Environmental Impact Assessment

January 2017

Georgia: Batumi Bypass Road Project (Part 2)

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8. Anticipated Environmental Impacts and Mitigation Measures

407. During the scoping stage of the EIA process, several potential environmental and social impacts of the project were identified. The baseline surveys were conducted keeping in consideration the potential impacts. In this chapter, the potential environmental and social impacts are evaluated. The impacts have been identified based on consideration of the information presented in previous chapters. To avoid unnecessary repetition of supporting information, cross referencing to previous sections is given where necessary. Following the impact assessment, the mitigation measures related to each impact category is presented.

8.1 Impact Assessment Methodology

408. The general methodology used for impact assessment is described in this section. It describes the process of impact identification and definition, significance rating, the mitigation, management and good practice measures.

8.1.1 Identification of Significant Environmental Aspects

409. There are several guidelines and textbooks on identification and description of environmental and social impacts. These documents use various tools in an attempt to define a comprehensive and consistent method to capture the potential impacts of a proposed Project. However, it is now widely recognized by EIA practitioners that impact evaluation is not a purely objective and quantitative exercise. It has a subjective element; often based on judgment and values as much as scientific criteria. Recognizing this, a uniform system of impact description is used to enable the reviewers to understand how impacts have been interpreted. The description of each impact will have the following features:

- a definition of the impact using an impact statement identifying the Project activity or activities that causes the impact, the pathway or the environmental parameter that is changed by the activity, and the potential receptors of the impact (aspect-pathway-receptor)
- description of the sensitivity and importance value of the receiving environment or receptors (based on the stakeholder consultations undertaken)
- extent of change associated with the impact
- rating of the significance of the impact
- description of appropriate mitigation and management measures and potential effectiveness of the proposed measures
- characterization of the level of uncertainty in the impact assessment
- The significance of an impact is determined based on the product of the consequence of the impact and the probability of its occurrence. The consequence of an impact, in turn, is a function primarily of three impact characteristics:
    - magnitude
    - spatial scale

- timeframe

410. Magnitude is determined from quantitative or qualitative evaluation of a number of criteria including:

- sensitivity of existing or reasonably foreseeable future receptors
- importance value of existing or reasonably foreseeable future receptors, described using the following:
  - inclusion in government policy
  - level of public concern
  - number of receptors affected
  - intrinsic or perceived value placed on the receiving environment by stakeholders
  - economic value to stakeholders
- severity or degree of change to the receptor due to impact, measured qualitatively or quantitatively, and through comparison with relevant thresholds:
  - legal thresholds—established by law or regulation
  - functional thresholds—if exceeded, the impacts will disrupt the functioning of an ecosystem sufficiently to destroy resources important to the nation or biosphere irreversibly and/or irretrievably
  - normative thresholds—established by social norms, usually at the local or regional level and often tied to social or economic concerns
  - preference thresholds—preferences for individuals, groups or organizations only, as distinct from society at large
  - reputational thresholds—the level of risk a company is willing to take when approaching or exceeding the above thresholds

411. Spatial scale is another impact characteristic affecting impact consequence. The spatial scale of impacts can range from localized (confined to the proposed Project Site) to extensive (national or international extent). They also may vary depending on the component being considered.

412. The impact timeframe is the third principal impact characteristic defining impact consequence and relates to either its duration or its frequency (when the impact is intermittent). Impact duration can range from relatively short (less than four years) to long (beyond the life of the Project). Frequency ranges from high (more than 10 times a year) to low (less than once a year). These timeframes will need to be established for each Project based on its specific characteristics and those of the surrounding environment.

413. Once the impact consequence is described on the basis of the above impact characteristics, the probability of impact occurrence is factored in to derive the overall impact significance. The probability relates to the likelihood of the impact occurring, not the probability that the source of the impact occurs. For example, a continuous Project activity may have an unlikely probability of impact if there are no receptors within the area influenced by that activity.

414. The reversibility of each impact at the end of construction and operation are important, as these impacts may need on-going management after operation. The reversibility of each impact at the end of construction and operation will be noted and

described alongside the three primary characteristics of magnitude, spatial scale and duration.

415. The characteristics are outlined in **Table 8-1**.

Table 8-1: Characteristics Used to Describe Impact

Characteristics	Sub-components	Terms used to describe the impact
Type		Positive (a benefit), negative (a cost) or neutral
Nature		Biophysical, social, cultural, health or economic Direct, indirect or cumulative or induced
Phase of Project		Construction, operation, decommissioning or post closure
Magnitude	Sensitivity of receptor	High, medium or low capacity to accommodate change High, medium or low conservation importance Vulnerable or threatened Rare, common, unique, endemic
	Importance or value of receptor	High, medium or low concern to some or all stakeholders High, medium or low value to some or all stakeholders (for example, for cultural beliefs) Locally, nationally or internationally important Protected by legislation or policy
	Severity or degree of change to the receptor	Gravity or seriousness of the change to the environment Intensity, influence, power or strength of the change Never, occasionally or always exceeds relevant thresholds
Spatial scale	Area affected by impact - boundaries at local and regional extents will be different for biophysical and social impacts.	Area or Volume covered Distribution Local, regional, transboundary or global
Timeframe	Length of time over which an environmental impact occurs or frequency of impact when intermittent	Short term or long term Intermittent (what frequency) or continuous Temporary or permanent Immediate effect (impact experienced immediately after causative project aspect) or delayed effect (effect of the impact is delayed for a period following the causative project aspect)

Characteristics	Sub-components	Terms used to describe the impact
Probability - likelihood or chance an impact will occur		Definite (impact will occur with high likelihood of probability) Possible (impact may occur but could be influenced by either natural or project related factors) Unlikely (impact unlikely unless specific natural or Project related circumstances occur)
Reversibility/Sustainability		Potential for recovery of the endpoint from a negative impact Reversible or irreversible Sustainability for positive impacts
Confidence in impact evaluation (degree of certainty in the significance ascribed to the impact)		Scientific uncertainty – limited understanding of ecosystem (or community) and processes governing change Data uncertainty – restrictions introduced by incomplete or incomparable information, or by insufficient measurement techniques Policy uncertainty – unclear or disputed objectives, standards or guidelines

8.1.2 Impact Significance Rating

416. The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the approval process; secondly, it serves to show the primary impact characteristics, as defined above, used to evaluate impact significance. The impact significance rating system is presented in **Table 8-2** and described as follows:

- **Part A**: Define impact consequence using the three primary impact characteristics of magnitude, spatial scale and duration.
- **Part B**: Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
- **Part C**: Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from Part B) and the probability of occurrence.

417. Using the matrix, the significance of each described impact is rated.

Table 8-2: Method for Rating the Significance of Impacts

PART A: DEFINING CONSEQUENCE IN TERMS OF MAGNITUDE, DURATION AND SPATIAL SCALE *Use these definitions to define the consequence in Part B*			
Definition		Criteria	
MAGNITUDE		Negative	Positive
	Major	Large number of receptors affected Receptors highly sensitive and/or are of conservation importance Substantial deterioration, nuisance or harm to receptors expected Relevant thresholds often exceeded Significant public concern expressed during stakeholder consultation Receiving environment has an inherent value to stakeholders	Large number of receptors affected Receptors highly amenable to positive change Receptors likely to experience a big improvement in their situation Relevant positive thresholds often exceeded
	Moderate	Some receptors affected Receptors slightly sensitive and/or of moderate conservation importance Measurable deterioration, nuisance or harm to receptors Relevant thresholds occasionally exceeded Limited public concern expressed during stakeholder consultation Limited value attached to the environment	Some receptors affected Receptors likely to experience some improvement in their situation Relevant positive thresholds occasionally exceeded
	Minor	No or limited receptors within the zone of impact Receptors not sensitive to change Minor deterioration, nuisance or harm to receptors Change not measurable or relevant thresholds never exceeded Stakeholders have not expressed concerns regarding the receiving environment	No or limited receptors affected Receptors not sensitive to change Minor or no improvement in current situation Change not measurable Relevant positive thresholds never exceeded No stakeholder comment expected
TIMEFRAME (determine specific to each Project)		Duration of continuous aspects	Frequency of intermittent aspects
	Short term/ low frequency	Less than 4 years from onset of impact	Occurs less than once a year
	Medium term/ frequency	More than 4 years from onset of impact up to end of life of project (approximately 30 years)	Occurs less than 10 times a year but more than once a year
	Long term/ high frequency	Impact is experienced during and beyond the life of the project (greater than 30 years)	Occurs more than 10 times a year

SPATIAL SCALE (determine specific to each project)		Biophysical	Socio-economic
	Small	Within the project fence line or within 200 m of unfenced facilities	Within the municipality in which the activity occurs
	Intermediate	Within the district in which is the facilities are located	Within the province in which the activity occurs
	Extensive	Beyond the district in which the facilities are located	Beyond the province in which the activity occurs

PART B: DETERMINING CONSEQUENCE RATING

Rate consequence based on definition of magnitude, spatial extent and duration

MAGNITUDE	TIMEFRAME	SPATIAL SCALE		
		Small	Inter-mediate	Extensive
Minor	Short term / low frequency	Low	Low	Medium
	Medium term / frequency	Low	Low	Medium
	Long term / high frequency	Medium	Medium	Medium
Moderate	Short term / low frequency	Low	Medium	Medium
	Medium term / frequency	Medium	Medium	High
	Long term / high frequency	Medium	High	High
Major	Short term / low frequency	Medium	Medium	High
	Medium term / frequency	Medium	Medium	High
	Long term / high frequency	High	High	High

PART C: DETERMINING SIGNIFICANCE RATING

Rate significance based on consequence and probability

		CONSEQUENCE		
		Low	Medium	High
PROBABILITY (of exposure to impacts)	Definite	Low	Medium	High
	Possible	Low	Medium	High
	Unlikely	Low	Low	Medium

8.1.3 Mitigation, Management and Good Practice Measures

418. Wherever the Project is likely to result in unacceptable impact on the environment, mitigation measures are proposed (over and above the inherent design measures included in the Project description). In addition, good practice measures may be proposed however these are unlikely to change the impact significance. In the case of positive impacts, management measures are suggested to optimize the benefits to be gained. Where mitigation measures are required the impact will be rated again to show the residual impact after implementation of management controls.

