

Legal background:

Regulation 29 of S.L. 549.59, grants ERA the power to issue guidance notes on the conduction of Air Quality Studies which are required by any Regulations issued under the Environment Protection Act including the EIA Regulations (S.L. 549.46).

Part II of Schedule 7 to S.L. 549.59 sets the following (legally binding limit values): an annual limit value of $40\mu\text{g}/\text{m}^3$ for PM_{10} , a daily limit value for PM_{10} of $50\mu\text{g}/\text{m}^3$ which cannot be exceeded on more than 35 calendar days (90.4% of the daily readings in a calendar year should be $< 50\mu\text{g}/\text{m}^3$), an annual limit value $40\mu\text{g}/\text{m}^3$ for NO_2 and an hourly limit value of $200\mu\text{g}/\text{m}^3$, which can not be exceeded more than 18 times per calendar year.

Regulations 19 and 20 of LN 78 of 2010 give ERA the responsibility to ensure that the above mentioned limits are complied with across Malta and Gozo.

0. **Applicability**

These terms of reference are applicable to all development applications irrespective of whether or not it qualifies for an Environmental Impact Assessment, as long as the expected increase in traffic flows due to the operation of the project is ≥ 1000 passenger cars AADT or ≥ 200 HDV AADT.

The Air Quality study shall be conducted as follows:

1. **Content**

The air quality study shall *inter alia* include the following sections:

- a) *The relevant details of the proposed development:* This should include an overview of the expected traffic changes when the project is FULLY operational. The report should also include a brief introduction to the sensitivity of the area to increases in traffic flows and changes in air pollution levels keeping in mind the NO_2 levels registered by the passive diffusion tubes (include in ERA's network) sited closest to the site.
- b) *Description of the relevant immission standards with reference to S.L. 549.59.*
- c) *The assessment methods:* This section shall include any relevant details on the methods used in order to monitor the base line levels of NO_2 and PM_{10} , including any proof of equivalence to the reference method(s) as applicable (see 2.i and 2.n below). The

section shall also include a part outlining the core details of the model (including version number) being used in order to predict the impact of the development. The consultants shall also include details on all the input data used and its source, including features of the traffic flows used, speeds, apportionment by vehicle type etc.

- d) *Site selection:* This section shall include the considerations made by the consultants in the selection of the monitoring site. The consultants shall also show how the selected site matches the site selection criteria in Annex I and the additional criteria Section 2 paragraph k).
- e) *Model verification:* Model verification involves a comparison between the predicted and the measured values for both PM₁₀ and NO₂. Any errors between modeled and measured values should be adequately corrected. In addition consultants are expected to include estimates of the uncertainties in the traffic flows, vehicle emission factors and background concentrations. Any modeled concentrations should include a cumulative sensitivity analysis for these uncertainties (the effect of each uncertainty should be clearly outlined). The limitations of the model should be clearly stated e.g. the software's inability to model dispersion of air pollutants if the air flow is affected by trees or the inability to model pollutant concentrations in street canyons.
- f) *Identification of sensitive receptors:* For the projects in Annex II to this document and within the scope of S.L. 549.46, the consultants will be required through the use of software modeling traffic flows, to delineate the extent of the area affected by increased traffic flows due to the project. Baseline studies may be required for more than one location. Any sensitive receptor within this area shall be clearly identified through the use of a GIS package. For any other project the identification of sensitive receptors shall be limited to a 3km radius around the site. Sensitive receptors include schools, retirement homes, residential units, hospitals, etc.
- g) *Description of the baseline conditions:* This section should details on location of the points at which the air quality monitoring was carried out, the reason for which this particular site was used, the sampling period, data capture, the scale up factors provided by ERA and if possible a break-up of the base line levels of the pollutant by the source.
- h) *Assessment of impact:* Results of the modeling for the "with development" scenario should be clearly set out in tables and also through the use of contour maps (which shall include the sensitive receptors identified in e) above), this should be compared to the "without development" scenario with respect to both the table and the contour map. The

comparison between both scenarios shall also be applied to each of the sensitive receptors identified in e) above.

