

APPENDIX B

ENVIRONMENTAL INSTRUMENTAL MONITORING PLAN

Table B-1: Lot 1 Environmental Instrumental Monitoring Plan

Aspects/Parameters to be Monitored	Applicable Standards	Location	Means of Monitoring	Frequency	Implementation Responsibility	Reporting	Non-compliance Actions
Pre-construction/Site Preparation Phase							
Soils (Cu, Zn, Ni, Cr, Pb, As, Cd, TPH, Asbestos)	Georgian Standards for Soil Quality (Section D.6.6 of the EIA)	Tskere	Analytical methods	Once	Contractor	Results provided to RD/Engineer and Lenders prior to the start of construction.	N/A, used to confirm baseline
Ambient air quality (Particulates PM10, PM2.5, CO, NOx, SO2)	IFC standards for air quality (as specified in the Table of Section D.6.1 of the EIA)	Tskere	Instrumental measurement	Once	Contractor	Results provided to RD/Engineer and Lenders prior to the start of construction and included in the Air Quality Management Plan.	N/A, used to confirm baseline
Groundwater Quality	Georgian Standards for Water Quality (Section D.6.2 of the EIA)	Tskere, Kobi	Analytical methods/ standards - ISO, USEPA or similar	Once	Contractor	Results provided to RD/Engineer and Lenders prior to the start of construction and included in the Ground Water Management Plan.	N/A, used to confirm baseline
Construction Phase							
Ambient air quality (Particulates PM10, PM2.5, CO, NOx, SO ₂)	IFC standards for air quality (as specified in the Table of Section D.6.1 of the EIA)	Tskere, Kobi	Instrumental measurement	Monthly and in response to complaints from residents.	Contractor	Results provided to the Engineer and RD for initial review on a monthly basis. Results reported in Engineers Monthly reports and Contractors Quarterly Reports.	In the event of non-compliance with the standards, Contractor will cease works in the area of the monitoring until the source of pollution is identified and suitable mitigation measures are employed. After mitigation measures have been put in place monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Day time and night	IFC Noise level	Tskere, Kobi	Instrumental	Monthly and	Contractor	Results provided to	In the event of non-

Aspects/Parameters to be Monitored	Applicable Standards	Location	Means of Monitoring	Frequency	Implementation Responsibility	Reporting	Non-compliance Actions
time noise levels dB(A)	guidelines (Section D.6.4 of the EIA)		measurement	in response to complaints from residents.		the Engineer and RD for initial review on a monthly basis. Results reported in Engineers Monthly reports and Contractors Quarterly Reports.	compliance with the standards, Contractor will cease works in the area of the monitoring until the source of elevated noise is identified and suitable mitigation measures are put in place. After mitigation measures have been implemented monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Day time and night time vibration levels dB(A)	DIN 4150-3 (Section D.6.5 of the EIA)	3 sites: Tskere (including PCR sites) 3 sites: Kobi	Instrumental measurement	Continuous	Contractor	Results provided to the Engineer and RD for initial review on a daily basis. Results reported in Engineers Monthly reports and Contractors Quarterly Reports.	In the event of non- compliance with the standards, Contractor will cease works in the area of the monitoring until the source of elevated vibration is identified and suitable mitigation measures are put in place. After mitigation measures have been implemented monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Groundwater Quality	Georgian Standards for Water Quality (Section D.6.2 of the EIA)	Kobi	Analytical methods/ standards - ISO, USEPA or similar	Monthly and in response to complaints from residents.	Contractor	Results provided to the Engineer and RD for initial review on a monthly basis. Results reported in Engineers Monthly	In the event of non- compliance with the standards, Contractor will cease tunneling works until it can be confirmed by the Contractor that the