419. The following mitigation hierarchy will be utilized in selecting practical mitigation measures for unacceptable impacts as follows (in order of preference):

- avoid the impact wherever possible by removing the cause(s)
- reduce the impact as far as possible by limiting the cause(s)
- ameliorate the impact by protecting the receptor from the cause(s) of the impact
- providing compensatory measures to offset the impact, particularly where an impact is of high significance and none of the above are appropriate.

8.2 Screening of Impacts

420. Based on the impact assessment methodology discussed in **Section 8.1**, **Table 8-3** presents the possible impacts of the proposed Project. Each impact is discussed further in this chapter.

Table 8-3: Initial Rating of Impacts

ID	Aspect	Phase	Impact	Receptors	Number of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Threshold (Legal or Other)	Magnitude	Duration of Continuous Aspect	Frequency of Intermittent Aspects	Timeframe	Spatial Scale	Consequence	Probability	Significance
1	Land Use	D	The change in land use due to the proposed Project is potentially incompatible with the existing land use and hence will affect the overall environmental quality in the Study Area	Overall EQ	H	M	M	None	Minor	Major		Medium	Small	L	Possible	L
2	Visual Impact	D	The proposed road will affect the visual and aesthetic quality in the Study Area	Nearby communities	M	M	M	None	Moderate	Moderate		Medium	Small	M	Possible	M
3	Visual Impact	C	Degradation of aesthetic value of the area due to construction activities	Nearby communities	M	M	M	None	Moderate	Minor		Short/ low	Small	L	Possible	L
4	Ecology and Habitat	C	Loss of habitat due to site clearance	Terrestrial flora, herpetofauna	M	M	L	Legal (for Red list species)	Moderate	Minor		Short/ low	Small	L	Definite	L
5	Ecology and Habitat	C	Pollution and waste generation during construction activities may deteriorate the surrounding habitats such as water bodies.	Overall EQ	M	L	L	None	Moderate		Moderate	Short/ low	Small	L	Possible	L
6	Ecology and Habitat	C	Lack of regulation may result in poaching of wildlife, especially birds, by staff.	Aviafuana	L	L	M	None	Minor		Minor	Short/ low	Intermediate	L	Possible	L

ID	Aspect	Phase	Impact	Receptors	Number of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Threshold (Legal or Other)	Magnitude	Duration of Continuous Aspect	Frequency of Intermittent Aspects	Timeframe	Spatial Scale	Consequence	Probability	Significance
7	Noise	C	Construction activities will generate noise which may result in annoyance, disturbance, stress.	Nearby communities	M	H	H	High (strict IFC and local regulations)	Major	Moderate		Short/ low	Small	M	Definite	M
8	Noise	O	Vehicles on the Project road will generate noise which may result in annoyance, disturbance, stress.	Nearby communities	M	H	H	High (strict IFC and local regulations)	Major	Major		Medium	Small	M	Definite	M
9	Vibration	C	Construction activities will generate vibration which may result in annoyance, disturbance, stress.	Nearby communities	L	M	H	None	Moderate	Minor		Short/ low	Small	L	Definite	L
10	Vibration	O	Vibration impacts unlikely of Project operation	Nearby communities	L	L	M	None	Minor	Major		Medium	Small	L	Definite	L
11	Air Quality	C	Construction activities will generate pollution which will deteriorate the air quality of the area.	Nearby communities	M	L	H	Moderate (IFC and local regulations)	Moderate	Minor		Short/ low	Intermediate	M	Definite	M
12	Air Quality	O	Vehicles on the Project road will generate pollution which will deteriorate the air quality of the area.	Nearby communities	M	L	M	Moderate (IFC and local regulations)	Moderate	Major		Medium	Intermediate	M	Definite	M
13	Water Resources	C	Construction may impact mountain springs including altering hydrology and damaging existing water infrastructure such as pipes and water collection units	Spring water users	L	M	M	None	Moderate		Minor	Short/ low	Small	L	Possible	L

ID	Aspect	Phase	Impact	Receptors	Number of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Threshold (Legal or Other)	Magnitude	Duration of Continuous Aspect	Frequency of Intermittent Aspects	Timeframe	Spatial Scale	Consequence	Probability	Significance
14	Land Stability	C	Excavation and site clearance will result in decreased slope stability which can result in landslides	Nearby communities, water bodies	L	H	H	None	Moderate		Minor	Medium	Small	M	Possible	M
15	Greenhouse Gas Emissions	C	Construction activities will generate Greenhouse Gas emissions	Global	H	L	L	None	Minor	Minor		Long/ high	Extensive	M	Definite	M
16	Greenhouse Gas Emissions	O	Project road will divert vehicles onto smoother road reducing net GHG emissions.	Global	H	L	L	None	Minor	Major		Long/ high	Extensive	M	Definite	M
17	Soil and Water Quality	C	Construction activities, especially excavation may damage old oil pipelines that can leak and contaminate soils and water.	Water and soils	M	M	M	None	Moderate		Minor	Short/ low	Small	L	Possible	L
18	Soil and Water Quality	C	Bridge construction at the oil terminal (near chainage 4310 m) may unearth contaminated soils which can contaminate the area if not handled properly.	Water and soils	L	M	M	None	Moderate		Minor	Short/ low	Small	L	Possible	L
19	Socioeconomic	D	A cemetery is within the RoW of the alignment and will be displaced resulting in sentimental impacts on the families.	Single family	L	M	M	None	Minor	Moderate		Short/ low	Small	L	Possible	L

ID	Aspect	Phase	Impact	Receptors	Number of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Threshold (Legal or Other)	Magnitude	Duration of Continuous Aspect	Frequency of Intermittent Aspects	Timeframe	Spatial Scale	Consequence	Probability	Significance
20	Socioeconomic	D and C	Access to residential and other land, via informal routes, may be hampered due to the Project road causing inconvenience to owners.	Households along the RoW	M	M	M	None	Moderate	Moderate		Medium	Small	M	Possible	M
21	Socioeconomic	C	Resettlement of households in the LARP may result in negative socioeconomic impacts to their wellbeing during the transition.	Households with the LARP	M	M	M	None	Moderate	Moderate		Medium	Small	M	Possible	M

	Number of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Threshold (Legal or Other)	Consequence	Significance
H	Large	Highly Sensitive	High	High	High	High
M	Moderate	Sensitive	Medium	Medium	Medium	Medium
L	Small	Not Sensitive	No or insignificant	Low or Not Applicable	Low	Low

8.3 Land Use

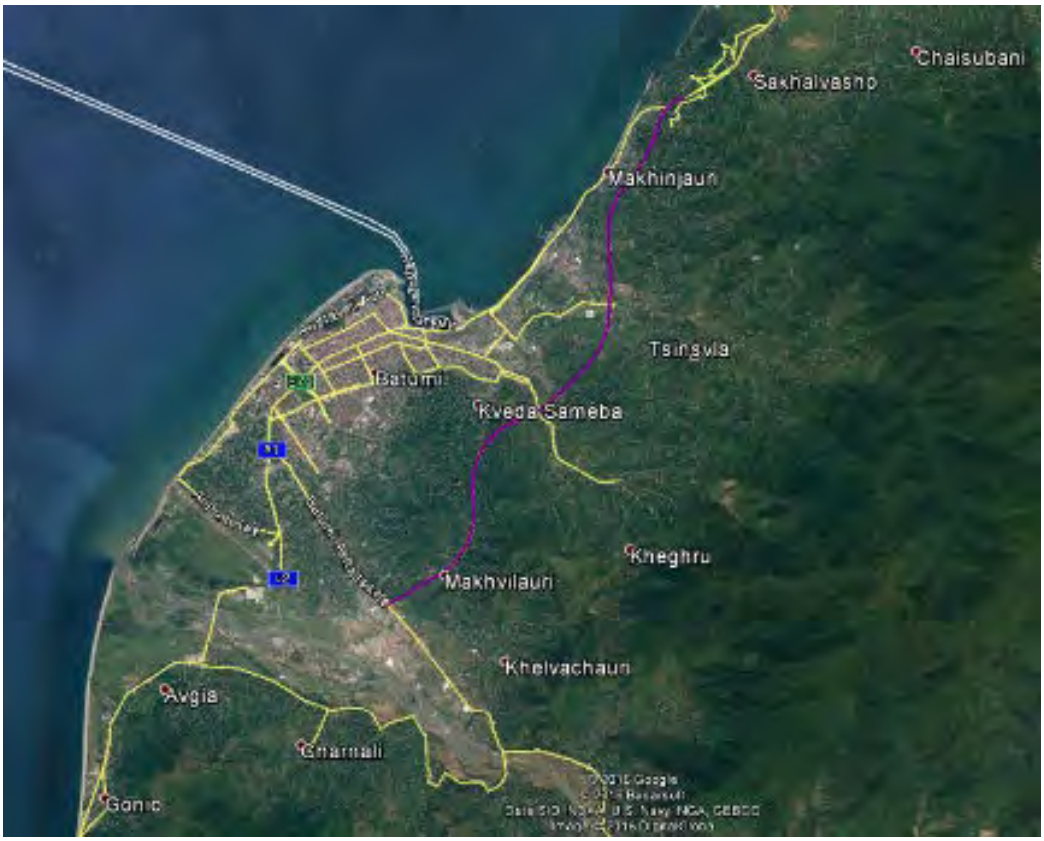
Phase	ID	Impact
Design	01	The change in land use due to the proposed Project is potentially incompatible with the existing land use and hence will affect the overall environmental quality in the Study Area

421. The current land use in the Study Area is discussed in Section 5.2.2. Nearly two-third of the land is covered with natural or planted vegetation. The footprint of the proposed Project is about 0.6 square km. Assuming that about half of it will require removal of vegetation, the proportion of natural habitat will reduce by about 1%.

