REPORT

# ESIA Kribi - Ebolowa Road - EAK Cameroon

*Appendix 22- Noise Modelling Quarry and Site installations*

Submitted to:

**WSP Italia srl**

Via Bernina 7, Milan/Italy

Submitted by:

**WSP Danışmanlık ve Mühendislik Ltd. Şti.**

Hollanda Cad. 691. Sok. Vadi Sitesi No:4, Yıldız 06550 Ankara, Türkiye

+90 312 4410031

24034 / 24706573_v0

December, 2024

# Distribution List

ICMC

Ramboll

WSP Italia S.r.l.

# Table of Contents



**TABLES**



**FIGURES**

# 1.0 NOISE IMPACT ASSESSMENT

Within the scope of the Ebolowa - Akom II - Kribi Road Upgrade Project (herein after referred as “the Project”), site installations will be established nearby Akom II Village. As part of the site installations, following plants and facilities will be established for the production of gravel, sand, concrete, asphalt and reinforced concrete precast elements:

- Quarry
- Crushing plant
- Asphalt plant
- Concrete batching plant
- Precast plant
- Other facilities (Powerhouse, offices, workshop, warehouse, fuel station, etc.)

Based on that, the Project has the potential to generate noise during the operation of site installations as part of the construction phase of the Project. This report aims to assess impacts of noise and provides mitigation measures and monitoring activities accordingly.

During the assessment of noise impacts originated from the Project’s activities, baseline noise levels of the potentially affected sensitive receptors near the site installations area have also been taken into consideration. As detailed below, the main approach for impact analysis is based on the calculations, modelling and predictions of noise impacts during the operation of site installations as part of the construction phase of the Project and background noise levels of the sensitive receptors in the close proximity of the site installation area. A noise modelling software "SoundPLAN Essential 5.0"[1] was applied to determine the predicted noise level that would potentially occur during the operation of site installations as part of the construction phase of the Project.

## 1.1 Noise Baseline Summary

In order to determine the baseline noise levels at the sensitive receptors around the site installations area, seven representative background noise measurement locations have been determined. Between August 27th - September 2nd, 2024, background noise levels were measured continuously over 24 hours in each location.

The noise measurement results are compared with both the IFC noise standards and Cameroonian regulatory noise limit values. In this respect, detailed breakdown of the baseline noise levels is given below:

- IFC day-time noise standard is exceeded at all locations (i.e. N1, N2, N3, N4, N5, N6 and N7). For these locations a maximum of 3 dBA increase in day-time background noise levels due to the proposed Project, is allowed by the IFC standard;
- IFC night-time noise standard is exceeded at all locations (i.e. N1, N2, N3, N4, N5, N6 and N7). For these locations a maximum of 3 dBA increase in night-time background noise levels due to the proposed Project, is allowed by the IFC standard;
- Cameroonian day-time noise regulatory limit value is exceeded at all locations (i.e. N1, N2, N3, N4, N5, N6 and N7);
- Cameroonian transition-time noise regulatory limit value is exceeded at all locations (i.e. N1, N2, N3, N4, N5, N6 and N7);

[1] https://www.soundplan.eu/en/software/soundplanessential/

- Cameroonian night-time noise regulatory limit value is exceeded at all locations (i.e. N1, N2, N3, N4, N5, N6 and N7).

The baseline noise measurement results revealed that the background noise levels at the receptors near the site installation area are high, potentially due to road traffic, human activities, and sounds of nature (animals, etc.).

## 1.2 Noise Modelling Methodology

A noise modelling software "SoundPLAN Essential 5.0" was applied to predict noise levels that would potentially occur during the operation of site installations as part of the construction phase of the Project. Information about the noise levels of plants, machinery, vehicles and equipment, identified as noise sources to be operated in the scope of the Project, was obtained from the Impresa di Costruzioni Maltauro - ICM SpA (herein after referred as “Client”).

During the modelling study conducted for the operation of site installations, below steps were followed:

1) As a first step of modelling study, the elevation model that directly affects the noise distribution on the natural terrain is created. In the meantime, elevation contours with 5 m intervals on the topographic map were digitized and loaded into the program. Interpolation of elevation contours was performed in the program and natural terrain data of the site installations area and its surroundings were obtained to be used in the model. After the elevations are digitalized, Temporary DGM (Digitalized Ground Model) is generated.
2) At the second step, the humidity, temperature and air pressure data of the area where the site installations area will be established, were introduced to the model.
3) At the third step, the noise sources identified within the study area were introduced to the model together with their noise levels (dBA).
4) At the fourth step, the determined receptors (i.e. the seven locations where the baseline noise measurements were carried out) have also been digitized in the model.
5) At the fifth step, ground effect, which is another important parameter for the noise distribution, was also digitized in the model. Ground effect varies between 0 to 1, where 0 corresponds to hard, reflective surfaces and 1 corresponds to soft, absorptive surfaces.
6) Finally, the modelling process has been initiated by determining a calculation area that includes all noise sources and sensitive receptors in the study area. For the worst-case scenario simulation, all the noise sources are assumed to work at the same time and at the distances identified before. As a result of the model run, noise levels at the defined receptors and grid noise map for the study area were obtained.