- i) *Determination of the significance of the impact:* The table in section 4 (and the tool made available through the ERA website) shall be used for each of the sensitive receptors identified in e) as well as for the modeled concentrations at the site where the monitoring was carried out.
- j) *Cumulative impacts:* If in the area there are other planned developments, which have already been granted development consent then the contribution of these developments should also be considered at a point in the future when these are fully operational.
- k) *Mitigation measures:* If the effect of the project is substantially adverse or worse, then the report shall include any mitigation measures, which have been identified and, which will reduce the impact of the project to at least slightly adverse. Non-quantifiable measures will not be expected.
- l) *Summary of the report.* The report should be written in clear, concise, grammatically correct English. If the English of the report is unacceptable, the report shall be sent to the consultants for correction and ERA will not take any responsibility for any delays in the process.

2. **Baseline Studies**

- a) The baseline levels of PM₁₀ and NO₂ shall be established through *in-situ* monitoring;
- b) Baseline levels of PM₁₀ shall be determined using the reference method (EN 12341:2014) for the determination of PM₁₀;
- c) The consultants should use the reference method for the sampling and measurement of PM₁₀;
- d) The design criteria for the samplers shall be as per Annex B to the said standard and shall be as per Section IV of Annex IX: EN 12341: 2014;

Inlet Design	Flow rate		Filters
See Section 5.1.2 and Annex A of EN 12341:2014	To a nominal value of 2.3 m ³ .hr ⁻¹ see Section 5.1.5 of EN 12341:2014	The instantaneous value of the flow rate shall be kept within 5% of the nominal value.	Circular: such that the diameter of the exposed area through which the sampled air passes

		The volumetric flow rate averaged over the sampling period shall be within 2% of the nominal value, see Section 5.1.5	is between 34mm and 44mm.
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Figure 1.1 design criteria for the samplers.

- e) The resolution of the balance used for the weighing of filters sampled using an LVS shall be at least 10 µg, Section 5.2.2 of EN 12341:2014;
- f) The filters should be conditioned for at least 48 hours (Section 6.2 of EN12341:2014) at 50% relative humidity (+ or - 5%) with an uncertainty of ≤ 2% RH and at 20 °C (+ or - 1 °C) with an uncertainty of ≤ 0.2 °C, according Table 2, Section 5.2 of EN12341:2014.
- g) The filters should be weighed at least twice for concordance (the difference between successive readings shall ≤ 40µg, Section 6.2 of EN12341:2014) with a time lag of at least 12 hours between the two weightings;
- h) Flow rates are at ambient volumes not at normalised volumes. The weighing shall take place in the same climate controlled room at the same environmental conditions as in f);
- i) Consultants can use alternative sampling and measurement methods if they demonstrate to ERA's satisfaction, equivalence to the above mentioned method under the Maltese air pollution climate. Equivalence shall be determined using the [European Commission's method for the determination of equivalence](#); any other method shall be deemed unacceptable. ERA will accept certificates of equivalence issued by third parties, which have been based on the method herein;
- j) Compliance with non-European standards does not satisfy the requirements above;
- k) Regarding the siting of the sampler/diffusion tube, the consultant shall submit a method statement indicating the location of the sampler/diffusion tube. The sampling point(s) should not be within the site to be developed or exactly adjacent to it, but should be sited at a location representative of the thoroughfare on which the highest traffic impacts (due to the project) are expected. In addition the consultant is obliged to use all the criteria in Annex I to determine the sampling location. In addition the ERA may at its discretion ask the consultant to change the location of the sampler;
- l) The sampling time shall be no less than 6 weeks and extendible by a further 3 weeks depending on the nature of the case and the consultant shall use a scale up factor to scale this up to a yearly average. The scale up factor shall be forwarded by ERA to the consultant;

m) The consultants shall discard readings influenced by Saharan dust intrusions. These episodes are characterized by a marked spatial consistency, demonstrated by concomitant peaks in the levels of PM₁₀ (and PM_{2.5}) across the Maltese Islands (see Figure 1 below). The consultants shall use this in conjunction with following two tools to confirm the occurrence of these episodes a) [MACC ensemble](#) and b) [HYSPLIT back trajectory model](#).