422. There are various impacts of land use change also. For example, conversion of farmland and forests to urban development reduces the amount of land available for food and timber production; conversions of farmland and forests to urban development reduce the amount of open space and environmental amenities for local residents; and where the rural community has unique cultural identity, the urban development may result in the loss of the community's identify.

423. As shown in the Figure below, the Batumi Region can be distinctly divided into three regions. The westernmost region is the urban area of Batumi. The eastern area are the mountain region with very little human population. Whereas the central region, where the proposed Project, will be located is semi urban are characterized by farmland, orchards, and houses scattered across the landscape.

Figure 8-1: Urbanization of Batumi Area



424. The proposed Project will be constructed in an area which is already modified by human activities and cannot be considered as pristine. There is a network of roads that connects the villages located in the area. The entire area is accessible by road. Therefore, it cannot be argued that the change in land use is completely incompatible.

425. However, the presence of the road will be the first major urban infrastructure in the area. To minimize the impact of the change in land use, following mitigation measures will be used:

- Removal of vegetation under the bridges will be minimized
- As part of the restoration following the completion of the construction, all areas which are not required for the project will be planted with trees.

8.4 Visual Impact

Phase	ID	Impact
Design	02	The proposed road will affect the visual and aesthetic quality in the Study Area
Construction	03	Degradation of aesthetic value of the area due to construction activities

426. Visual impacts are the effects on people of the changes in available views through intrusion or obstruction and whether important opportunities to enjoy views may be improved or reduced. Visual impact to nearby receptors of the Project include:

- Degradation of aesthetic value of the area due to construction activities
- Permanent change in visual character due to proposed Project

427. The Project Area largely consists of mountainous valleys with large trees and bushes of heights greater than 2 m. The hilly landscape greatly restricts visibility to a less than one km at receptor locations. It is likely that some hiking trails are located in the Study Area, however, this is not a popular location for hiking and trekking and other areas further east of the Batumi are the preferred location.

428. The construction phase visual impact will be local and temporary. The activities during construction that will affect the aesthetics of the area include excavation, stacking of material onto stockpiles and dumping at the waste disposal areas. Borrow pits and quarry areas are to be excavated, useful material will be stacked to stockpiles whereas waste and spoils will be dumped to waste disposal areas. Quarries and borrow areas may leave a long-term scar on the hillsides.

- Minimize disturbance to, or movement of, soil and vegetation;
- Wherever possible back fill the pits that are not required;
- Undertake landscaping after the completion of the activities to match in with surrounding landscape;
- Reinstate vegetation; and
- Consider environmentally friendly design for structures particularly noise walls.

8.5 Ecology and Habitat

Phase	ID	Impact
Construction	04	Loss of habitat due to site clearance
Construction	05	Pollution and waste generation during construction activities may deteriorate the surrounding habitats such as water bodies.
Construction	06	Lack of regulation may result in poaching of wildlife, especially birds, by staff.

429. The main concerns for impacts on ecological receptors are disturbances caused by site clearance/preparation, the spread of invasive species and contamination of feeding, breeding and resting habitats. Another concern is poaching due to a lack of regulation.

430. In order to determine which species are likely to be impacted by the Project, all species listed as Vulnerable (VU), Near Threatened (NT), Endangered (EN) or Critically Endangered (CR) on the IUCN Red List were shortlisted and a selection process was devised taking into consideration the following:

- Species reported in the Project area
- Likelihood of species being found within the Project area based on habitat preference

431. The IUCN Red List species falling in one of the four categories (VU, NT, EN, CR) that are either reported from the Project area or likely to be present based on habitat preference were classified as receptors. The results of the selection process are presented in **Table 8-4**.

Table 8-4: Species Selection as Receptors

Species	IUCN Status	Reported from Project area (Yes/No)	Likelihood of presence in Project area based on habitat preference (Yes/No)	Classification as Receptor (Yes/No)
Plants				
Colchic Boxwood *Buxus colchica*	NT	Yes	Yes	**Yes**
Common Walnut *Juglans regia*	NT	Yes	Yes	**Yes**
Similar Laserwort *Laserpitium affine*	EN	No	No	No
Pontic Campanula *Campanula pontica*	VU	No	No	No
Astrantia-like Cow Parsley *Chaerophyllum astrantiae*	NT	No	No	No
Buckler Fern Dryopteris liliana	VU	No	No	No

Species	IUCN Status	Reported from Project area (Yes/No)	Likelihood of presence in Project area based on habitat preference (Yes/No)	Classification as Receptor (Yes/No)
Colchic Kemulariella *Kemulariella colchica*	VU	No	No	No
Lazetian Forget-me-not *Myosotis lazica*	NT	No	Yes	**Yes**
Colchis Water-Chestnut *Trapa colchica*	CR	No	Yes	**Yes**
Mammals				
Mehely's Horseshoe Bat *Rhinolophus mehelyi*	VU	Yes	Yes	**Yes**
Mediterranean Horseshoe Bat *Rhinolophus Euryale*	NT	Yes	Yes	**Yes**
Common Otter *Lutra lutra*	NT	Yes	Yes	**Yes**
Western Barbastelle *Barbastella barbastellus*	NT	No	Yes	**Yes**
Schreiber's Bent-winged Bat *Miniopterus schreibersii*	NT	No	Yes	**Yes**
Bechstein's Myotis *Myotis bechsteinii*	NT	No	Yes	**Yes**
Giant Noctule *Nyctalus lasiopterus*	VU	No	Yes	**Yes**
Birds				
Dalmatian Pelican *Pelecanus crispus*	VU	Yes	Yes	**Yes**
White-winged Scoter *Melanitta fusca*	VU	Yes	Yes	**Yes**
Imperial Eagle *Aquila heliacal*	VU	Yes	Yes	**Yes**
Greater Spotted Eagle *Aquila clanga*	VU	Yes	Yes	**Yes**
Egyptian Vulture Neophron percnopterus	EN	Yes	Yes	**Yes**

Species	IUCN Status	Reported from Project area (Yes/No)	Likelihood of presence in Project area based on habitat preference (Yes/No)	Classification as Receptor (Yes/No)
Black Vulture Aegypius monachus	NT	Yes	Yes	**Yes**
Saker Falcon *Falco cherrug*	EN	Yes	Yes	**Yes**
Red-footed Falcon *Falco vespertinus*	NT	Yes	Yes	**Yes**
Ferruginous Duck *Aythya nyroca*	NT	No	No	No
Bearded Vulture *Gypaetus barbatus*	NT	No	No	No
Caucasian Grouse *Lyrurus mlokosiewiczi*	NT	No	No	No
Velvet Scoter *Melanitta fusca*	VU	No	Yes	No
Yelkouan Shearwater *Puffinus yelkouan*	VU	No	No	No
Herpetofauna				
Caucasian Viper *Vipera kaznakovi*	EN	Yes	Yes	**Yes**
Caucasian Salamander *Mertensiella caucasica*	VU	Yes	Yes	**Yes**
Caucasian Toad *Bufo verrucosissimus*	NT	No	No	No
Northern Banded Newt *Ommatotriton ophryticus*	NT	No	No	No
Caucasian Parsley Frog *Pelodytes caucasicus*	NT	No	Yes	**Yes**
Derjugin's Lizard *Darevskia derjugini*	NT	No	Yes	**Yes**
Large-headed Water Snake *Natrix megalocephala*	VU	No	Yes	**Yes**

Species	IUCN Status	Reported from Project area (Yes/No)	Likelihood of presence in Project area based on habitat preference (Yes/No)	Classification as Receptor (Yes/No)
Invertebrates				
Fen Raft Spider *Dolomedes Plantarius*	VU	Yes	Yes	**Yes**
Fish				
Beluga/ Giant Sturgeon *Huso huso*	CR	Yes	Yes	**Yes**
Atlantic Sturgeon *Acipenser sturio*	CR	Yes	Yes	**Yes**
Fringebarbel Sturgeon *Acipenser nudiventris*	CR	Yes	Yes	**Yes**
Starred Sturgeon *Acipenser stellatus*	CR	Yes	Yes	**Yes**
Persian Sturgeon *Acipenser persicus*	CR	Yes	Yes	**Yes**
European Eel *Anguilla anguilla*	CR	No	Yes	**Yes**
Common Thresher Shark *Alopias vulpinus*	VU	No	No	No

432. The species found or likely to be found in the Project area, based on the selection were classified as receptors. The impacts on receptors, both generally based on category and for each species, are provided in **Table 8-5**. Specific mitigation measures for the impacts are also provided in **Table 8-5**.