Based on that, the noise model assumptions and approaches are listed below:

- The list of plants, machinery, vehicles and equipment that will be used under the normal operating conditions of site installations, and their corresponding noise levels are provided by the Client and presented in Table 1.
- The humidity, temperature and air pressure for the study area are taken as 85%, 23°C and 1,013 hPa, respectively, by assuming a general average for region[2,3].

[2] https://en.climate-data.org/africa/cameroon/south/ngbwa-akom-892445/

[3] https://www.noaa.gov/jetstream/atmosphere/air-pressure

- The ground effect was taken as 0.8 according to the rurality & urbanity intensity of the study area; and
- The model is set considering the worst-case scenario, which represents the situation where all the noise sources are operating at the same time, in a collective way and at maximum sound power levels.

**Table 1: Plants, Machinery, Vehicles and Equipment List**

| Plants/Machinery/Vehicles/Equipment | Amount | Sound Power (Lw) |
|---|---|---|
| Crushing Plant | 1 | 104 |
| Asphalt Plant | 1 | 105 |
| Concrete Batching Plant | 1 | 85 |
| Precast Plant | 1 | 70 |
| Powerhouse | 1 | 26 |
| Wheel Loader | 5 | 85 - 95 |
| Dump Trucks | 3 | 85 - 100 |
| Excavator with a Hydraulic Hammer | 1 | 80 - 90 |
| Rock Drill | 1 | 95 - 105 |
| Truck with Crane | 1 | 80 - 90 |
| Crane | 1 | 85 - 90 |
| Forklift | 1 | 75 - 85 |
| Minor Equipment | 1 | 60 - 70 |

## 1.3 Impact Analysis

Potential impacts of noise during the operation of site installations as part of the construction phase of the Project, will mainly be originated from the operations of plants, machinery, vehicles and equipment.

Based on that, impacts will be mainly associated to the following impact factor:

- Emission of noise and vibrations

The Project actions related to the abovementioned impact factor are the followings:

- Operation of the plants and facilities (i.e. quarry, crushing plant, asphalt plant, concrete batching plant, precast plant, powerhouse)
- Temporary stockpiling of material
- Transportation of construction materials

In this section, the environmental noise to be generated by the operations of plants, machinery, vehicles and equipment, is evaluated cumulatively and conservatively for the purpose of displaying the worst-case scenario during the operation of site installations as part of the construction phase of the Project. However, in accordance with the information provided by the Client, it should be noted that no activity will take place during the transition-time and night-time.

The determined study area, where the baseline noise measurements were carried out, are modelled for the cumulative assessment (i.e. baseline noise levels + predicted noise levels due to operation of the equipment) of the construction phase of the Project. The predicted noise levels (i.e. modelling results), baseline noise levels and cumulative results (i.e. baseline + predicted noise levels) at the sensitive receptors where baseline noise measurements were conducted, and the comparison of the results with the IFC standards and Cameroonian regulatory limit values are presented in Table 2. Detailed breakdown of the cumulative results of the assessed receptors are given below:

- Although cumulative noise levels at all locations (i.e. N1, N2, N3, N4, N5, N6 and N7) are above the IFC day-time noise standard due to the high baseline noise levels, the difference between the baseline noise levels and cumulative noise levels at all locations are below the 3 dBA treshold defined by the IFC standards. Based on that, cumulative day-time noise levels at all locations are in compliance with the IFC day-time noise standard.
- On the other hand, Cameroonian day-time noise regulatory limit value is also exceeded at all locations (i.e. N1, N2, N3, N4, N5, N6 and N7) due to the high baseline noise levels at the receptors. However, the maximum difference between the baseline noise levels and cumulative noise levels at all locations are about 0.3-0.4 dBA which could not be a noticeable noise increase by an average human ear.

The day-time grid noise map obtained for the operation of site installations as part of the construction phase of the Project, is presented in the Figure 1 below.

