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Environment Monitoring Program Criteria and Results

<u>Water Monitoring</u>	Water has two dimensions closely linked to quantity and quality. Water quality is commonly defined by its physical, chemical, biological and aesthetic (appearance and smell) characteristics. As such, a healthy environment is one in which water quality supports a rich and varied community of organisms and protects public health. At QAIA, water is supplied through ground wells located within the airport. There are also two groundwater aquifers in the area: • B2/A7: ➢ Shallow groundwater aquifer overlain by an impermeable clay layer. ➢ Water table is approximately 80m - 150m below ground surface. ➢ Groundwater lateral flow is in the east direction from recharge areas to the west near Madaba. ➢ Good quality water, providing municipal supply to various areas across Jordan including QAIA. • Kurnub: ➢ Deep sandstone aquifer, from which there is relatively limited abstraction. In 2019, water samples were collected from more than 34 different sampling locations, with comprehensive tests conducted on water samples gathered from ground wells, airport reservoirs and third-party suppliers. The parameters were selected based on the requirements of the Jordanian Drinking Water Standards JS 286/2015. Moreover, network sites were tested for chlorine and main microbiological pollution indicators such as total coliform count (TCC) and E. coli. As for water pumped from groundwater wells, it is not directly used for drinking purposes as it gets pumped into reservoirs for disinfection using chlorine - in compliance with the guidelines issued by the Water Quality Higher Committee for 'Microbiological Standards on Raw Water Quality for Drinking Water Sources and Minimum Requirements of Treatment for Utilization of those Sources' in 2017.

	The overall results of the 2019 water monitoring program confirmed compliance with official Jordanian standard requirements. For a detailed overview of test parameters and frequency, please refer to the Environment, Health and Safety Plan here.
Domestic Wastewater Monitoring	The QAIA wastewater treatment plant (WWTP) was designed for an average flow of 1,889 m^3/day, a biochemical oxygen demand (BOD5) load of 755 kg/day and a BOD5 inlet concentration of 400 mg/L. Wastewater is pumped into the inlet channel for screening using a manual screen and then is passed through three oil separator tanks before being transferred to an equalization tank. Biological treatment based on activated sludge extended aeration technology takes place in parallel in two aeration tanks, followed by secondary clarifiers. Reclaimed water is then disinfected by adding chlorine before being discharged to two irrigation tanks. The effluent is currently used to irrigate QAIA's roadside plantation and the two olive orchards within the premises of the airport. Different samples were collected from the WWTP inlet and outlet - with test result averages summarized as below: • Average pH value at inlet was within the normal range (5.50 - 8.00 SU), which is suitable for the existence of most biological life forms including bacteria. This helps biological activities in wastewater, thus enhancing organic matter stabilization. • The ratio of average BOD5/average chemical oxygen demand (COD) is approximately 0.48, which falls within the typical range values for untreated municipal wastewater (0.3 - 0.8). This indicates that the wastewater is considered to be easily treatable using biological means. • Wastewater can be classified as strong - since the average BOD5 is 567 mg/L, which exceeds the benchmark value of 400 mg/L. Raw wastewater in Jordan is usually classified as strong, which can be attributed to the relatively low per capita water consumption rate. • Effluent water quality complied with the requirements of the Jordanian Standard JS 893/2006 for reclaimed domestic wastewater for all stated

	categories (i.e. categories I, II and III) - whereas the average concentration of heavy elements were below detection limits. • The average concentration of fat, oil and grease (FOG) in the effluent water was below 0.002 mg/L, compared to levels in the raw wastewater, which amounted to 0.263 mg/L, indicating high-level performance of the treatment plant in 2019. • The average efficiency of the WWTP in removing BOD5, COD and total suspended solids (TSS) exceeded 95%. For a detailed overview on wastewater tested parameters and frequency, please refer to the Environment, Health and Safety Plan here.
Biosolids Generated from Wastewater Treatment	Biosolids are the residual semi-solid materials generated from industrial or domestic wastewater treatment processes. The Wastewater Management Policy issued by the Ministry of Water and Irrigation addresses the management of wastewater as a water resource, encompassing operations such as development, collection, treatment and reuse. Biosolids (known as treated sewage sludge) are considered one of the beneficial by-products of the wastewater treatment plant (WWTP). In general, biosolids are a very good source of nutrients for soil. Using them as fertilizers can benefit the environment through the transformation of waste into valuable products. However, heavy metals such as nickel, zinc, copper, lead and cadmium can sometimes be found in biosolids, which may pose environmental issues and risks. Updated Jordanian Standard JS 1145/2016: Sludge for the use and disposal of biosolids - which replaces the one issued in 2006 - restricts the use of biosolids to improve soil properties in pasturelands only and the disposal of them in landfill sites. The standard classifies domestic biosolids into three main types: • Type (I) and Type (II): Biosolids that may be used to improve soil properties in pasturelands or can be disposed of in landfill sites. • Type (III): Biosolids that may only be disposed of in landfill sites. The standard also stipulates the following:

	• The use of untreated sludge is prohibited. • Biosolids must not be accumulated near water bodies, flood prone areas, irrigation channels and anywhere they may negatively impact the surface and groundwater. • In rainy areas, biosolids must be added to pasturelands before the beginning of rain season and is mixed with surface soil. • The biosolid user must check the nutrient content of the soil and actual nutrient requirements needed to improve soil quality. • In the case of accumulating and using biosolids, suitable conditions must be provided to prevent the spread of disease-carrying insects. • Biosolids should be mixed with the soil within two days from the time of application. • Biosolids should not be used for land reclamation purposes in areas with slopes exceeding 15%. • In the case of adding biosolids to locations near residential areas, the distance between the land of application and the residential area must not be less than one kilometer. • Livestock grazing can only be practiced after two months of biosolid application. • Indicative signs must be placed on lands to which biosolids were applied. • It is not allowed to apply amounts greater than 6 metric tons/hectare a year of the biosolids that comply with the requirements of the JS 1145/2016. Samples that were collected from the WWTP drying beds to assess biosolid quality showed compliance with the requirements of the Jordanian Standard JS 1145/2016 for Type (II). This means that such biosolids may be used for improving soil properties in pasturelands or can be disposed of in landfill sites.
<u>Industrial Wastewater</u>	Several companies, contractors and suppliers operate at QAIA and provide services relating to aircraft maintenance, logistics support, cargo, vehicle maintenance, supplies and jet fuel supplies, solid waste management, among others. Moreover, a pretreatment unit is available at different locations to remove oil and grease from industrial wastewater prior to connecting to the main sewer network.

	The quality of wastewater was assessed in line with the instructions of non-domestic wastewater discharge into the public sewerage network issued by the Ministry of Water and Irrigation in 2017, and according to the Jordanian Standard JS 202/2007 for Industrial Reclaimed Wastewater concerning its reuse in irrigation. The instructions focus on various aspects related to the quality of non-domestic wastewater to be discharged into the public sewerage network. Among these are the following: • It is prohibited to discharge wastewater with a fat, oil and grease (FOG) concentration of more than 100 mg/L and a phenol concentration of more than 5 mg/L into the sewerage network. • The summation of chromium, copper, nickel, cadmium, lead, silver, mercury, cobalt and selenium concentrations must not exceed 10 mg/L. • It is prohibited to discharge wastewater with a methylene blue active substances (MBAS) concentration of more than 40 mg/L into the sewerage network. • It is prohibited to discharge wastewater with a pH less than 5.5 SU or more than 9.5 SU into the sewerage network. • An extra fee is charged for discharging wastewater with a chemical oxygen demand (COD) of more than 1,500 mg/L, total suspended solids (TSS) of more than 700 mg/L and total dissolved solids (TDS) of more than 2,000 mg/L. The overall test results showed an excess of FOG concentration discharge at the main sewer network. Such test results are usually communicated to the concerned entity or authority. For a detailed overview of test parameters and frequency, please refer to the Environment, Health and Safety Plan here.
Soil Quality	Different samples were collected from areas irrigated with treated wastewater and underground fuel tanks used to supply boilers and generators. Since there is no official local Jordanian standard for soil quality, the Dutch Ministry of Housing, Spatial Planning and the Environment soil quality standards were adopted for assessment. The overall test results confirmed compliance with relevant standard requirements.