Table 8-5: Species Impacts and Mitigation

Receptors	Impacts	Management and Mitigation Measures
Plants	Site Clearance • Loss of habitat • Rapid spread of invasive species hence native species are outcompeted • Close proximity of Mtirala NP (4 km) and the native, endemic and relict flora within it • Soil removal leading to a decrease in biological activity Pollution and Waste Generation • Dumping on vegetation • Contamination of soil • Dust Pollution Lack of Regulation • Introduction of invasive species	• Planting of native species • Use of measures to prevent the spread of invasive species including environmentally friendly pesticides • Monitoring surveys to identify growth of invasive species in the disturbed area • Replacement of top soil to restore conditions for biological activity • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife
Colchic Boxwood *Buxus colchica*	• The species will lose habitat as it is reported to be present in the Project area. • Spread if invasive species has not been identified as a major threat for this species, however, it is a relict species, therefore, the impact of the spread of invasive species will be more severe than for other species. In addition the main growing area is the Mtirala National Park located 4 km away	• Re-planting of the species
Common Walnut *Juglans regia*	• It will undergo loss of habitat as it is reported to be present in the Project area • Cutting of trees is already a threat to the species • It is rare in the Adjara region which makes it even more important within the Project area and for consideration in mitigation measures	• Re-planting of species. This is a key measure for this species as tree cutting is major threat and the species is rare in Adjara

Receptors	Impacts	Management and Mitigation Measures
Colchis Water-Chestnut *Trapa colchica*	• As this is an aquatic plant, site clearance will not impact the species • It is endemic to Georgia • Irresponsible dumping of waste that results in contamination of aquatic sites within the Study Area will cause habitat loss and mortality, especially since the species requires unpolluted, nutrient-rich water. • It is in important food source for birds and provides fish with spawning grounds, therefore, loss of this species will impact birds and fish fauna	• Use of sites designated for dumping to avoid polluting aquatic habitat • Mitigating impacts against this species will result in benefits to bird and fish fauna as well
Lazetian Forget-me-not *Myosotis lazica*	• Habitat loss will have an impact on the plants present within any cleared area	• Re-planting of the species
Mammals	Site Clearance • Loss of habitat will result in loss of suitable feeding, breeding and resting sites Pollution and Waste Generation • Contamination of water bodies • Contamination of the food chain • Noise Pollution • Dust Pollution Lack of Regulation • Hunting and poaching	• Re-plantation will result in some habitat restoration. Wildlife that will re-locate may return once planted vegetation is established • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain • Noise pollution should be minimized to reduce the disturbance to animals as far as possible • Dust pollution should be minimized to reduce disturbance to animals as far as possible • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project

Receptors	Impacts	Management and Mitigation Measures
Mehely's Horseshoe Bat *Rhinolophus mehelyi*	• Site clearance and presence of the Project will result in habitat fragmentation which are already documented threats for it • It may also lose feeding areas due to both habitat loss and contamination of the food chain • As it is reported to be present in the Project area it will affected by noise and dust pollution • The species is legally Protected in Georgia	• The species is legally protected in Georgia, therefore, if any specimens are found in the Project area or any roosting sites are identified, a specialist should be consulted on re-location of the bats • If bats are found within the Project area, pollution including noise, dust and contamination of nearby habitat should be prevented • Re-plantation is needed to for the re-establishment of feeding sites
Mediterranean Horseshoe Bat *Rhinolophus Euryale*	• The species is already facing a loss of foraging habitat. Construction of the Project is likely to result in further loss as the species has been reported to be present in the Project area • Urbanization is already a threat to the species, therefore, the Project's contribution to it could result in an increase in threat to this species • As it is reported to be present in the Project area it will affected by noise and dust pollution • The species is legally Protected in Georgia	• The species is legally protected in Georgia, therefore, if any specimens are found in the Project area or any roosting sites are identified, a specialist should be consulted on re-location of the bats • If bats are found within the Project area, pollution including noise, dust and contamination of nearby habitat should be prevented • Re-plantation is needed to for the re-establishment of feeding sites
Western Barbastelle *Barbastella barbastellus*	• The removal of mature woodland will impact the species as it prefers such habitat	• Clearance of mature woodland should be minimized as far as possible to preserve the species' habitat • Re-plantation and support to trees until they are established will increase chances of habitat restoration for the species
Schreiber's Bent-winged Bat *Miniopterus schreibersii*	• Impacts are expected to be low as the species is adaptable to living in artificial habitats including suburban areas	• Habitat loss should be minimized to avoid depletion of its food supply • Disturbances to caves should be minimized as that is present threat

Receptors	Impacts	Management and Mitigation Measures
Giant Noctule *Nyctalus lasiopterus*	• The removal of mature woodland will impact the species as it prefers such habitat	• Clearance of mature woodland should be minimized as far as possible to preserve the species' habitat • Re-plantation and support to trees until they are established will increase chances of habitat restoration for the species
Common Otter *Lutra lutra*	• The species is very unlikely to be affected as it is very rare in Adjara due to an already low food supply and conflict with commercial fisheries	• Although this species is reported to be present in the Project area, its distribution within Georgia does not overlap with the Study Area • If the species is observed in the Project area, a biodiversity specialist should be notified the specimens re-located
Birds	Site Clearance • Loss of habitat will result in loss of suitable feeding, breeding and nesting sites Pollution and Waste Generation • Contamination of water bodies. Can result in contamination of the breeding and resting grounds of congregatory bird species some of which include the Red-necked Grebe, Great White Pelican and the White Stork • Contamination of the food chain • Noise Pollution • Dust Pollution Lack of Regulation • Hunting and poaching • The migratory season is through August and September so restrictions should be placed during this period	• Re-plantation will result in some habitat restoration. Wildlife that will re-locate may return once planted vegetation is established • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain, especially of water bodies which are very important for bird fauna in and around the Study Area • Noise pollution should be minimized to reduce the disturbance to birds as far as possible • Dust pollution should be minimized to reduce disturbance to birds as far as possible • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project

Receptors	Impacts	Management and Mitigation Measures
Dalmatian Pelican *Pelecanus crispus*	• The species does not inhabit areas typical of those in the Study Area, however, it does breed in dense aquatic vegetation so any such habitat in or around the Study Area that is lost will result in loss of breeding sites for this species • Contamination of aquatic habitat, due to improper waste disposal, will contaminate the species' food source • Shooting is a threat, therefore, is a target for those engaged in hunting	• If vegetation around aquatic habitat is disturbed it should be re-planted at similar sites to facilitate the development of habitat to replace that lost • Contamination of aquatic areas should be prevented to minimize risk of contamination of its food source • Staff should not engage in hunting as this species is often targeted
White-winged Scoter *Melanitta fusca*	• The main impact on this species is from pollution from improper disposal of waste	• Improper waste disposal should be avoided to minimize the risk of contamination of aquatic habitat which, as pollution is one of the threats to this species
Imperial Eagle *Aquila heliacal*	• The main impacts will be from habitat loss, mostly indirectly as the prey base of the species can be impacted • The species is legally Protected in Georgia	• Re-plantation should be done to restore habitat as far as possible to prevent decline in the species' prey base • Staff should not engage in hunting as this species can be targeted and is legally protected in Georgia
Greater Spotted Eagle *Aquila clanga*	• The Project will result in habitat loss which will impact the species directly or indirectly as it is affected by urbanization and loss of habitat.	• Re-plantation to restore habitat is important to minimize impacts on this species, both direct and indirect
Egyptian Vulture *Neophron percnopterus*	• The Project will result in a loss of habitat • The species can also suffer from being shot	• Re-plantation to restore habitat is important. In particular this species forages around human settlements, therefore, the likelihood of loss of habitat for it is higher than for other bird species • Staff should not engage in shooting of wildlife as this species is sometimes targeted
Black Vulture *Aegypius monachus*	• The main impact will be from reduced food availability due to loss of habitat • Human-caused mortality, for example, by hunting, is also possible	• Re-plantation to restore habitat is important as one of the threats to this species reduced food availability • Staff should not engage in shooting of wildlife as this species is sometimes targeted

Receptors	Impacts	Management and Mitigation Measures
Saker Falcon *Falco cherrug*	• The species will not face impacts related to the Project with the possible exception of some habitat loss indirectly impacting it by causing a loss in prey	• Re-plantation to restore habitat is important
Red-footed Falcon *Falco vespertinus*	• The species will be impacted by habitat loss as destruction of suitable nesting sites is a threat it is facing	• Re-plantation is important to restore habitat so that the species can have alternative nesting sites to replace those destroyed by the Project
Migratory species	• The main impact will be due to hunting	• Staff should not engage in hunting as migratory bird species are targeted by hunters in Batumi
Herpetofauna	Site Clearance • Loss of habitat will result in loss of suitable feeding, breeding and resting sites • Loss of habitat on site especially because of limited mobility • Loss of habitat in nearby surrounding area is especially important because of their limited ability to relocate • Risk of being killed by Project-related activities such as movement of equipment Pollution and Waste Generation • Contamination of water bodies • Contamination of the food chain • Noise Pollution • Dust Pollution Lack of Regulation • Hunting and poaching	• Re-plantation will result in some habitat restoration. Reptile and amphibian species that will re-locate may return once planted vegetation is established • Any herpetofauna species observed during construction activities should be re-located with assistance from a biodiversity expert to ensure proper handling • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain • Noise pollution should be minimized to reduce the disturbance to herpetofauna species as far as possible • Dust pollution should be minimized to reduce disturbance to herpetofauna species as far as possible • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project