Aspects/Parameters to be Monitored	Applicable Standards	Location	Means of Monitoring	Frequency	Implementation Responsibility	Reporting	Non-compliance Actions
						reports and Contractors Quarterly Reports.	tunneling works will not impact upon water quality, or specific mitigation measures are put in place to prevent degradation of ground water. After mitigation measures have been implemented monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Surface water quality (turbidity, pH, conductivity, total petroleum hydrocarbons, COD, Coliforms)	Georgian standards (as specified in the Table of Section D.6.2 of the EIA)	4 sites: Baidara and Narvani river crossings (upstream and downstream the crossing area)	Analytical methods/ standards - ISO, USEPA or similar	Weekly during project activities implemented close to the river.	Contractor	Results provided to the Engineer and RD for initial review on a bi-weekly basis. Results reported in Engineers Monthly reports and Contractors Quarterly Reports.	In the event of non-compliance with the standards, Contractor will cease works in the area of the monitoring until the source of pollution/degradation is identified and suitable mitigation measures are put in place. After mitigation measures have been implemented monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Subsidence	N/A	Ground benchmarks/ Inclinometers in every 1km	Observation	Checking daily during tunneling.	Contractor	Results provided to the Engineer and RD for initial review on a daily basis. Results reported in Engineers Monthly reports and	In the event that subsidence is identified that may have significant impacts to the local community or have specific engineering impacts the Contractor will cease works

Aspects/Parameters to be Monitored	Applicable Standards	Location	Means of Monitoring	Frequency	Implementation Responsibility	Reporting	Non-compliance Actions
						Contractors Quarterly Reports.	in the area of the monitoring until suitable mitigation measures are put in place. No works shall commence until approval from the Engineer has been given.
Ground water level	N/A	Maximum six locations in Kobi, Tskere	Observation	Seasonally	Contractor	Results provided to the Engineer and RD for initial review. Results reported in Engineers Monthly reports and Contractors Quarterly Reports.	In the event of non-compliance with the standards, Contractor will cease tunneling works until it can be confirmed by the Contractor that the tunneling works will not impact upon water quality, or specific mitigation measures are put in place to prevent degradation of ground water. After mitigation measures have been implemented monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Operation (first year)							
Ambient air quality (Particulates PM10, PM2.5, CO)	IFC standards for air quality (as specified in the Table of Section D.6.1 of the EIA)	Tskere, Kobi	Instrumental measurement	Quarterly and in response to complaints from residents.	Contractor hired by RD	Results provided to the Lenders on a bi-annual basis.	No significant impacts to air quality have been identified in the EIA within the first ten years of operation. Monitoring is to be undertaken only to confirm the findings of the EIA.
Day time and night time noise and vibration levels dB(A)	IFC Noise level guidelines (Section D.6.4 of the EIA)	Tskere, Kobi	Instrumental measurement	Quarterly and in other sites in response to complaints	Contractor hired by RD	Results provided to the Lenders on a bi-annual basis.	No significant noise impacts in Tskere have been identified as part of the EIA. Monitoring to be undertaken to confirm this

Aspects/Parameters to be Monitored	Applicable Standards	Location	Means of Monitoring	Frequency	Implementation Responsibility	Reporting	Non-compliance Actions
				from residents.			is the case during the operational phase. Noise monitoring in Kobi will confirm if the noise barrier is effective. In the unlikely event of non-compliance the RD and Contractor (during his two year Defects Liability Period) will be responsible for managing this issue and ensuring additional measures are implemented for compliance, e.g. speed limits.
Surface water quality monitoring (turbidity, pH, conductivity, total petroleum hydrocarbons, COD, Coliforms)	Georgian standards (as specified in the Table of Section D.6.2 of the EIA)	4 locations (near the tunnel water discharge points and randomly in Baidara, Narvani)	Instrumental measurement	Twice a year	Contractor hired by RD	Results provided to the Lenders on a bi-annual basis.	In the event of non-compliance with regulations the RD will be responsible for upgrading the drainage system of the tunnels.