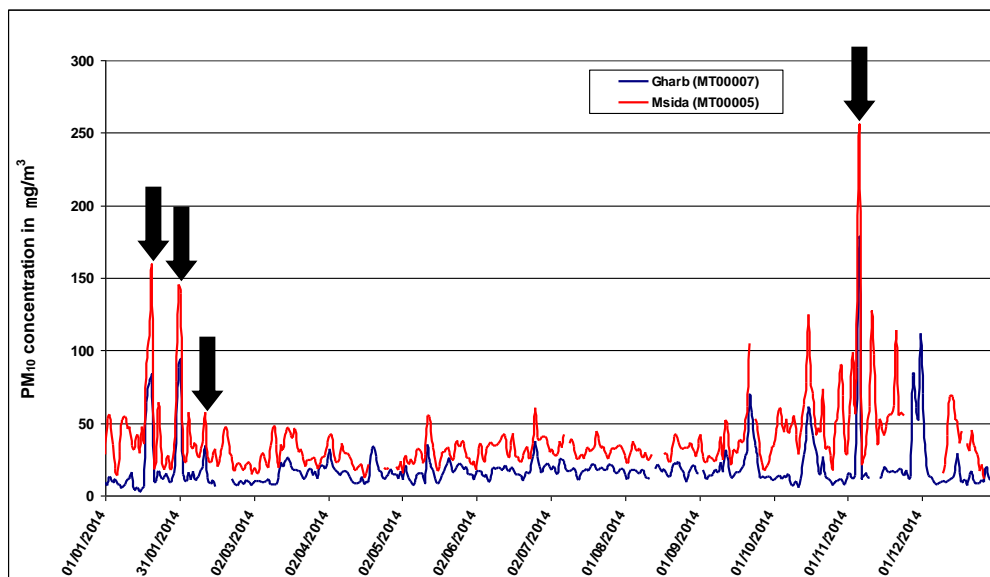


Figure 1: Comparison of the PM₁₀ levels in Għarb (blue) to the PM₁₀ levels in Msida (red) measured in 2014. The black arrows show some of the Saharan events throughout 2014.

n) The PM₁₀ dataset shall in no case consist of <42 or <63 (depending on whether the baseline monitoring period has been set for 6 or 9 weeks) daily readings, excluding any discarded readings.

Baseline levels of NO₂.

o) Baseline levels of NO₂ shall be determined using EN 14211:2005. The consultant may use passive diffusive tubes if it is shown that the latter are equivalent to the reference method.

p) If the consultant opts for passive diffusion tubes, he shall forward at least 1 article in a peer reviewed journal e.g. Pfeffer *et al.* (2010) – *Gefahrstoffe-Reinhalt der Luft*. 70, 500-506, which shows that the equivalence of these tubes has been demonstrated for field trials (not exposure chambers) in at least 1 EU Member State. Equivalence should preferably, also have been demonstrated in Malta. The field trial shall include the comparison of at least 40 individual measurements taken throughout a whole calendar year. Equivalence

shall be determined using a modification of European Commission's method for the determination of equivalence for PM₁₀; any other method shall be deemed unacceptable

- q) The sampling point for NO₂ shall be the same as for PM₁₀.
- r) The sampling time shall be identical to the one for PM₁₀ (i.e. no less than 6 weeks and extendible by a further 3 weeks depending on the nature of the case). The consultant shall use a scale up factor to scale this up to a yearly average. The scale up factor shall be forwarded by ERA to the consultant.

Annualisation of the 6 (or 9) week averaged values for PM₁₀ and NO₂.