Receptors	Impacts	Management and Mitigation Measures
Caucasian Viper *Vipera kaznakovi*	• The species will be impacted by habitat loss • It will also be impacted by Project –activities as it is known to inhabit disturbed areas • The Project will contribute towards urbanization which is a threat to the species, therefore, it will be impacted by the Project • The species is legally Protected in Georgia	• Re-plantation to restore habitat is important • Care should be taken when carrying out Project-related activities even in areas that are already disturbed • If the species is spotted, the specimens should be re-located with the help of a biodiversity specialist to ensure proper handling
Caucasian Salamander *Mertensiella caucasica*	• Habitat loss and fragmentation will impact the species as these are already threats to it • Tree felling is also a threat, therefore, site clearance will impact the species especially near small streams	• Re-plantation to restore habitat is important • If the species is spotted, the specimens should be re-located with the help of a biodiversity specialist to ensure proper handling
Caucasian Parsley Frog *Pelodytes caucasicus*	• Habitat loss will impact the species as it relies on dense vegetation (bushes and grasses) • Loss of pools and small ponds will also impact the species as it is also found in such habitats • Pollution of aquatic habitat will also impact the species	• Disturbance to pools and small pond habitats should be minimized to preserve the species' habitat • Re-plantation to restore habitat is important • If the species is spotted, the specimens should be re-located with the help of a biodiversity specialist to ensure proper handling
Derjugin's Lizard *Darevskia derjugini*	• Loss of damp forest areas will impact the species as these are typical habitats • Deforestation is a current threat	• Re-plantation to restore habitat is important • If the species is spotted, the specimens should be re-located with the help of a biodiversity specialist to ensure proper handling
Large-headed Water Snake *Natrix megalocephala*	• Loss of Colchis type forests will impact the species especially loss of evergreen undergrowth	• Disturbance of undergrowth in Colchis type forests should be minimized as far as possible to preserve the species' habitat • Re-plantation to restore habitat is important • If the species is spotted, the specimens should be re-located with the help of a biodiversity specialist to ensure proper handling

Receptors	Impacts	Management and Mitigation Measures
Invertebrates	Site Clearance • Loss of habitat will result in loss of suitable feeding, breeding and nesting sites Pollution and Waste Generation • Contamination of water bodies • Contamination of the food chain • Noise Pollution • Dust Pollution	• Re-plantation will result in some habitat restoration. Wildlife that will re-locate may return once planted vegetation is established • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain, especially of water bodies which are very important for invertebrates • Noise pollution should be minimized to reduce the disturbance as far as possible • Dust pollution should be minimized to reduce disturbance as far as possible
Fen Raft Spider *Dolomedes Plantarius*	• The species will be impacted by loss of pools and ditches, which are its habitats • It will also be impacted by contamination of water, especially increase in turbidity, as it requires relatively clear water • Its foraging and reproduction, both will be impacted by removal and contamination of standing or slow-moving water	• During re-plantation, some habitat that is restored should be ponds and small bodies of water so that the species can re-colonize
Fish	Pollution and Waste Generation • Contamination of water bodies can result in contamination of habitat used for breeding by migratory species like the Sturgeons. These rivers are especially important for their juvenile life stage • Contamination of the food chain Lack of Regulation • Hunting and poaching	• Use of sites designated for dumping to avoid polluting ecologically important aquatic habitat • Use of sites designated for dumping will also prevent contamination of the aquatic food chain • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project

Receptors	Impacts	Management and Mitigation Measures
Sturgeon Species	• All the Sturgeon species reported from the Project area will be impacted by pollution of rivers because they migrate into the rivers and breed • The impact is not expected to be high as the rivers reported to be used by these species are not in the Study Area, however, one, the Chorokhi River is adjacent to the Study Area and is important for them • The juveniles of Sturgeon species will be most impacted by contamination of riverine habitat • Sturgeon species will be impacted by poaching by staff. Poaching is already a threat to these species	• Dumping of waste should not be carried out in the riverine habitat or any aquatic habitat that connects to the river system • Hunting and poaching should be prevented to protect species especially the Sturgeon species for whom this is already a threat
European Eel *Anguilla anguilla*	• The species will be impacted by pollution of any aquatic habitat as it inhabits a range of aquatic habitats from small streams to large rivers and lakes. It occurs in natural bodies connected to the sea, which are present in the Study Area, and adjacent to it • The causes of decline are not well understood, therefore, it cannot be said with certainty whether pollution of aquatic habitat will impact the species. However, the accumulation of lipophilic chemical pollutants is indicated as a threat to adults	• Dumping of waste should not be carried out in the riverine habitat or any aquatic habitat that connects to the river system • It is indicated that adults may be at risk from accumulation of lipophilic chemical pollutant, therefore, preventing contamination of aquatic habitats is very important for this species
Periphyton	Pollution and Waste Generation • Contamination of water bodies • Contamination of the food chain • Impacts on periphyton will impact other organisms as it makes up the base of the food chain in marine and freshwater ecosystems. The impacts can be felt through the ecosystem	• Use of sites designated for dumping to avoid polluting aquatic habitat • Impacts on periphyton should be minimized to avoid impacts on other organisms in the food chain

8.5.1 Site Clearance

433. The main effects of site clearance/preparation and movement of equipment include loss of habitat. The ecological receptors most affected include those that have limited mobility such as terrestrial flora, reptiles and amphibians. Loss of habitat can also affect more mobile species which lose breeding, nesting and feeding sites. The spread of invasive plant species is facilitated by disturbances (**Section 5.3.1**) such as site clearance and this results in a risk to the native, endemic and relict flora (**Section 5.3.1**).

434. The removal of vegetation, including up-rooting of shrubs and cutting of trees, will result in loss of plants, contributing to a decline in their numbers, as well as loss of habitat for species of mammals, birds, insects and herpetofauna that they provide. Fauna with limited mobility, such as reptiles, are at a greater risk of direct mortality due to Project-related activities such as movement of equipment. Site clearance may also result in loss of some pools and small, stagnant water bodies which are important habitat for invertebrate species such as the Fen Raft Spider. However, extensive loss of aquatic habitat due to site clearance and preparation is not a risk.

435. Terrestrial flora is at risk from disturbances such as site clearance because this can result in the spread of invasive species as they grow more rapidly than native species under these conditions (**Section 5.3.1**). The two species classified as being of conservation importance, the Colchic Boxwood *Buxus colchica* and Common Walnut *Juglans regia*, are of particular concern. The Project area is already modified by anthropogenic activity. Invasive species in Georgia include *Ailanthus altissima, Clerodendrum bungei, Miscanthus sinensinsis, Robinia pseudoacacia, Spiraea japonica* and *Vitex rotundifolia* of which *Ailanthus altissima* and *Robinia pseudoacacia* have distributions within Batumi (**Section 5.3.1**). However, Project-related activities can add to their spread. The close proximity (4 km from the Project) of the Mtirala National Park, an area that is home to numerous endemic and relict plant species of Georgia, is a concern as the increase in invasive species within the Project area can be followed by their spread to the National Park which threatens the native, endemic and relict species within it (**Section 5.3.1**). Site clearance/preparation and movement of equipment results in the removal of top soil which can negative influence several soil functions which are relevant in nature and environmental protection, e.g. carbon storage, and a decrease in biological activity.[177]

436. There are two herpetofauna species, the Caucasian Viper and the Caucasian Salamander, reported from the Project area. The Caucasian Salamander, in particular, is at risk because it is endemic to Georgia and Turkey (**Section 5.3.4**). Reptiles and amphibians have limited ranges and are unable to travel long distances unlike birds and mammals. As a result any individuals found within the Project area are at risk of either being killed by Project-related activities, or having suitable habitat destroyed and perishing as a result of their inability to re-locate.

437. Loss of habitat results in the loss of breeding, feeding and nesting sites for all species including highly mobile ones. Even though the Project is located in habitat modified by anthropogenic activity, certain bird species, such as the Endangered Egyptian Vulture is known to forage around human settlements (**Section 5.3.3**). However, no evidence of the presence of this species or its nests in or around the Project area is

[177] Geissen, V., S. Wang, K. Oostindie, E. Huerta, K. B. Zwart, A. Smit, C. J. Ritsema, and D. Moore. "Effects of topsoil removal as a nature management technique on soil functions." *Catena* 101 (2013): 50-55.

available. Mammal species of conservation importance that can suffer habitat loss include Mehely's Horseshoe Bat and Mediterranean Horseshoe Bat (**Section 5.3.2**). Invertebrate species that have limited mobility are more at risk than those that are more mobile. The Project is not expected to alter aquatic habitat, therefore, there is lower risk from site clearance/preparation and movement of equipment impacting aquatic ecology.

438. Site clearance/preparation will also result in habitat fragmentation. This will cause a disturbance in the connectivity of habitat. Individuals belonging to species with limited ranges will be most affected, especially species with limited mobility who will be unable to re-locate. An example of a species already at risk from habitat fragmentation is the Mehely's Horseshoe Bat.

8.5.2 Pollution and Waste Generation

439. Pollution and improper disposal of waste, generated during construction activities, poses a threat to surrounding flora and fauna. The ecological receptors at risk are not only those that have limited mobility but also more mobile receptors, such as migratory fish and bird fauna which pass through the Project area. Improper waste disposal can result in dumping on vegetation and contamination of soil which can result spread of contaminants into the ecosystem. Water bodies can also be contaminated. Both land and water pollution can result in contamination of the food chain. Pollution of water channels can put at risk both aquatic and terrestrial ecosystems. Pollution from noise and dust from construction activities will result in presently suitable habitat nearby becoming uninhabitable. It can also cause loss of suitable foraging and breeding sites.

