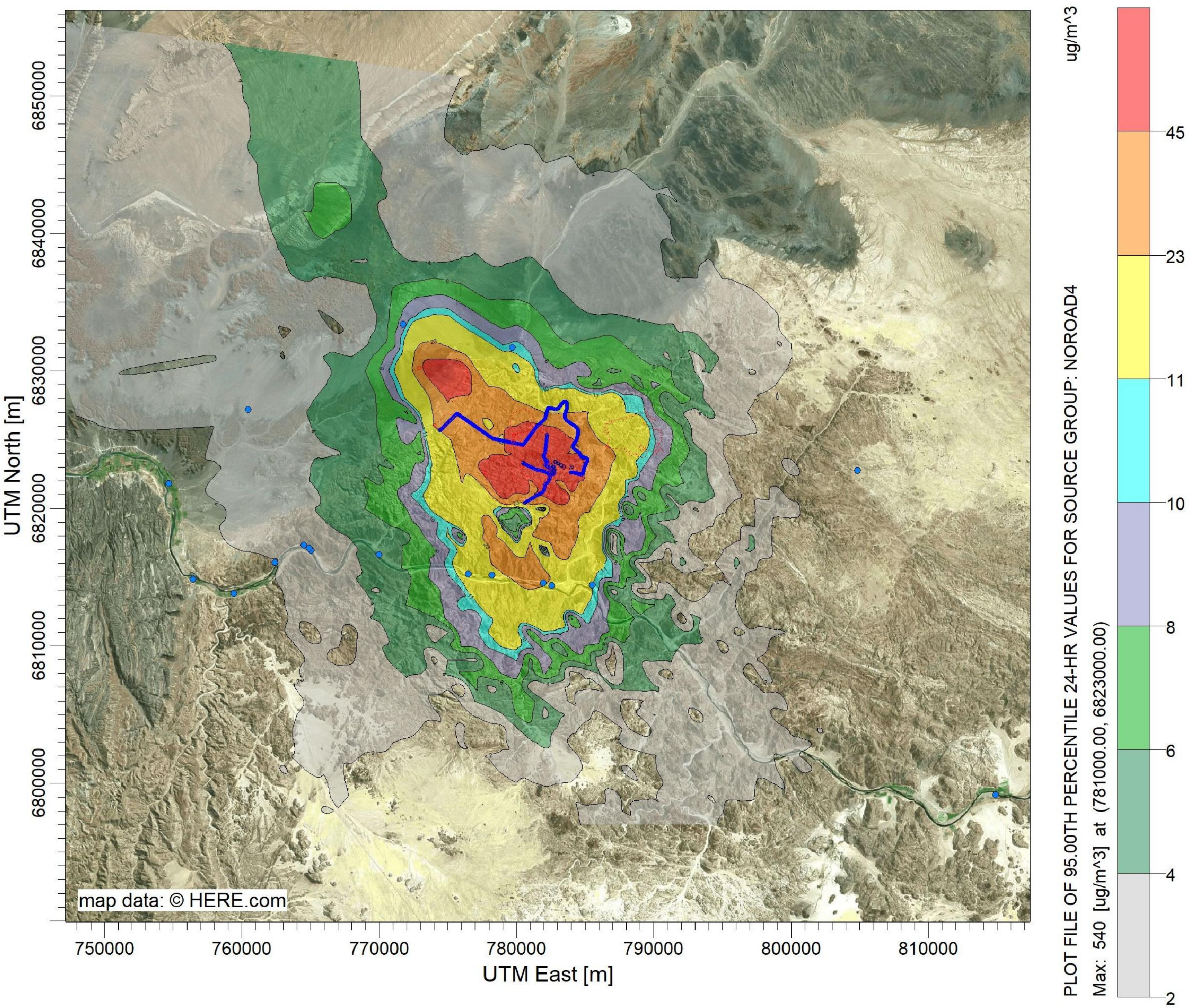
Scenario 2B - PM10 24-hour Averaging Period Isopleth



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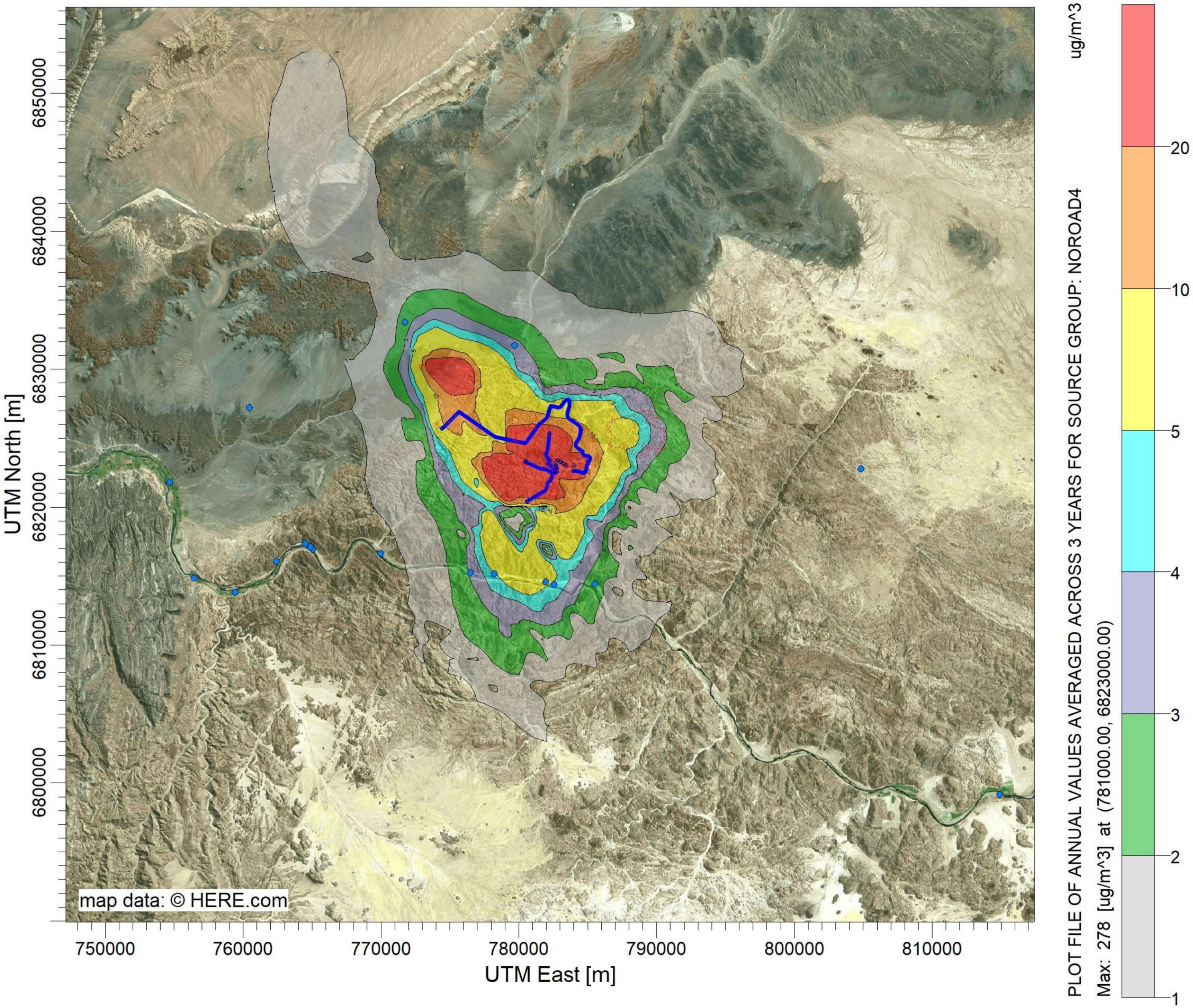
Scenario 2B - PM10 Annual Averaging Period Isopleth