- s) The factor in l) and p) above shall be based on the use of the following equation (adapted from LAQM TG(16), April 2016 version:

$$CAA = \frac{p_{y+1}^{x \text{ weeks}}}{p_y^{x \text{ weeks}}} \times P_y^{52 \text{ weeks}}$$

Where:

CAA is the corrected annual average;

$p_{y+1}^{x \text{ weeks}}$ is the concentration of NO₂ or PM₁₀ measured by the consultants throughout the 6 (9) week (baseline) monitoring period;

$p_y^{x \text{ weeks}}$ is the concentration of NO₂ or PM₁₀ measured throughout the same 6 (9) week monitoring period of the preceding year at a comparable ERA fixed station; and

$P_y^{52 \text{ weeks}}$ is the annual average of NO₂ or PM₁₀ measured at the comparable ERA fixed station.

Traffic Counts.

- a) The consultant shall also take traffic counts at the main junctions near the monitoring site. The number and location of the counters are to be approved by ERA, (unless longer term traffic counts are already available).
- b) The traffic count shall take into consideration the vehicle type and the legislation class.
- c) The consultant shall use an appropriate model in order to scale the traffic counts obtained during the 6 (or 9) week period to AADT.

3. Modeling

- a) Once the baseline levels have been obtained the consultant shall determine the impact of the project on air quality through dispersion modeling.



- b) The following models are deemed acceptable by ERA:
IMMIS^{em}
BREEZE Roads.
ADMS-Urban
- c) The model used should use the logic outlined by e) below,
- d) The consultant shall use exclusively the emission factors in the latest version of the Handbook of emission factors for road transport emissions ([HBEFA v 3.2](#)). The average age of the Maltese vehicle fleet shall be taken as 13 years.
- e) The use of other emission factors is not acceptable.
- f) The consultant shall estimate the ambient background levels for both NO₂ and PM₁₀. The approach in Figure 2 below shall be deemed acceptable for both pollutants.

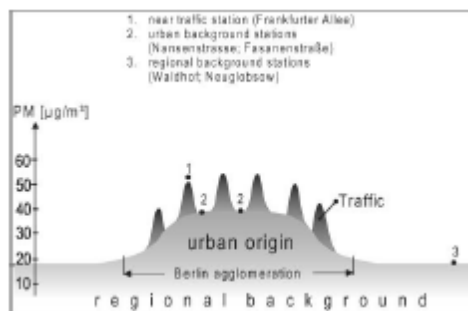


Figure 2: Horizontal profile for PM₁₀ concentration, Lenschow *et al.* (2001) – *Atmospheric Environment* 35, 29-33.

- g) The rural background can be captured through the use of the [EMEP](#) or [LOTOS-EUROS](#) model at a resolution of 50km × 50km (The [GAINS](#) model might have to be used for emissions data for the EU), the urban background can be captured through the use of a model such as [CHIMERE](#) at a resolution of 7km × 7km.
- h) The predictions of the model shall be assessed by comparing the modeled data to the monitoring data provided by the baseline studies. The modeled data must not deviate by more than ±20%.
- i) Other methods can be used in order to determine the background levels of NO₂ and PM₁₀, including statistical methods aimed at deriving “horizontal profiles” similar to the ones in Figure 1 (see e.g. Gómez-Losada *et al.*, 2016 – *Atmospheric Environment* 127, 255-261) and based on a full year’s dataset, interpolation of data from the nearest ERA diffusion tubes, etc.