440. Batumi and the nearby Chorokhi Delta (less than 3.75 km from the Project) are important habitat for numerous bird species, many of which are of conservation importance based on the IUCN Red List. Many of them are also migratory and congregatory species (**Section 5.3.3**). The Eastern Black Sea Flyway, which passes over Batumi, is an important migratory route for a number of waterbirds (migratory and wintering waterbirds), cranes and raptors (**Section 5.3.3**). Pollution as a result of noise and contamination of water puts their feeding and resting grounds at risk.

441. Pollution of water bodies such as the rivers and streams in and around the Project area can result in contamination of sites that may currently be suitable habitat for feeding and breeding of migratory fish species. Some of these species spend a part of their life in the rivers, especially when they are juveniles, therefore, the water quality in this habitat is important for their survival and reproduction (**Section 5.4.1**).

442. The phytoplankton in Batumi's rivers and coastal areas is already disturbed by pollution and other anthropogenic impacts (**Section 5.4.2**). Project-related activities can add to this if proper waste management and disposal practices are not followed. As phytoplankton is an important primary producer in marine and aquatic ecosystems, contamination can result in impacts to the entire ecosystem. One invertebrate species, the Fen Raft Spider, in particular, is of concern as uses aquatic habitat for breeding (**Section 5.3.5**).

8.5.3 Lack of Regulation

443. Staff involved on-site, such as workers and site managers, can engage in poaching and illegal exploitation of wildlife. This can result in the targeting of species of conservation importance including those currently under legal protection from hunting and exploitation. A number of bird species are also at risk, in particular, raptor species that pass through Batumi during the passage season (**Section 5.3.3**). There are reports that bird species of

conservation importance are shot during this season by indiscriminate hunting (**Section 5.3.3**).

444. Staff can introduce invasive species, such as alien plant species, which can have adverse impacts on native flora by out-competing them. Invasive can spread rapidly and pose a threat to the Mtirala National Park which has a number of endemic and relict plant species.

445. There are four legally protected species in the Project area, therefore, hunting should be avoided to avoid the risk of violation of laws (see **Section 8.5.6**).

8.5.4 Impacts on Ecosystems

446. Ecosystems[178] can be divided into terrestrial and aquatic ecosystems.

- The impact on terrestrial ecosystems will be limited, with the main one being due to loss of habitat from construction of the Project. The resulting habitat fragmentation will impact certain species but not all. Furthermore, loss of connectivity will be limited to the extent of the road.
- The spread of invasive species, however, if not prevented, will have an impact on the terrestrial ecosystem, especially on the composition of native flora. Under disturbed conditions invasive species will be able out-compete native flora and alter the plant community composition permanently.
- Irresponsible waste disposal will result in impacts on both terrestrial and aquatic ecosystems. Dumping on soil will reduce soil quality and inhibit biological activity, whilst dumping in water bodies will reduce water quality, which will impact the aquatic ecosystem. Contamination of both ecosystems will result in adverse impacts on the food chain for both terrestrial and aquatic organisms. The Study Area partially overlaps with an IBA, therefore, bird species dependent on resources in the Study Area or immediately surrounding areas will at risk from contaminated food chains.

8.5.5 Impacts on Wildlife Habitat

447. Impacts on wildlife habitat include habitat loss, fragmentation and loss of connectivity along pollution from noise, dust and irresponsible dumping of waste.

- Site clearance carried out for the Project will result in loss of habitat that is presently being used by wildlife.
- Construction activities will result in generation of noise and dust which will drive wildlife away from areas surrounding the Project site.
- Improper waste disposal will result in pollution which will contaminate soil and water resulting in a reduction in quality of habitat available for wildlife.
- During the operational life of the Project the habitat for wildlife will be fragmented and there will be loss of connectivity for certain species, especially herpetofauna and mammal species. Loss of connectivity will not impact birds and fish.

[178] An ecosystem is defined as a the complex of living organisms, their physical environment and all their interrelationships in a particular unit of space

8.5.6 Protected Species

448. There are four protected species in the Project area which include Mehely's Horseshoe Bat, Mediterranean Horseshoe Bat, Imperial Eagle and Caucasian Viper. Mitigation measures to ensure that the Project does not impact these species are provided in **Table 8-5**, for each species.

8.5.7 Mitigation Measures

449. As the habitat is classified as a Modified Habitat, examples of opportunities to protect and enhance it, based on ADB standards[179] include the following:

- assisting traditional forest users to protect and enhance areas of forest adjacent to the project by funding forest patrols to prevent illegal harvesting or fence installation to exclude livestock
- funding the replanting of degraded land or forest within a protected area or community forest
- funding the relocation of an endangered wildlife species to a protected area where it previously existed

450. The mitigation measures that will be incorporated to minimize the impacts on the ecological resources, in line with the ADB standards presented above are provided along their associated residual impacts:

- The implementation of the mitigation measures recommended in Table will 5 8 ensure that the impacts on wildlife and wildlife habitat are minimized. It will also result in colonize areas of r-restoration of habitat, therefore, any wildlife displaced can reestored habitat, successfully reproduce and establish their populations.
- Avoiding clearance of vegetation and disturbance of habitat where possible, including aquatic habitat (such as pools and small ponds) is important as these are important habitat for wildlife.
- Re-plantation to compensate for loss of vegetation and to restore habitat for fauna. Within the part of the Study Area that overlaps with the IBA, tree species used by birds can be planted including those used by the Endangered Egyptian Vulture.
- The re-planted vegetation should be monitored and supported until it establishes itself.
- Planting of native plant species and preventing the spread of invasive plant species, for example, by use of chemical or physical means of prevention of growth as well as removal. This will allow native species to colonize successfully.
- Re-plantation should be carried out in areas that are disturbed by the Project. These include areas that need to be restored as well as those located immediately around the Project structures, such as along the road-side. These area are most susceptible to the spread of invasive species, therefore, planting and ensuring the success of native species at these sites is most important. Re-planting in areas further from Project structures is also recommended as

[179] Asian Development Bank, December 2012, Environmental Safeguards, A Good Practice Sourcebook Draft Working Document

this will contribute towards habitat restoration and compensation for loss of habitat as a result of the Project. Factors such as soil conditions and likelihood of success of re-planted species at each site need to be taken into consideration in deciding the most suitable locations for each species to be re-planted.

- Monitoring the spread of invasive species using monitoring surveys. This will provide information on the spread of invasive species.
- The restoration of top soil is important because its removal can result in a negative influence on several soil functions including biological activity. Restoration will ensure soil functions are replaced as far as possible so that risks to biological activity are reduced.
- The plant species of conservation importance, Colchic Boxwood, Common Walnut, Lazetian Forget-me-not and Colchis Water-Chestnut are facing threats that are not Project-related (**Section 5.3.1**). Except those plants that come directly into the footprint of the road, the removal of these species should be avoided. However, mitigation measures to re-plant any of the four species of conservation importance removed by Project-related activities is recommended, preferably in a higher than 1:5 ratio of replantation to removal. This will ensure that the Project does not negatively impact their numbers in Georgia.
- Re-planted vegetation should be monitored and supported until it is established. This will provide them with the best chance of establishment.
- Providing wildlife crossings so that impacts of habitat fragmentation are minimized.
- Re-location of any specimens found while Project-related activities are being carried out, with the help of biodiversity experts to ensure proper handling. This is especially important for species of conservation importance. The practice will provide the best possible chance of survival for wildlife. Biodiversity experts can devise effective relocation plans, taking species-specific factors into consideration, to maximize the chances of success.
- If herpetofauna species are observed in the Project area, they should be removed to other suitable habitat, with the help biodiversity experts to ensure proper handling. Herpetofauna species are most at risk because of their limited ability to re-locate. These species are at higher risk because of their limited ranges. Also there are two species of conservation importance present here, the Caucasian Viper and Caucasian Salamander.
- If bird nests are observed, they should be carefully removed and placed in suitable habitat, with the help of biodiversity experts to ensure proper handling. An expert can help identify the species the nests belong to. If it is a species of conservation importance, special care should be taken. This will reduce the risk of mortality faced by them as a result of Project-related activities.
- Waste should be disposed without dumping on vegetation or allowing it to contaminate water ways. This will prevent contamination of habitat and the spread of pollution through the food chain.

- If roosting sites for bat species are identified, first priority needs to be given to protecting the roosting sites. However, in the absence of this option, biodiversity experts should be consulted. The bats should be re-located with the help of experts to ensure proper handling and development of a plan for relocation that maximizes chances of its success. Research into relocation of bats is limited with documented success of relocations even more so. It is recommended that the following characteristics be taken into consideration for the species being relocated, to both assess feasibility and develop an effective relocation protocol:[180]
    - Dispersal from the release site
    - Size of the founder group
    - Habitat quality at the release site
    - Disease transmission
    - Anthropogenic effects on the founder population
    - Post-release monitoring

  These factors have implications for establishing populations, effects of these populations on the release site, and ability to monitor translocation success following release.[181]

- Noise and dust pollution should be minimized to minimize disturbance to habitat surrounding the Project. This will reduce disturbance to wildlife as a result of Project-related activities.
- Hunting and exploitation of flora and fauna should be avoided by staff. In particular, hunting of birds during the passage season is practiced in the nearby Chorokhi Delta as well as in Batumi. The staff should also avoid bringing alien plant species into the Project facilities as these can spread and become invasive species. this will ensure that Project-related activities do not contribute to the mortality of bird species of conservation importance, however, it will not have any impact on the hunting that occurs annually in the area.
- It is notable that there are non-Project-related threats to many of the species mentioned. These threats, such as widespread hunting and habitat loss due to increase in agriculture, urbanization and pollution, will continue regardless of the construction and operation of the Project. Pollution of water bodies in Batumi is also an issue that is likely to continue regardless of the Project. Restrictions on hunting will limit animals lost that would otherwise be killed by staff engaging in it.