**Table 2: Modelled Noise Levels for the Operation of Site Installations and Baseline Noise Levels at the Receptors**

| Measurement Point | Measurement Location | | | Modelled Noise Level (originated from Project activities) (dBA) | | | | | Baseline Noise Levels (dBA) | | | | | Modelled Noise Level + Baseline Ambient Noise Level (dBA) | | | | | Difference Between Ambient and Modelled Noise Levels (dBA) | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Village | Receptor Type* | Distance to Project Area (m) | IFC | | Cameroonian | | | IFC | | Cameroonian | | | IFC | | Cameroonian | | | IFC | | Cameroonian | | |
| | | | | Day (07-22) | Night (22-07) | Day (07-19) | Transition (06-07) (19-22) | Night (22-06) | Day (07-22) | Night (22-07) | Day (07-19) | Transition (06-07) (19-22) | Night (22-06) | Day (07-22) | Night (22-07) | Day (07-19) | Transition (06-07) (19-22) | Night (22-06) | Day (07-22) | Night (22-07) | Day (07-19) | Transition (06-07) (19-22) | Night (22-06) |
| N1 | Ekowong-Ndong | Residential / II | 750 | 33.4 | - | 33.4 | - | - | 61.7 | 61.9 | 61.4 | 62.4 | 62.0 | 61.7 | 61.9 | 61.4 | 62.4 | 62.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| N2 | Ekowong-Bettel | Residential / IV | 830 | 33.4 | - | 33.4 | - | - | 62.7 | 63.6 | 61.6 | 65.4 | 63.6 | 62.7 | 63.6 | 61.6 | 65.4 | 63.6 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| N3 | Ekowong | Residential / IV | 1,050 | 33.3 | - | 33.3 | - | - | 57.3 | 56.7 | 56.4 | 59.6 | 57.0 | 57.3 | 56.7 | 56.4 | 59.6 | 57.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| N4 | Akom II | Residential / II | 600 | 36.8 | - | 36.8 | - | - | 64.7 | 64.4 | 64.2 | 65.7 | 64.5 | 64.7 | 64.4 | 64.2 | 65.7 | 64.5 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| N5 | Akom II | Residential / II | 240 | 30.3 | - | 30.3 | - | - | 57.9 | 58.9 | 57.5 | 59.3 | 58.9 | 57.9 | 58.9 | 57.5 | 59.3 | 58.9 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| N6 | Akom II | Residential / III | 0 | 51.5 | - | 51.5 | - | - | 62.0 | 62.4 | 62.1 | 61.8 | 62.4 | 62.4 | 62.4 | 62.5 | 61.8 | 62.4 | 0.4 | 0.0 | 0.4 | 0.0 | 0.0 |
| N7 | Akom II | Residential / III | 40 | 47.8 | - | 47.8 | - | - | 59.9 | 64.3 | 59.5 | 62.2 | 64.4 | 60.2 | 64.3 | 59.7 | 62.2 | 64.4 | 0.3 | 0.0 | 0.3 | 0.0 | 0.0 |
| IFC Noise Standards[1,2] | Industrial; commercial areas | | | **70** | **70** | - | - | - | **70** | **70** | - | - | - | **70** | **70** | - | - | - | **3** | **3** | - | - | - |
| | Residential; institutional; educational areas | | | **55** | **45** | - | - | - | **55** | **45** | - | - | - | **55** | **45** | - | - | - | **3** | **3** | - | - | - |
| Cameroonian Noise Limit Values[3,4] | I: All areas where the measurement point is located less than 500 m from the extraction zone, economic or industrial activities, or specific economic activities, or less than 200 m from the economic activity zone where the establishment is located | | | - | - | **55** | **50** | **45** | - | - | **55** | **50** | **45** | - | - | **55** | **50** | **45** | - | - | - | - | - |
| | II: Residential and rural habitat areas, except I | | | - | - | **50** | **45** | **40** | - | - | **50** | **45** | **40** | - | - | **50** | **45** | **40** | - | - | - | - | - |
| | III: Agricultural, forest, green spaces, natural, and park areas, except I | | | - | - | **50** | **45** | **40** | - | - | **50** | **45** | **40** | - | - | **50** | **45** | **40** | - | - | - | - | - |
| | IV: Recreation areas, public service areas, and community facilities | | | - | - | **55** | **50** | **45** | - | - | **55** | **50** | **45** | - | - | **55** | **50** | **45** | - | - | - | - | - |

**Notes:**
* Receptor types are defined in accordance with the IFC standards and Cameroonian regulation.
[1] IFC Environmental, Health, and Safety (EHS) Guidelines General EHS Guidelines: Environmental - Noise Management;
[2] IFC Guidelines provide noise standards for two-time intervals in 24 hours: day (07:00 to 22:00), and night (22:00 to 07:00).
[3] NC 1962: 2021 Environment – Limits on noise and odour emissions;
[4] NC 1962: 2021 Environment – Limits on noise and odour emissions provides noise standards for three-time intervals in 24 hours: day (07:00 to 19:00), transition (06:00 – 07:00 & 19:00 – 22:00) and night (22:00 – 06:00).