	For a detailed overview of test parameters and frequency, please refer to the Environment, Health and Safety Plan here.
Air Quality Monitoring	Airport International Group has two air quality monitoring stations located at predefined areas within QAIA. Air quality and weather data from both stations are collected automatically on a regular basis. One of the main objectives of this project is to provide efficient and accurate information on ambient air quality at QAIA and its surrounding areas - in view of potential future developments of the national economy and industries in Amman. Ambient air quality and meteorological parameters monitored at Airport International Group stations are: nitric oxide (NO)/nitrogen dioxide (NO2); particular matter that is 10 microns or less in diameter (PM_{10}); particular matter that is 2.5 microns or less in diameter (PM2.5); carbon monoxide (CO); ozone (O3); wind speed (WS); wind direction (WD); temperature (T); relative humidity (RH); and atmospheric pressure (AP). The common criteria used in the selection of air quality monitoring stations are as follows: • Realistic representation of receptors and emission sources in the region. • Most prevailing wind directions. • Availability of electric power. • Site accessibility. Ambient air quality monitoring data from station analyzers is acquired and stored locally at all monitoring stations using the SAM-WI Data Acquisition System. The data is then transferred to a central XR Premium database server located at the Airport International Group Environment, Health and Safety (EHS) Department - with the help of a global system for mobile communication (GSM) and public switched telephone network (PSTN) telephone lines - on a quarter-hourly to half-hourly basis. Data analysis is performed on an average of one, eight and 24 hours - and on a monthly average basis.

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Hourly monitoring data of each parameter is used for further analysis. Average data captured during 2019 for NO_2, PM_{10}, O_3, CO, T, WS, RH and AP was 99%.

Ambient Air Quality Pollutant Concentrations in 2019 can be summarized as below:

Air Quality Monitoring for NO_2	The annual average value of NO_2 was 13.3 ppb and 11.9 ppb, with the maximum value recorded being 46.3 ppb and 145.9 ppb at the Met and Volt stations, respectively. As such, there were no hourly exceedances against the Jordanian Standards for Ambient Air Quality No. 1140/2006 of 210 ppb, as well as yearly exceedances against the International Finance Corporation (IFC) guidelines of 22 ppb at any of the stations during the monitoring period.
Air Quality Monitoring for O_3	The annual average value of O_3 was 37.1 ppb and 46.8 ppb, with the maximum value recorded being 106.7 ppb and 171.8 ppb at the Met and Volt stations, respectively. As such, there were hourly exceedances against the Jordanian Standards for Ambient Air Quality No. 1140/2006 of 120 ppb at the Volt station during each month from April until August 2019. Moreover, there were exceedances against the IFC eight-hourly guidelines of 50 ppb at both the Met and Volt stations during the year.
Air Quality Monitoring for CO	The annual average value of CO was 0.5 ppm and 1.0 ppm, with the maximum value recorded being 2.1 ppm and 14.6 ppm at the Met and Volt stations, respectively. As such, there were no hourly exceedances against the Jordanian Standards for Ambient Air Quality No. 1140/2006 of 26 ppm at any of the stations during the monitoring period. Moreover, there is no prescribed limit for CO in the IFC guidelines.
Air Quality Monitoring for PM_{10}	The annual average value of PM_{10} was 62.5 µg/m³ and 71.4 µg/m³, with the maximum value recorded being 400.0 µg/m³ and 371.1 µg/m³ at the Met and

		Volt stations, respectively. As such, there were daily exceedances against the Jordanian Standards for Ambient Air Quality No. 1140/2006 of 120 µg/m³ from January until July and from September until December 2019, at both the Met and Volt stations. Moreover, both stations exceeded the IFC guidelines of 20 µg/m³ during the year.	
	Air Quality Monitoring for $PM_{2.5}$	The annual average value of $PM_{2.5}$ was 33.7 µg/m³ and 33.4 µg/m³, with the maximum value recorded being 248.2 µg/m³ and 303.6 µg/m³ at the Met and Volt stations, respectively. As such, there were exceedances against the Jordanian Standards for Ambient Air Quality No. 1140/2006 of 65 µg/m³ from January until May, in July and from September until December 2019 at the Met station, as well as from January until May and from September until December 2019 at the Volt station. Moreover, both stations exceeded the annual IFC guidelines of 10 µg/m³ during the year.	
Indoor Air Quality	Indoor air quality at different sites within QAIA are measured for short (15 minute) and long (24 hour) periods. The average concentrations of sulfur dioxide (SO_2), carbon monoxide (CO), nitrogen dioxide (NO_2), carbon dioxide (CO_2) and total volatile organic compounds (TVOC) at measurement sites confirmed compliance with Jordanian Regulation No. 43/1998 and the guidelines of the Occupational Safety and Health Administration (OSHA).		
Stack Emission Measurement	In 2019, emissions generated from boilers and generator stacks were measured and compared with the requirements of the Jordanian Standards. The results showcased compliance with the maximum allowable limits stated in the Jordanian Standards JS 1189/2006. For a detailed overview of test parameters and frequency, please refer to the Environment, Health and Safety Plan here		