451. Mitigation and management measures for each species are provided in **Table 8-5**.

Significance of Impacts

452. If the mitigation measures suggested are implemented, the residual impacts of the Project will not be significant. The vegetation removed as a result of Project-related activities will be re-planted. Monitoring of re-planted vegetation and supporting it until it-

[180] Ruffell, Jay, Joshua Guilbert, and Stuart Parsons. "Translocation of bats as a conservation strategy: previous attempts and potential problems." Endangered Species Research 8 (2009): 25-31.

[181] Ibid

establishes will result in restoration of habitat that is lost due to the Project. Relocation of species with proper handling will ensure that that mortality of wildlife located within the Study Area is minimized. The prevention of the spread of invasive species by monitoring and removal will protect the native vegetation and increase the chance of native species, which are re-planted, to re-establish themselves.

8.6 Noise

Phase	ID	Impact
Construction	07	Construction activities will generate noise which may result in annoyance, disturbance and stress.
Operation	08	Vehicles on the Project road will generate noise which may result in annoyance, disturbance and stress.

453. Noise is undesirable or unwanted sound that interferes with normal human activities. Noise perception may be subjective. Its documented impacts include annoyance, disturbance, stress, and physical and psychological damage. If it disturbs the surrounding community (environmental noise), it is classified as nuisance and normally has no direct health impacts. However, long-term exposure to such noise may affect overall well-being of human beings. Exposure to very high noise levels (exceeding 85 dBA), particularly for prolonged period can cause hearing loss. This level of noise is usually encountered in the workplace around construction sites and is considered an occupational hazard.

454. In general, human sound perception is such that a change in sound level of 3 dB is just noticeable, a change of 5 dB is clearly noticeable, and an increase of 10 dB is perceived as a doubling of sound level

455. The following is a brief description of terminology used in this assessment:

- Sound: A vibratory disturbance created by a vibrating object, which, when transmitted by pressure waves through a medium such as air, is capable of being detected by a receiving mechanism, such as the human ear or a microphone
- Noise: Sound that is loud, unpleasant, unexpected, or otherwise undesirable
- Decibel (dB): A unitless measure of sound on a logarithmic scale, which indicates the squared ratio of sound pressure amplitude to a reference sound pressure amplitude. The reference pressure is 20 micro-pascals
- A-Weighted Decibel (dB(A)): An overall frequency-weighted sound level in decibels, which approximates the frequency response of the human ear. The typical human ear is not equally sensitive to all frequencies of the audible sound spectrum. As a consequence, when assessing potential noise impacts on people, an electronic filter is used that de-emphasizes certain frequencies in a manner corresponding to the human ear's decreased sensitivity to low and extremely high frequencies. All of the noise levels reported in this Section are A-weighted
- Equivalent Sound Level (Leq): The equivalent steady state sound or vibration level, which in a stated period of time, typically one hour, would contain the same acoustical or vibration energy.

- Maximum Sound Level (Lmax): The greatest A-weighted sound level, within a stated time interval. When the noise consists of a small number of discrete events, Lmax is a better indicator of the disturbance to sleep and other activities.

8.6.1 Construction Phase Impact

456. The potential noise related issue during construction of the project is disturbance to surrounding communities of the Project.

457. There is no continuous major anthropogenic source of noise in the communities. Intermittent sources include farm equipment and traffic. River noise is only the continuous source present at construction sites of the Project. Noise baseline conditions at the project construction sites in the villages is reported in **Section 5.2.10**.

458. The noise during the construction phase greatly depends on the stage of construction work and equipment used at the site. The construction activities can be divided into the following phases:

- Site clearing and preparation,
- delivery of equipment and materials to the site,
- excavation and tunnel construction,
- bored piling and concrete placement,
- erection of bridges, and
- finishing.

459. The main sources of noise and vibration during construction of the project are as follows:

- Construction machinery
- Drilling activities
- Haulage activities
- Concrete mixing and aggregate production systems,
- Vehicular movement; and
- Construction Camps

460. Criteria for Determining Significance is the World Bank guidelines for noise require that the sound level in residential areas should not exceed 55 dB(A) during the day and 45 dB(A) during the night. During construction period, it is likely that these standards will be exceeded for short duration during the day.

461. The potential sources of significant noise during the construction period include the construction machinery, generators at camps and construction related traffic. Precise prediction of noise due to construction activity at given location at a given time requires the list of all equipment that is operational at the time and the following information regarding each piece of equipment:

- The maximum and minimum noise levels, measured at a reference distance from the equipment, during a work cycle

- The fraction of time it operates at maximum level during a work cycle
- The usage factor, i.e., the number of hours during the day when the equipment is operational
- The distance of the equipment from the receptor
- Potential noise barriers and other topographic features that attenuate the sound.
- Atmospheric conditions—the wind speed and direction, humidity and barometric pressure—also affect the propagation of sound, however, for short distances the effect of these is insignificant compared to other variables.

462. The analysis presented in this Section is based on the approach recommended by Federal Highway Administration of the US Department of Transportation for assessment of construction noise and uses Roadway Construction Noise Model (RCNM) Ver 1.1, for the prediction of construction equipment noise.

463. Construction noise levels at the receptors would fluctuate depending on the type, number, distance from receptor, and duration of use of various pieces of construction equipment. In this analysis, first the noise level due to each piece of equipment, which is likely to be used in the construction, is calculated. The peak noise levels of construction equipment mainly used at a typical construction site, are shown in **Table 8-6**. The list includes all equipment except vehicles and some minor pieces of equipment. Using this data, the expected noise level, Leq(8-hr), is calculated. The predicted noise levels at 100 m from the source are shown in **Table 8-7**. It shows that the highest equivalent noise level for an 8-hour shift due to a single piece of equipment at a receptor, at a typical distance of 100 m from the source will be about 61 dB(A) during preparation stage.

464. When more than one piece of equipment are working simultaneously, the noise level at the receptor will increase. The attenuation due to topographic factors could be up to 2 dB(A). Good maintenance of equipment with installation of noise mufflers may also reduce the noise.

Table 8-6: Construction Equipment Noise (dB(A))

Equipment	Actual Max	Usage Factor (%)
Roads -Preparation Stage		
Dozer	81.7	30
Excavator	80.7	30
Grader	85	30
Roller	80.0	15
Rock Drill	81.0	15
Dump Truck	76.5	30
Roads - Completion Stage		
Compressor	77.7	30
Paver	77.2	30
Roller	80.0	15

Equipment	Actual Max	Usage Factor (%)
Tractor	84.0	30
Concrete mixer truck	78.8	30
Tunnel Mouth		
Jack Hammer	88.9	50
Tunnel		
Blasting	94.0	1
Bridge		
Boring Jack Power Unit	83.0	20

Source: Roadway Construction Noise Model

Notes:

[a] the fraction of time each piece of construction equipment is operating at full power (i.e., its loudest condition) during a construction operation

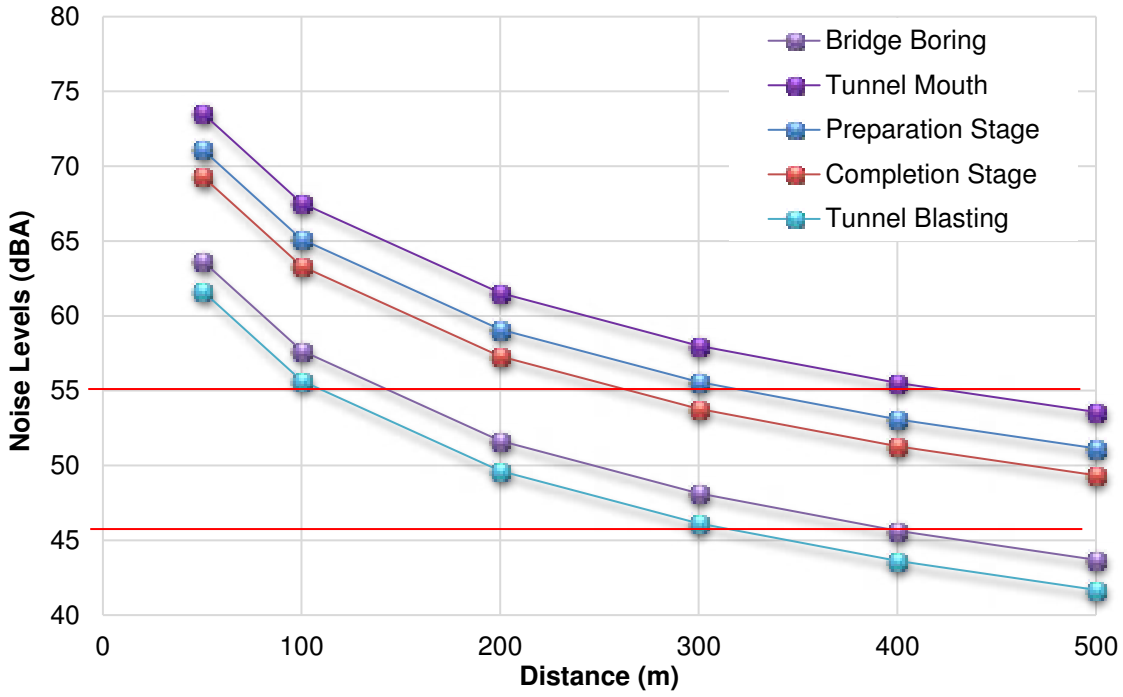
Table 8-7: Predicted Noise Level for Construction Equipment (dB(A))