- j) The consultant should clearly explain the rationale behind the determination of the background levels.
- k) The consultant shall use the model to project the annual PM₁₀ and NO₂ levels into the future, when the project is fully operational taking into account the cumulative impact of projects in the area, which have been granted development consent.
- l) The consultant shall model two distinct scenarios: A) without the project and B) with the project.
- m) Results shall be displayed as a colour-coded contour map with the modelled annual concentrations of NO₂ and PM₁₀ as well as the calculated 90.4th percentiles for the daily PM₁₀ levels (calculated using the equation in q) within a 3km radius and especially at the sensitive receptors in point 1e. The position of the sensitive receptors shall be clearly labeled.
- n) For the annual averages of NO₂ and PM₁₀ as well as for the 90.4th percentile of the PM₁₀ levels, the contour maps shall show the situation with the scheme and without the scheme.
- o) Contour plots for the 90.4th percentile of the PM₁₀ levels shall include the error in the prediction of this value, which shall be calculated using the equation in q).
- p) For the three criteria above the consultants shall also draw colour-coded contour maps expressing the difference in the annual levels/90.4th percentile, between the two scenarios (with and without the scheme) in terms of the significance criteria in 4 b) and 4 c).

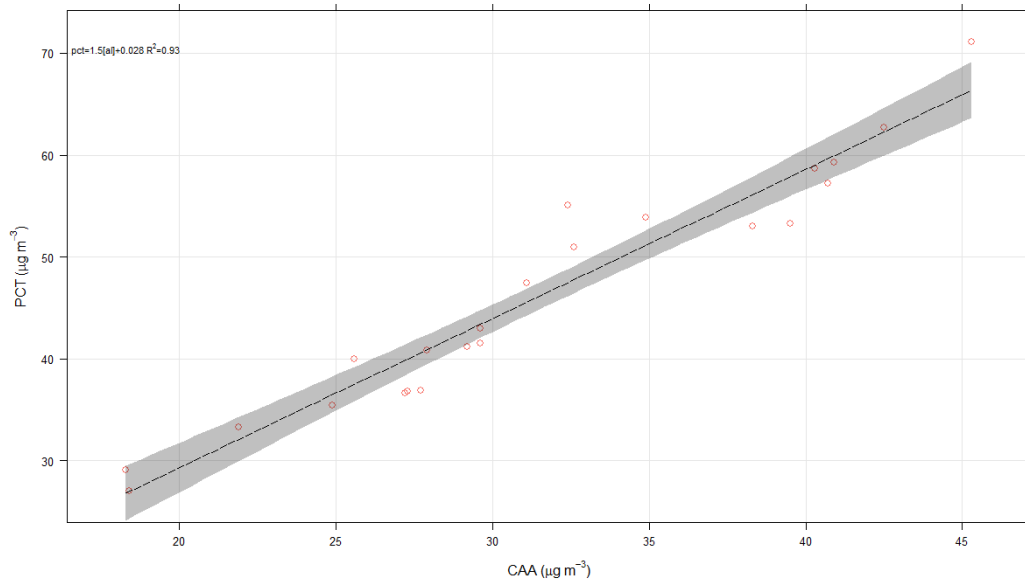


Figure 3: Plot of CAA vs PCT
see e.g. Querol *et al.* (2004) – *Journal of Aerosol Science* 35.9, 1151 – 1172.

- q) The consultant shall calculate the baseline of the 90.4th percentile of the daily PM₁₀ using the following equation:

$$\text{PCT} = (1.46 \times \text{CAA}) - 0.03$$

Where CAA (in $\mu\text{g/m}^3$) is the average of the 6 (or 9) week monitoring period and corrected to an annual average using a factor, which shall be determined by ERA, PCT is the 90.4th percentile of the daily PM₁₀ averages in $\mu\text{g/m}^3$. The equation above will be modified on a yearly basis by ERA.

- r) If $\text{PCT} > 50 \mu\text{g/m}^3$ then it is likely that the site is not in compliance with the 90.4th percentile criterion.
- s) The consultant shall also use the modeled annual levels for PM₁₀ (AA) to calculate the PCT due to the project using the same equation as in n) but substituting AA for CAA.
- t) For scaled up annual averages (CAA) $< 29 \mu\text{g/m}^3$ the consultants will not be obliged to analyse for compliance with the 90.4th percentile criterion.
- u) For NO₂ the consultant shall assume that the annual mean is always exceeded before the allowed number of hourly exceedances.
- v) Any assumptions must be clearly stated by the consultant.