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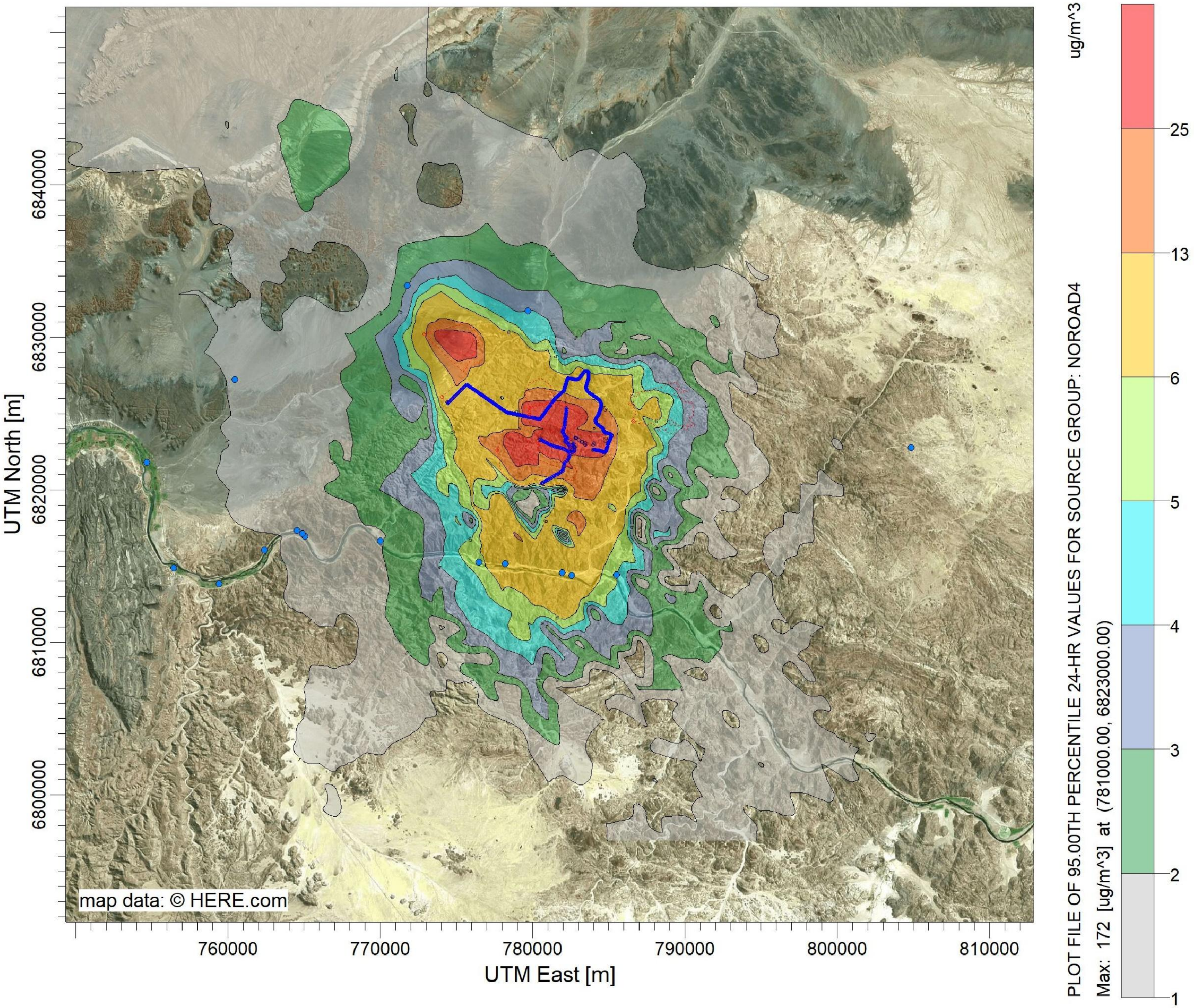
Scenario 2B - PM2.5 24-hour Averaging Period Isopleth