Table B-2: Lot 2 Environmental Monitoring Plan

Aspects/Parameters to be Monitored	Applicable Standards	Location	Means of Monitoring	Frequency	Implementation Responsibility	Reporting	Non-compliance Actions
Pre-construction/Site Preparation Phase							
Soils (Cu, Zn, Ni, Cr, Pb, As, Cd, TPH, Asbestos)	Georgian Standards for Soil Quality (Section D.6.6 of the EIA)	Benian-Begoni	Analytical methods	Once	Contractor	Results provided to RD/Engineer and Lenders prior to the start of construction.	N/A, used to confirm baseline
Ambient air quality (Particulates PM10, PM2.5, CO, NOx, SO2)	IFC standards for air quality (as specified in the Table of Section D.6.1 of the EIA)	Benian-Begoni	Instrumental measurement	Once	Contractor	Results provided to RD/Engineer and Lenders prior to the start of construction and included in the Air Quality Management Plan.	N/A, used to confirm baseline

Aspects/Parameters to be Monitored	Applicable Standards	Location	Means of Monitoring	Frequency	Implementation Responsibility	Reporting	Non-compliance Actions
Ambient air quality (Particulates PM10, PM2.5, CO)	IFC standards for air quality (as specified in the Table of Section D.6.1 of the EIA)	Kvesheti, Arakveti, Bedoni, Zakatkari, Benian-Begoni	Instrumental measurement	Monthly and in response to complaints from residents.	Contractor	Results provided to the Engineer and RD for initial review on a monthly basis. Results reported in Engineers Monthly reports and Contractors Quarterly Reports.	In the event of non-compliance with the standards, Contractor will cease works in the area of the monitoring until the source of pollution is identified and suitable mitigation measures are employed. After mitigation measures have been put in place monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Day time and night time noise levels dB(A)	IFC Noise level guidelines (Section D.6.4 of the EIA)	Kvesheti, Arakveti, Bedoni, Zakatkari, Benian-Begoni	Instrumental measurement	Monthly and in response to complaints from residents.	Contractor	Results provided to the Engineer and RD for initial review on a monthly basis. Results reported in Engineers Monthly reports and Contractors Quarterly Reports.	In the event of non-compliance with the standards, Contractor will cease works in the area of the monitoring until the source of elevated noise is identified and suitable mitigation measures are put in place. After mitigation measures have been implemented monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Day time and night time vibration levels dB(A)	DIN 4150-3 (Section D.6.5 of the EIA)	6 sites: All identified PCR sites that maybe affected by vibration.	Instrumental measurement	Continuous	Contractor	Results provided to the Engineer and RD for initial review on a daily basis. Results	In the event of non-compliance with the standards, Contractor will cease works in the area of the monitoring until the

Aspects/Parameters to be Monitored	Applicable Standards	Location	Means of Monitoring	Frequency	Implementation Responsibility	Reporting	Non-compliance Actions
						reported in Engineers Monthly reports and Contractors Quarterly Reports.	source of elevated vibration is identified and suitable mitigation measures are put in place. After mitigation measures have been implemented monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Surface water quality (turbidity, pH, conductivity, total petroleum hydrocarbons, COD, Coliforms)	Georgian standards (as specified in the Table of Section D.6.2 of the EIA)	2 sites: Tetri Aragvi and Khadistskali (upstream and downstream the crossing area)	Analytical methods/ standards - ISO, USEPA or similar	Weekly during project activities implemented close to the river.	Contractor	Results provided to the Engineer and RD for initial review on a bi-weekly basis. Results reported in Engineers Monthly reports and Contractors Quarterly Reports.	In the event of non-compliance with the standards, Contractor will cease works in the area of the monitoring until the source of pollution/degradation is identified and suitable mitigation measures are put in place. After mitigation measures have been implemented monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Subsidence	N/A	Ground benchmarks/ Inclinometers in every 1km	Observation	Checking daily during tunneling.	Contractor	Results provided to the Engineer and RD for initial review on a daily basis. Results reported in Engineers Monthly reports and Contractors	In the event that subsidence is identified that may have significant impacts to the local community or have specific engineering impacts the Contractor will cease works in the area of the monitoring until suitable