4. Significance Criteria

- a) The following criteria of significance (adapted from IAQM's Planning for Air Quality Guidance, January 2017 version) shall be used by the consultant to determine the significance of the impact at all sensitive receptors and at any point within the 3km radius at which the impact of the project on traffic increases is the highest.
- b) A significance criteria tool shall be made available on the ERA website, for guidance and interpretative purposes.
- c) For annual levels of NO₂/PM₁₀ in µg/m³.

		Change in the annual NO ₂ /PM ₁₀ (dAA) levels due to scheme (µg/m ³).			
		dAA ≤ 0.4 µg/m ³	0.8 µg/m ³ ≤ dAA ≤ 2.0 µg/m ³	2.4 µg/m ³ ≤ dAA ≤ 4.0 µg/m ³	dAA > 4.0 µg/m ³
CAA for NO ₂ /PM ₁₀ (µg/m ³)	CAA ≥ 44µg/m ³	MODERATE	SUBSTANTIAL	SUBSTANTIAL	SUBSTANTIAL
	43.6 µg /m ³ ≤ CAA ≤ 41.2 µg/m ³	MODERATE	MODERATE	SUBSTANTIAL	SUBSTANTIAL
	40.8 µg /m ³ ≤ CAA ≤ 38.0 µg/m ³	SLIGHT	MODERATE	MODERATE	SUBSTANTIAL
	37.6 µg/m ³ ≤ CAA ≤ 30.4 µg/m ³	NEGLIGIBLE	SLIGHT	MODERATE	MODERATE
	CAA ≤ 30 µg/m ³	NEGLIGIBLE	NEGLIGIBLE	SLIGHT	MODERATE

- d) For compliance with the 90.4th percentile criterion for PM₁₀.

		Change in the PCT (dPCT) due to scheme (µg/m ³).			
		dPCT ≤ 0.5µg/m ³	1.0 µg/m ³ ≤ dPCT ≤ 2.5 µg/m ³	3.0 µg/m ³ ≤ dPCT ≤ 5.0 µg/m ³	dPCT > 5.0 µg/m ³
PCT (µg/m ³)	PCT ≥ 55µg/m ³	MODERATE	SUBSTANTIAL	SUBSTANTIAL	SUBSTANTIAL
	54.5 µg /m ³ ≤ PCT ≤ 51.5 µg /m ³	MODERATE	MODERATE	SUBSTANTIAL	SUBSTANTIAL
	51.0 µg /m ³ ≤ PCT ≤ 47.5 µg /m ³	SLIGHT	MODERATE	MODERATE	SUBSTANTIAL
	47.0 µg/m ³ ≤ PCT ≤ 38.0 µg/m ³	NEGLIGIBLE	SLIGHT	MODERATE	MODERATE
	PCT ≤ 37.5 µg/m ³	NEGLIGIBLE	NEGLIGIBLE	SLIGHT	MODERATE

- e) Whenever the impact of the project is determined to be “negligible” no further action will be required from the developer.
- f) If the impact of the project is classified as “substantially adverse” then ERA will not recommend approval unless the project is modified in such a way (including scaling down) that the significance of the impact is measurably lessened to at least “slightly adverse”. In this case a green travel plan will not be considered as sufficient.
- g) If the impact of the project is “moderate adverse” then the developer will be asked to modify the project. The modifications can include a green travel plan which has to include specific, measurable¹ and achievable objectives together with their respective implementation time-frames. The developer will be asked to finance at least in part, the implementation of the green travel plan. The implementation of the plan will have to be audited and eventually updated by the developer on a periodic basis. If the green travel plan does not lower the significance of the impact then the developer will be asked to take additional measures, which may include scaling-down the project.
- h) If the impact of the project is slightly adverse then the developer will be asked to consider alternatives, which will lessen the impact of the project.