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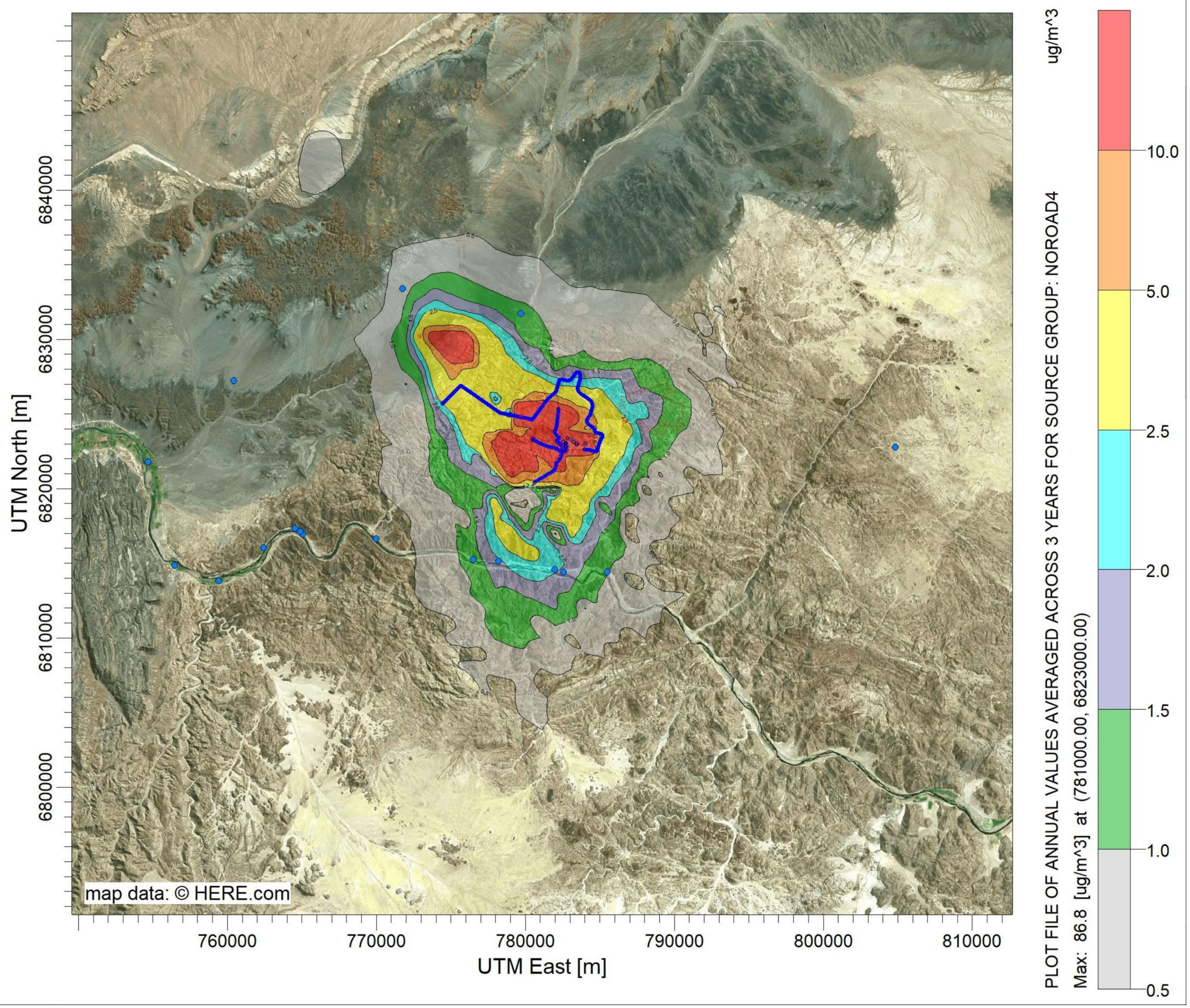
J-SAF-50862 Haib Copper Project
Scenario 2B - PM2.5 Annual Averaging Period Isopleth



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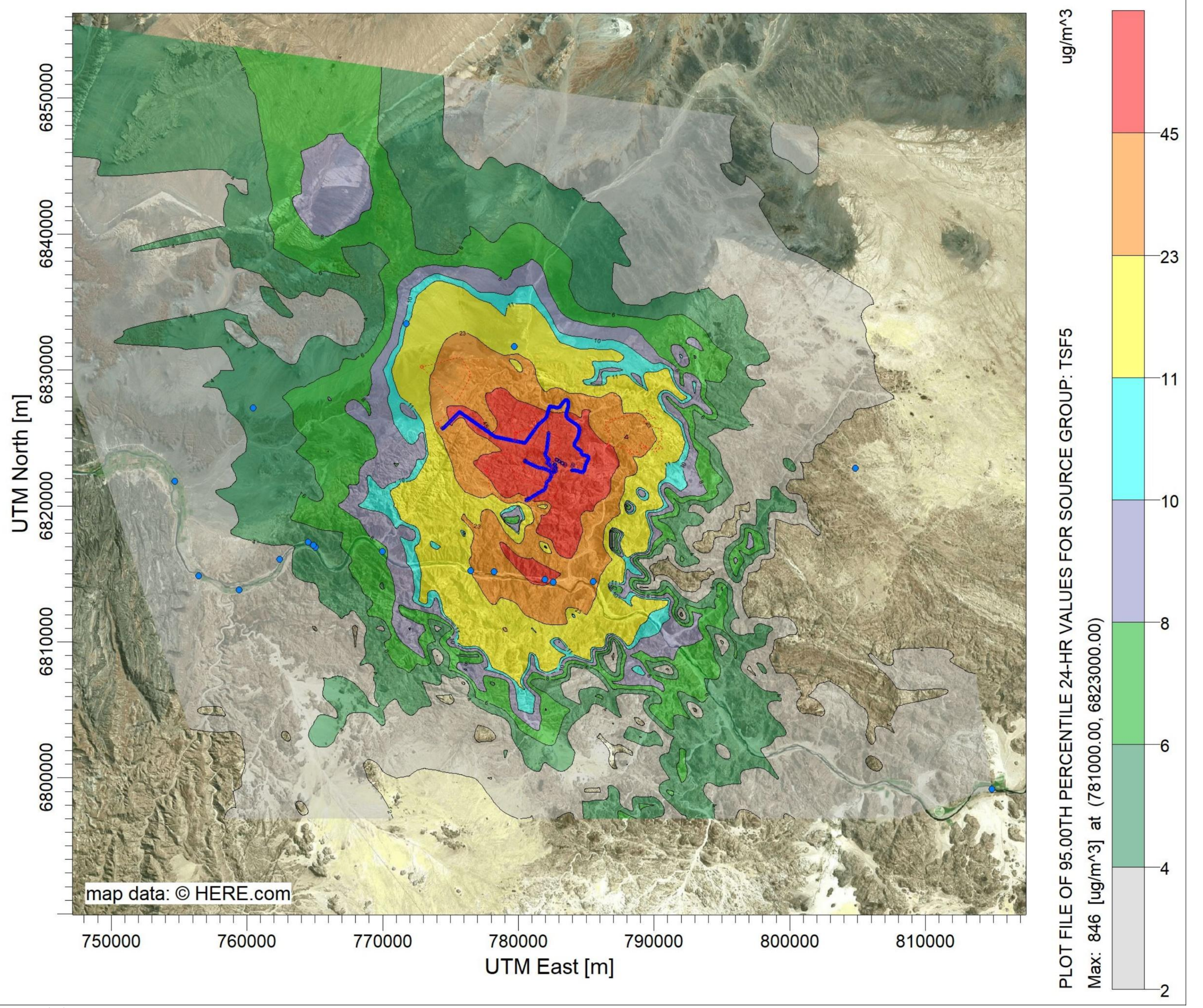
J-SAF-50862 Haib Copper Project
Scenario 3A - PM10 24-hour Averaging Period Isopleth