Aspects/Parameters to be Monitored	Applicable Standards	Location	Means of Monitoring	Frequency	Implementation Responsibility	Reporting	Non-compliance Actions
						Quarterly Reports.	mitigation measures are put in place. No works shall commence until approval from the Engineer has been given.
Ground water level and Groundwater Quality	Georgian standards (as specified in the Table of Section D.6.2 of the EIA)	One location in Khada Valley	Instrumental measurement	Seasonally	Contractor	Results provided to the Engineer and RD for initial review. Results reported in Engineers Monthly reports and Contractors Quarterly Reports.	In the event of non-compliance with the standards, Contractor will cease tunneling works until it can be confirmed by the Contractor that the tunneling works will not impact upon water quality, or specific mitigation measures are put in place to prevent degradation of ground water. After mitigation measures have been implemented monitoring will be repeated. This process will continue until compliance with the standards is met. No works shall commence until approval from the Engineer has been given.
Ambient air quality (Particulates PM10, PM2.5, CO)	IFC standards for air quality (as specified in the Table of Section D.6.1 of the EIA)	Kvesheti, Arakveti, Bedoni, Zakatkari, Benian-Begoni	Instrumental measurement	Quarterly and in response to complaints from residents.	Contractor hired by RD	Results provided to the Lenders on a bi-annual basis.	No significant impacts to air quality have been identified in the EIA. Monitoring is to be undertaken only to confirm the findings of the EIA.
Day time and night time noise and vibration levels dB(A)	IFC Noise level guidelines (Section D.6.4 of the EIA)	Kvesheti, Arakveti, Bedoni, Zakatkari, Benian-Begoni	Instrumental measurement	Quarterly and in other sites in response to complaints from residents.	Contractor hired by RD	Results provided to the Lenders on a bi-annual basis.	Noise monitoring in will confirm if the noise barriers are effective. In the unlikely event of non-compliance the RD and Contractor (during his two year Defects Liability Period) will be responsible for

Aspects/Parameters to be Monitored	Applicable Standards	Location	Means of Monitoring	Frequency	Implementation Responsibility	Reporting	Non-compliance Actions
							managing this issue and ensuring additional measures are implemented for compliance, e.g. speed limits.
Surface water quality monitoring (turbidity, pH, conductivity, total petroleum hydrocarbons, COD, Coliforms)	Georgian standards (as specified in the Table of Section D.6.2 of the EIA)	6 locations (near the tunnel water discharge points and randomly in Khadistskali and Tetri Aragvi)	Instrumental measurement	Twice a year	Contractor hired by RD	Results provided to the Lenders on a bi-annual basis.	In the event of non-compliance with regulations the RD will be responsible for upgrading the drainage system of the tunnels.

Table B-3: Estimated Instrumental Monitoring Costs

Lot 1					
Phase	Parameter	Unit Cost (\$)	# Units	Cost (\$)	Total Cost (\$)
Pre-construction	Soils	200	1	200	1,700
	Air	400	1	800	
	Groundwater	350	1	700	
Construction	Air	400	72	28,800	131,760
	Noise	400	72	28,800	
	Vibration	5,000	6	30,000	
	Ground water	350	48	16,800	
	Surface Water	380	72	27,360	
Operational (first two years)	Air	400	16	6,400	19,200
	Noise	400	16	6,400	
	Surface Water	380	16	6,400	
Lot 2					
Pre-construction	Soils	200	1	200	1,000
	Air	400	1	800	
Construction	Air	400	216	86,400	263,120
	Noise	400	216	86,400	
	Vibration	5,000	6	30,000	
	Ground water	350	16	5,600	
	Surface Water	380	144	54,720	
Operational (first two years)	Air	400	40	16,000	41,600
	Noise	400	40	16,000	
	Surface Water	380	24	9,600	