¹ The term measurable in this context means that the green travel plan shall quantify the reduction in the pollutant levels (in $\mu\text{g}/\text{m}^3$), over the scenario leading to the classification of the impact as “moderately adverse”.

Concluding Remarks

- a) The air quality study shall consider the **cumulative** impact of all development taking place and/or which is planned for the site in question irrespective of the number of separate Planning Applications involved.

- b) If the applicant decides to develop a part of the site at some point in the future, then a full air quality study will be requested and this will have to consider the cumulative impact from the whole site, in line with the ERA Guidelines on the issue. This requirement will apply irrespective of the incremental increase in traffic flow as a result of the latter development.

ANNEX I

Site selection Criteria mention in Section 1 d) and in Section k).

- i. PM₁₀ samplers shall be sited at least 500m from:
 - a) dust piles;
 - b) construction/demolition/excavation sites & quarries;
 - c) dirt tracks;
 - d) un-asphalted surfaces;
 - e) surfaces which are visibly covered with dust; and
 - f) any other surface or activity likely to lead to the entrainment of dust
- ii. There shall be absolutely no bends in between the PM₁₀ sampling head/sampling inlet for NO₂ and the analyser.
- iii. The height of the PM₁₀ sampling head/sampling inlet for the NO₂ analyser/NO₂ passive diffusive tube shall be $\geq 1.5\text{m}$ and $\leq 4\text{m}$ above the ground.
- iv. For active samplers, the exhaust outlet shall be positioned in such a way that recirculation of the exhaust air to the sampling inlet is avoided.
- v. The distance of the PM₁₀ sampling head/sampling inlet for the NO₂ analyser/NO₂ passive diffusive tubes from the edge of any road junction shall be $\geq 25\text{m}$.
- vi. The PM₁₀ sampling head/sampling inlets for the NO₂ analyser/NO₂ passive diffusive tube shall be placed at $\leq 10\text{m}$ from the kerbside.
- vii. The flow around the PM₁₀ sampling head/sampling inlets for the NO₂ analyser/NO₂ passive diffusive tube shall be unrestricted, without any obstructions in the vicinity of the sampler i.e. free in an arc of at least 270°.
- viii. The PM₁₀ sampling head/sampling inlets for the NO₂ analyser/NO₂ passive diffusive tube shall in no case be at < 0.5 from the nearest building.

Note: The selection of the site is solely the consultants' responsibility. ERA will not waive the requirement for in situ monitoring due to erroneous readings resulting from poorly chosen monitoring sites. The 6 (or 9) week monitoring period will apply regardless of any time constraint the consultants might have. ERA will therefore not assume responsibility for any delays caused by this issue.

ANNEX II

(Projects identified in section 1f).

Projects falling within the scope of the following categories in Schedule I of LN 412 of 2017 are covered by the article above:

All Section 1 (*General land use*) projects depending on the type of project.

The following projects within Section 2 (*Transport Infrastructure Projects*):

Section 2.1 (*Roads*) - Category I

2.1.1.1;

2.1.1.2.

Section 2.1 (*Roads*) - Category II

2.1.2.1.

All projects in Section 2.2 (*Airports*) irrespective of the Category;

The following projects within Section 6 (*Development on the coast or at sea – including ports*):

Section 6.1 (*Ports, Marinas and Waterways*)

6.1.1.1;

6.1.1.2.

All the projects in Section 7 (*Urban Development and Recreational Projects*), with the exclusion of:

Section 7.1 (*Urban Development Projects*)

7.1.2.2;

7.1.2.3 unless it is accompanied by a Section 2, Section 6 or a Section 7 project, which is not covered by this exclusion.

Section 7.2 (*Recreational or Sporting Establishments*)

7.2.1.1;

7.2.2.3;

7.2.2.4.

The following projects within Section 12 (*Industrial Development*)

Section 12.7 (*Industrial Estates*)

12.7.2.1.

Section 13.0 (*Changes or Extensions to approved projects, and reactivation of projects*) on a case by case basis.