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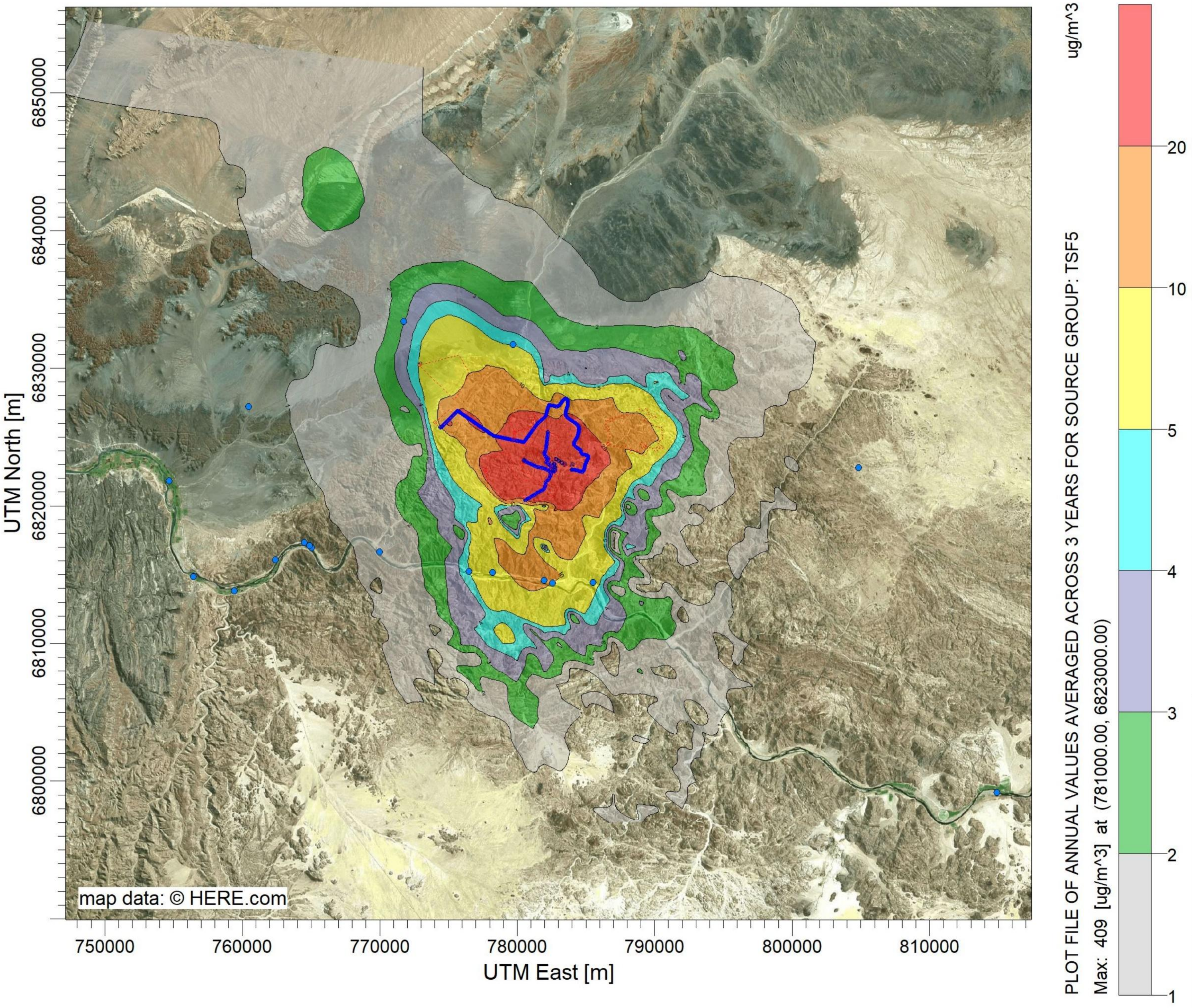
Scenario 3A - PM10 Annual Averaging Period Isopleth