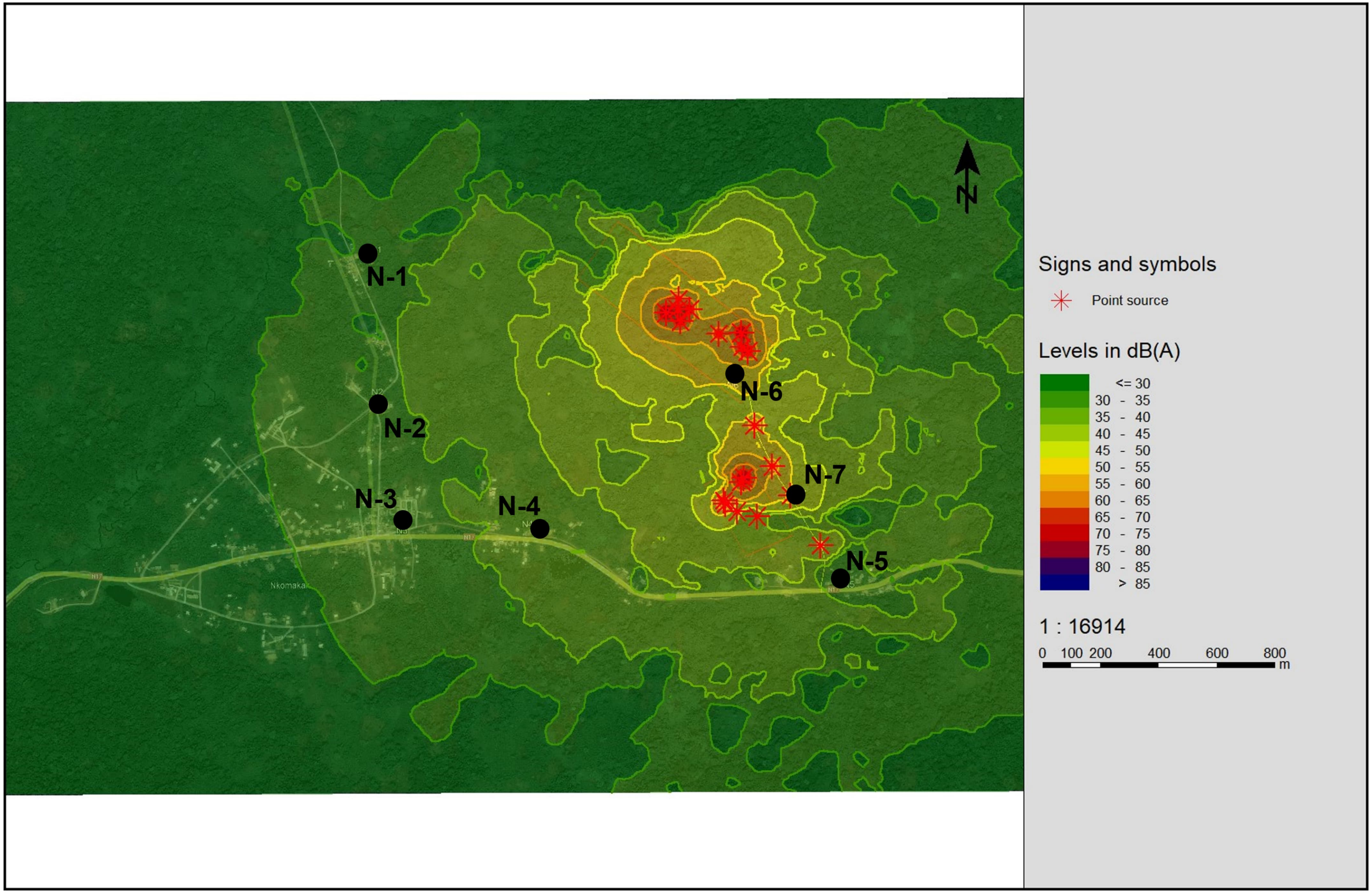


**Figure 1: Day-time Grid Noise Map for the Operation of Site Installations as Part of the Construction Phase of the**

# Signature Page

Serkan Küçükünsal
*Noise Modelling Specialist*

Federico Breda
*Project Director*

*Society subjected to direction and coordination from WSP Global Inc. ex. Art. 2497-bis c.c.*

wsp.com