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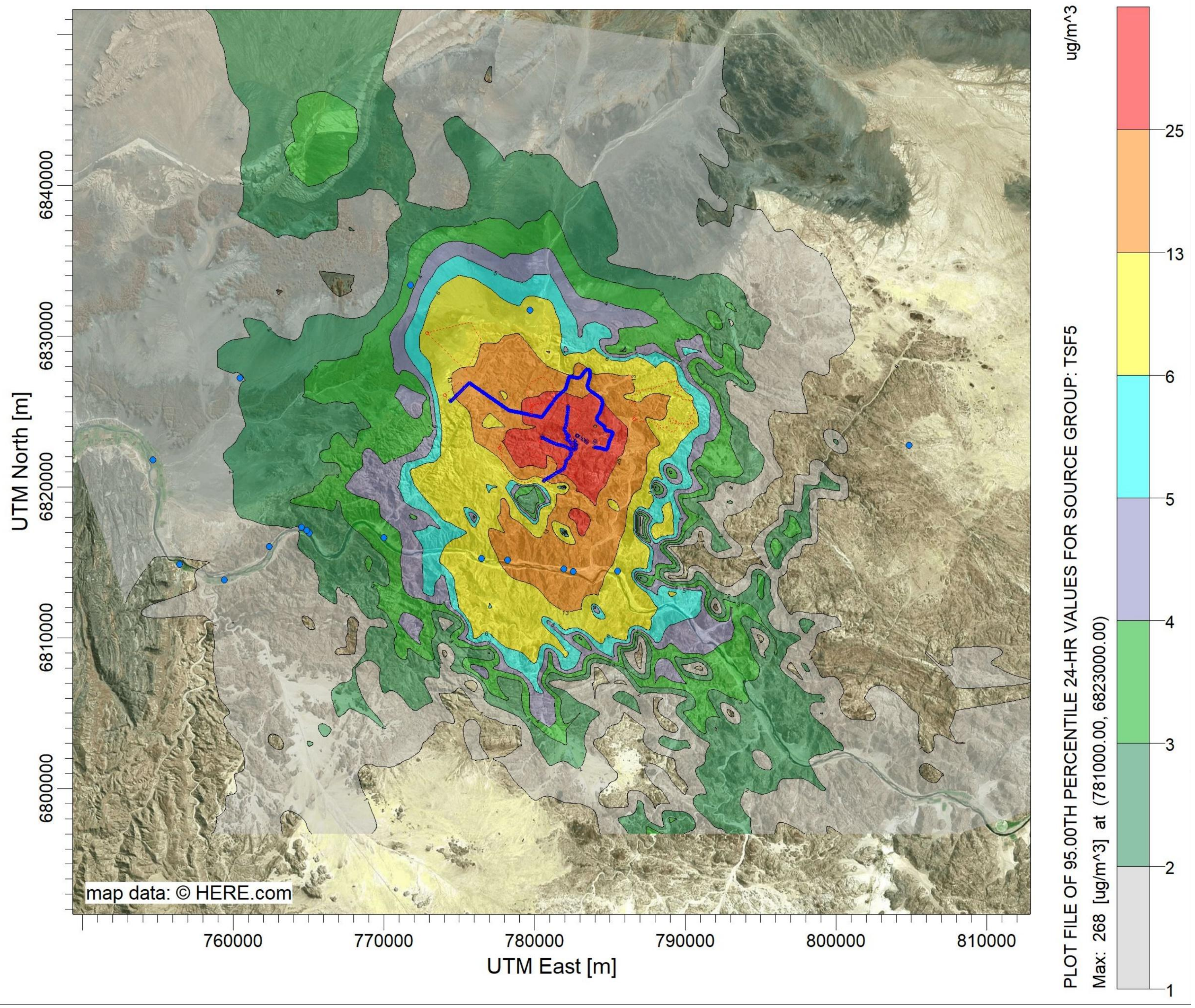
Scenario 3A - PM2.5 24-hour Averaging Period Isopleth



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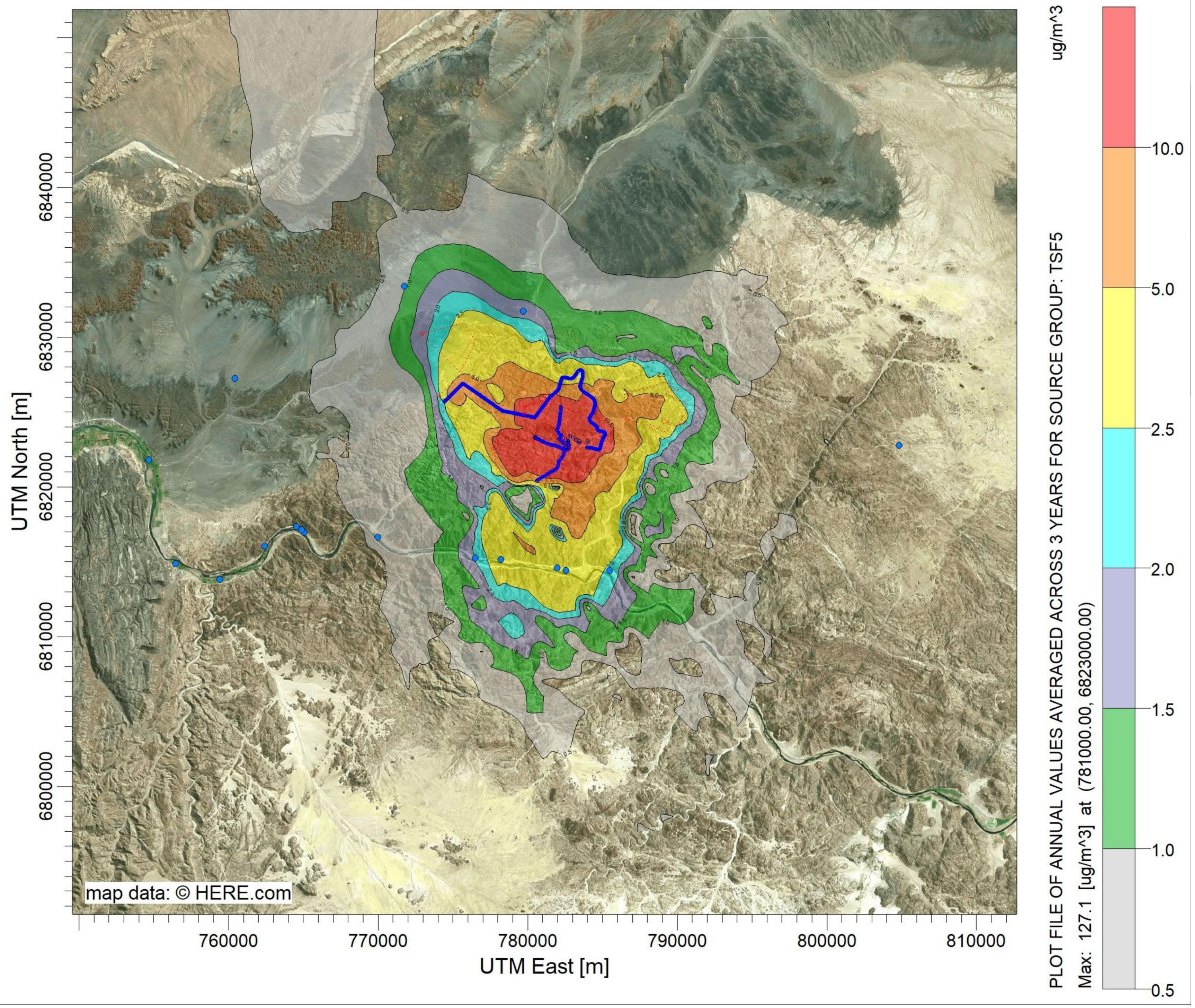

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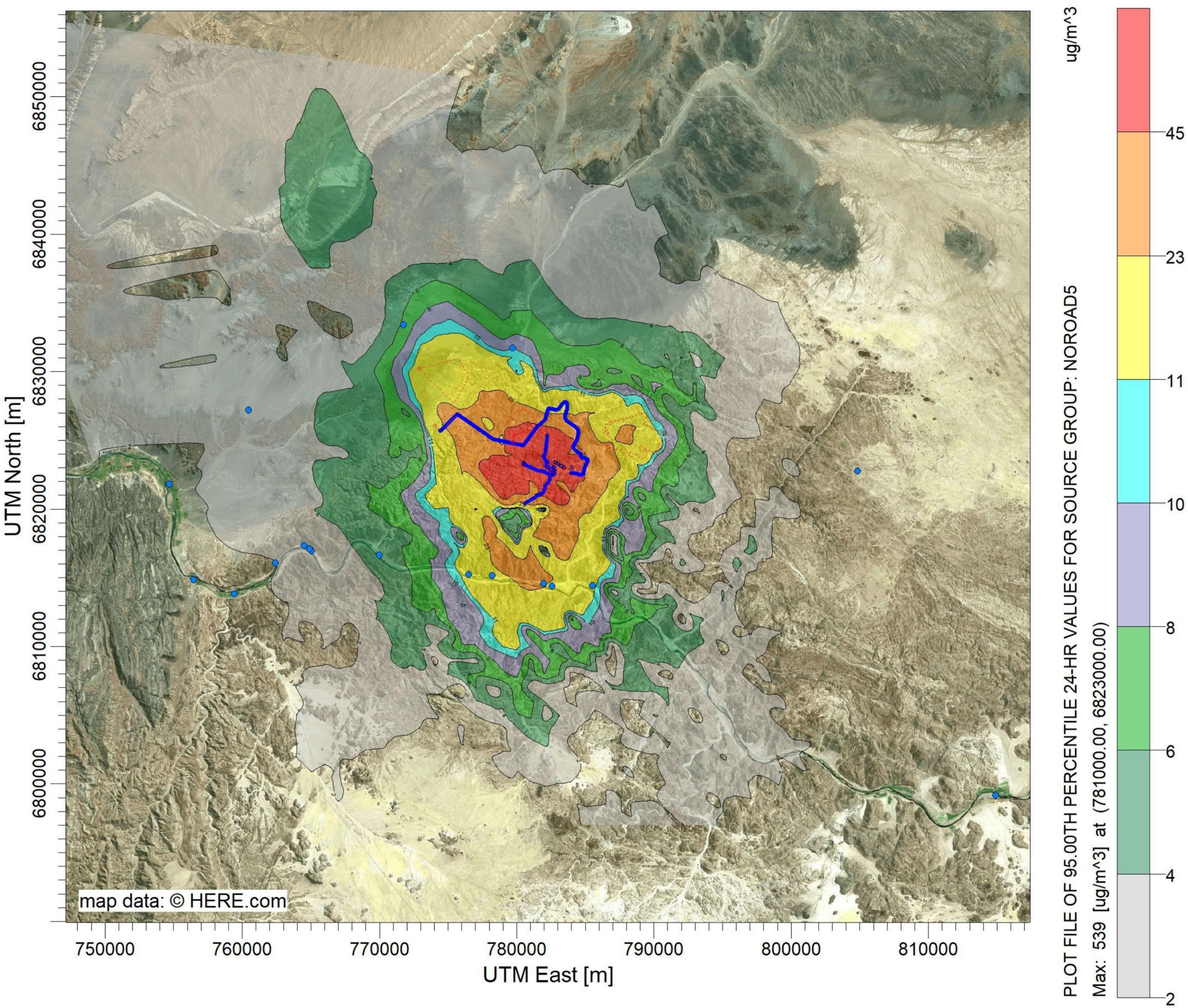

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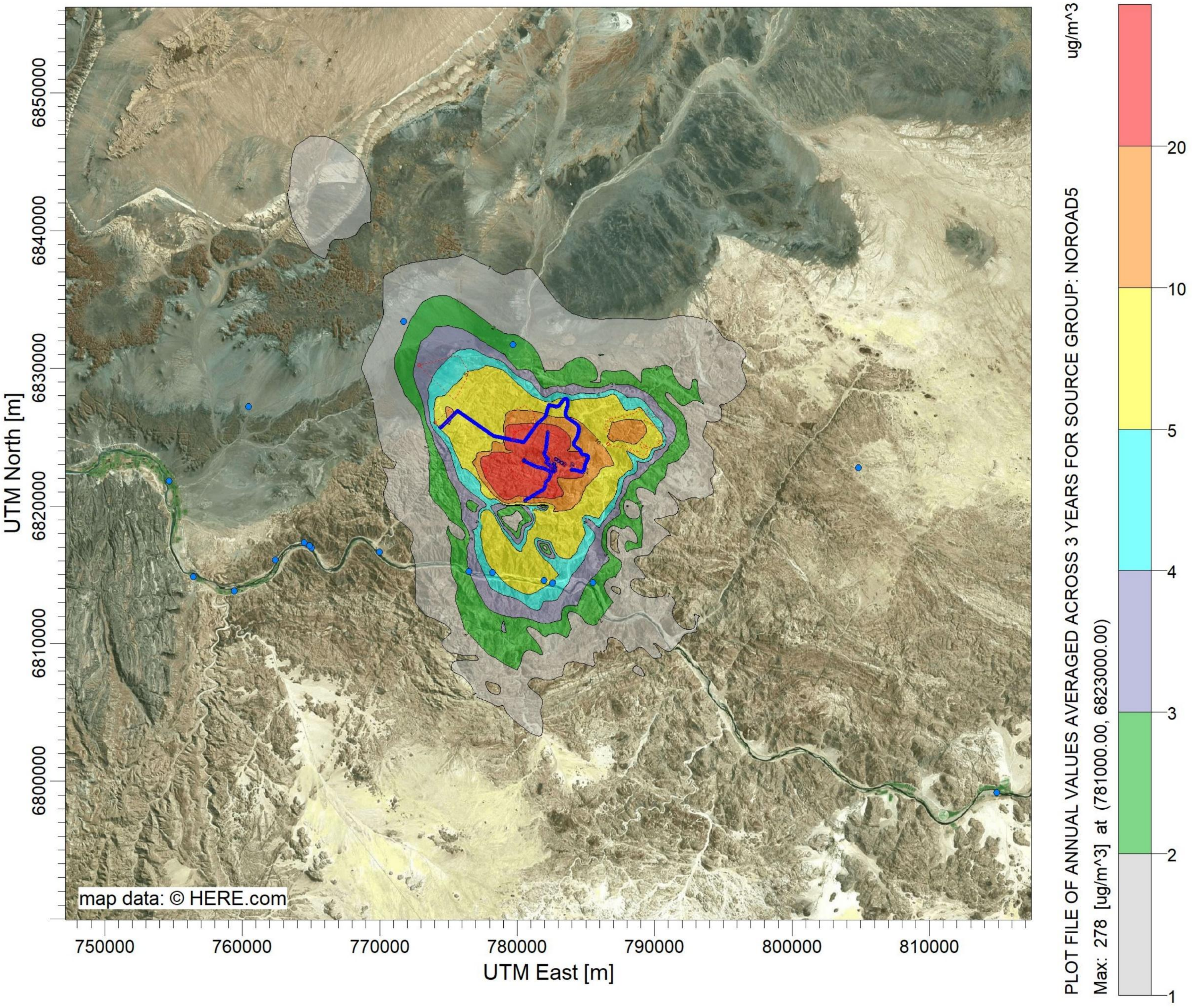
Scenario 3B - PM10 Annual Averaging Period Isopleth



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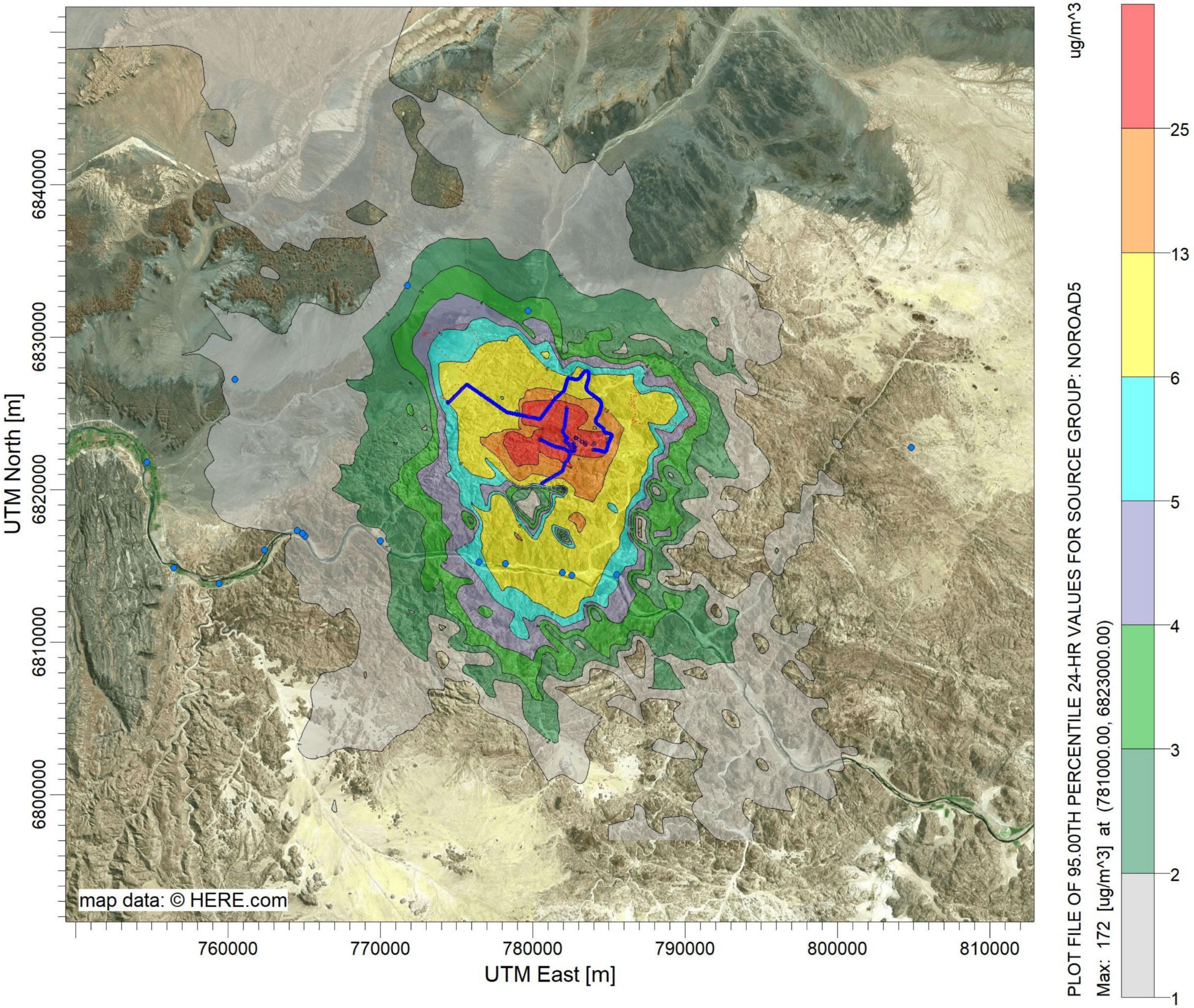
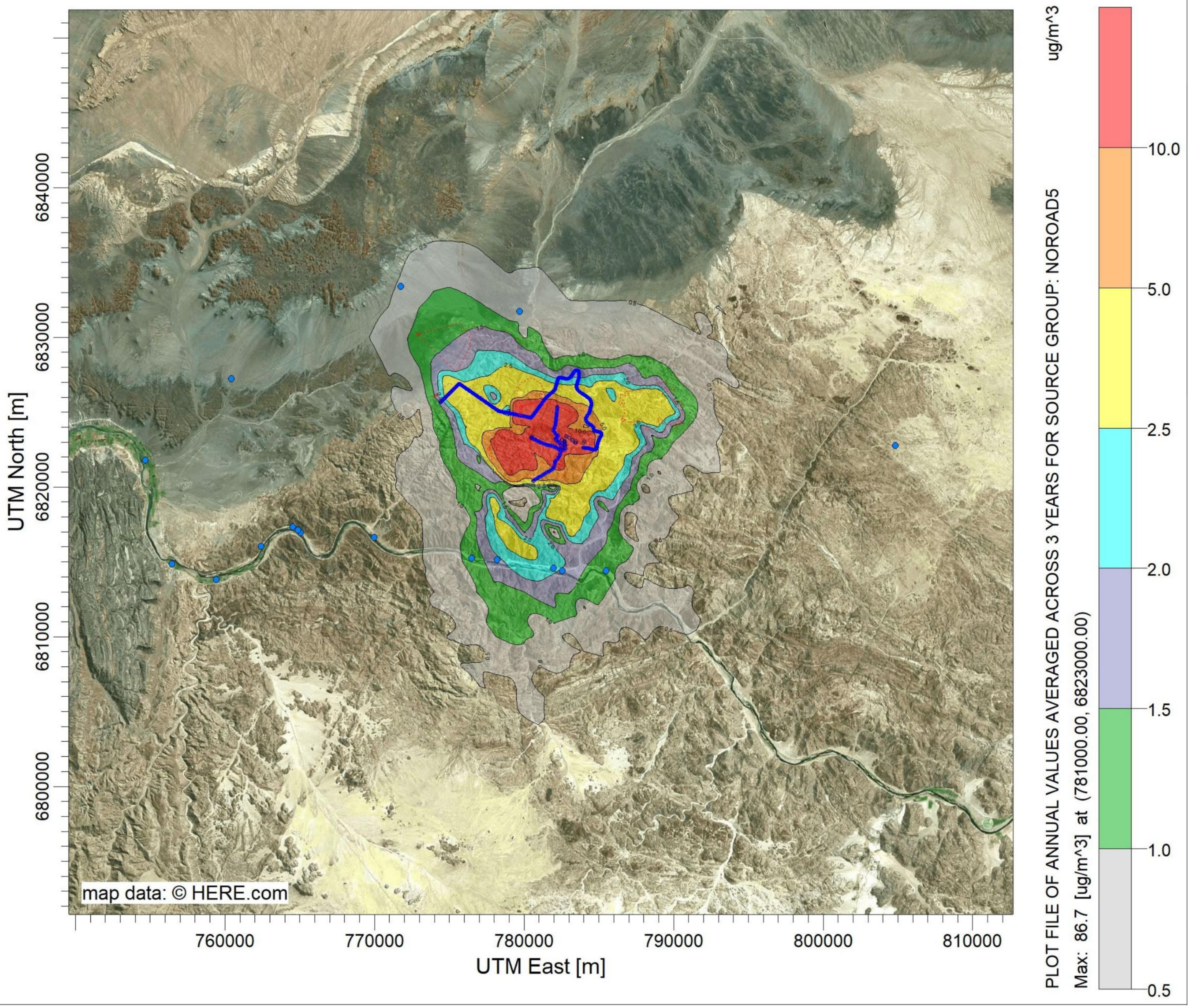
Scenario 3B - PM2.5 24-hour Averaging Period Isopleth



PROJECT TITLE:

J-SAF-50862 Haib Copper Project
Scenario 3B - PM2.5 Annual Averaging Period Isopleth



Appendix D – Independence Declaration

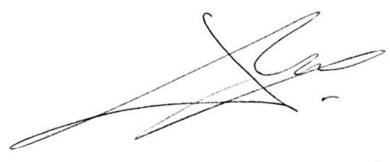
26 January 2026

Re: INDEPENDENCE DECLARATION

I, the undersigned, declare the following in respect to the above-mentioned client:

- I acted as the independent specialist for this assessment
- I have expertise in conducting specialist assessments and reporting relevant to this report, including relevant legislation and any guidelines that have relevance to the proposed activity
- I performed the work relating to the assessment in an objective manner, even if this results in views and findings that are not favourable to the applicant
- I do not hold any financial interest, business and personal relationships or provision of other services, which would impair my independence and objectivity (e.g. shares held by a trust where I am trustee and a beneficiary etc.)
- The fees relating to the specialist work performed is of a fixed nature and are not contingent on the results of your report.
- I acted independently from the above mentioned· client during my performance of the specialist services and can confirm that the following threats did not impair my objectivity in performance of the service:
    - Self-interest
    - Advocacy
    - Familiarity
    - Self-review
    - Intimidation

Yours sincerely



Ashley Meyer

Partner

For WKC Group (PTY) Ltd