Equipment	Actual Max	Usage Factor (%)	Leq (dB(A)) at Various Distance					
			50m	100m	200m	300m	400m	500m
Roads -Preparation Stage								
Dozer	81.7	30	64.2	58.1	52.1	48.6	46.1	44.2
Excavator	80.7	30	63.2	57.1	51.1	47.6	45.1	43.2
Grader	85	30	67.5	61.4	55.4	51.9	49.4	47.5
Roller	80.0	15	59.4	53.4	47.4	43.9	41.4	39.4
Rock Drill	81.0	15	60.4	54.4	48.4	44.9	42.4	40.4
Dump Truck	76.5	30	59.0	52.9	46.9	43.4	40.9	39.0
Roads - Completion Stage								
Compressor	77.7	30	60.2	54.1	48.1	44.6	42.1	40.2
Paver	77.2	30	59.7	53.6	47.6	44.1	41.6	39.7
Roller	80.0	15	59.4	53.4	47.4	43.9	41.4	39.4
Tractor	84.0	30	66.5	60.4	54.4	50.9	48.4	46.5
Concrete mixer truck	78.8	30	61.3	55.2	49.2	45.7	43.2	41.3
Tunnel Mouth								
Jack Hammer	88.9	50	73.6	67.6	61.5	58.0	55.5	53.6
Tunnel								
Blasting	94.0	1	61.7	55.7	49.6	46.1	43.6	41.7
Bridge								
Boring Jack Power Unit	83.0	20	63.7	57.7	51.7	48.1	45.6	43.7

465. For a more detailed impact assessment, the construction noise was calculated at distances starting from 50 m to 500 m to see the extent of spreading of noise and separately for surface, bridge and tunnel. The modeling results for construction noise are shown in **Figure 8-2.** Following assumptions were made during calculation:

- It was assumed that the equipment working simultaneously in preparation stage are; dozer, excavator, grader, road roller, rock drill and dumpers whereas in completion stage the equipment are; compressor, paver, road roller, tractor and concrete mixers.
- Blasting will not be used for excavation at the tunnel mouth and portal.
- Boring is used for bridges whereas the jack hammer is used for tunnel mouth.
- The estimated shielding was taken as 2 dBA. Shielding is the reduction in noise due to addition of mitigation measures like barriers and dirt mound.

Figure 8-2: Construction Noise



Note: The maximum sound levels (L_{MAX}) of blasting is highest of all construction activities but the above graph reports average sound levels (L_{EQ}) which is dependant on the frequency of the activity, which is low for blasting.

466. It can be seen that all the construction activities detailed above cannot take place at nighttime (22:00pm to 7:00am) except the boring which is meeting the nighttime limit at 400 m distance.

467. The overall construction noise at a distance of 100 m exceeds the prescribed 55/45 dB(A) limit. However, the resultant noise levels at the receptors when the construction work is carried out at a distance of the 500 m from the receptor could be in the range 45-55 dB(A). As a worst case, when the baseline noise level is over 60 dB(A) like in Kapreshumi In areas where the baseline noise level is high, say 60 dB(A), there the increase will be still less than 2 dB(A) and thus barely noticeable. Note that the above

statement is valid if there is a continuous non-fluctuating noise source. As the noise levels of construction equipment vary considerably, the community can easily notice the variation.

468. The proposed mitigation measures include:

- Equipment emitting excessive noise in comparison with other similar equipment will not be allowed to operate.
- Equipment under use will be regularly maintained, tuned, and provided with mufflers to minimize noise levels.
- Equipment in poor state of maintenance, particularly without effective noise control will be checked to determine if it can be improved, and replaced with less noisy equipment as soon as practicable.
- Blowing of horn will be prohibited within the construction zones except under emergency conditions.
- Close liaison with the community and regular monitoring of the noise levels in the community are key to successfully implementation of the above mitigation measures. Specifically, the communities will be informed of all major construction activities at least three days in advance. Noise control measures will be discussed with the community through informal and formal meetings.
- A complaint registering, tracking and redressal mechanism will be implemented.
- Noise levels will be monitored regularly in the community in order to take timely corrective measures, if needed.

8.6.2 Operation Phase Impacts

469. The impact of the traffic noise on the community is a major concern of the community. It is planned that all residential buildings within 25 m of the edge of the road will be acquired by the project. However, in many sections of the road there are houses located within 100 m of the road and there is a concern that the noise level in these houses will exceed the acceptable limits. Sources of noise from highway traffic includes:

- Engine noise mainly from exhaust, during acceleration and stopping
- Friction between road surface and vehicle tire
- Horns and loud music
- Aerodynamic friction

470. Typical noise levels are in the Study Area are:

- Country side during night — About 40 dB(A)
- Country side during day — About 50 dB(A)
- Quiet road — About 60 dB(A)
- Busy road — 65 to 90 dB(A)

471. Characteristics of Traffic Noise [1]

- The noise of one large truck such as an flat-bed 40 feet articulated truck is equal to the noise of about 9 to 10 cars
- The noise of one large truck such is equal to the noise of about 32 cars [3]
- Doubling the distance between the receptor and road decreases the noise by about 3 dB(A)
- Doubling the traffic volume results in increase of noise by about 3 dB(A)
- Increasing the traffic volume from 200 to 2000 results in doubling the noise [3]
- Doubling the speed results in increasing the noise by about 6 dB(A)
- Increase in the speed from 15 mph to 55 mph results in doubling the noise [3]
- Noise exposure is also affected by the relative position of the road and the receptor as shown in **Figure 8-3**.

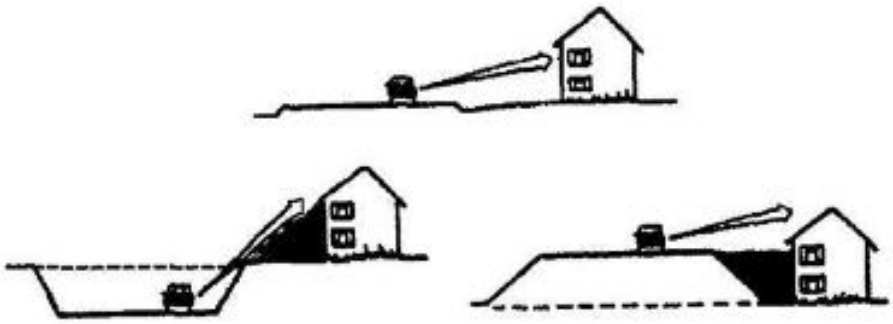


Figure 8-3: Effect of Noise levels due to Relative Position of the Roadway and Receptor

472. The propagation of noise depends on various factors such as:

- Noise is generated at source and spreads spherically away from source
- Intensity diminishes with distance
- Losses also occur from sound energy being dissipated as sound is transferred by air particles
- Bending and diffraction occurs as sound waves encounter natural and manufactured solid objects

473. To assess the impact of the proposed traffic on the surrounding communities, noise modeling was undertaken with the following objectives:

- Predict the noise level due to traffic on the proposed Batumi Bypass Road on the surrounding areas, particularly on the residences located within 100 m of the proposed road.
- Identify generic specifications of noise barriers to reduce the noise levels to acceptable criteria.
- Identify the areas, where the noise levels are unlikely to be mitigated to acceptable noise levels using the standard mitigations methods

474. The noise model, SoundPLAN Essential Version 3.0 by Braunstein + Berndt GmbH / SoundPLAN International LLC was used. The model is capable of modeling noise levels in three-dimensions. The following are the key inputs and assumptions:

- 1-m resolution Ground Elevation Model was used;
- Projected Traffic for 2033 was modeled (**Section 4.7**);
- Uniform traffic speed of 90 kph was used;
- Trees and grassland was assumed as volume attenuation areas;
- Each receptor was separately identified, with location, building height and number of floors,
- No noise emission from the tunnels was assumed; and
- Road Surface: Asphalt concrete, without gritting

475. The detailed results of the Noise model are included at the end of this section. For the convenience of modeling the entire road was divided into 9 segments and each segment was modelled separately (**Figure 8-4 to Figure 8-31**). In the 100 m zone on each side of the road, a total of 490 houses were identified. These are the potential receptors.

476. In addition to these 490 houses, 25 houses fell within 25 m of the edge of the road on either side. These were not modeled as the Road Department intends to remove all houses within 25 m of the edge of the road. These houses will be thus included in the LARP.

477. Following the modeling of "without mitigation" emission, noise walls were introduced to reduce the impact on the receptors. The length and surface area of the walls in each segment is provided in the table. An estimated 14.5 km of noise wall of 2 to 4 m height will be required. The total surface area of the walls is estimated to be 57,250 m^2. For bridges, the noise wall will be installed at the edges of the bridge. Where the road runs on the surface the noise wall will be installed either on the edge of the on the side of the road, within the area acquired for the road construction.

478. The current speed limit on the existing highways in the Adjara region is 90 kph. There are some reports that vehicle can exceed the limit by 10-15% on the highways. A 10-15% increase in the speed may result in 1-2 dB(A) increase in traffic noise. Therefore, a key assumption in the modeling is that the speed limit of 90 kph will have to be strictly enforced.

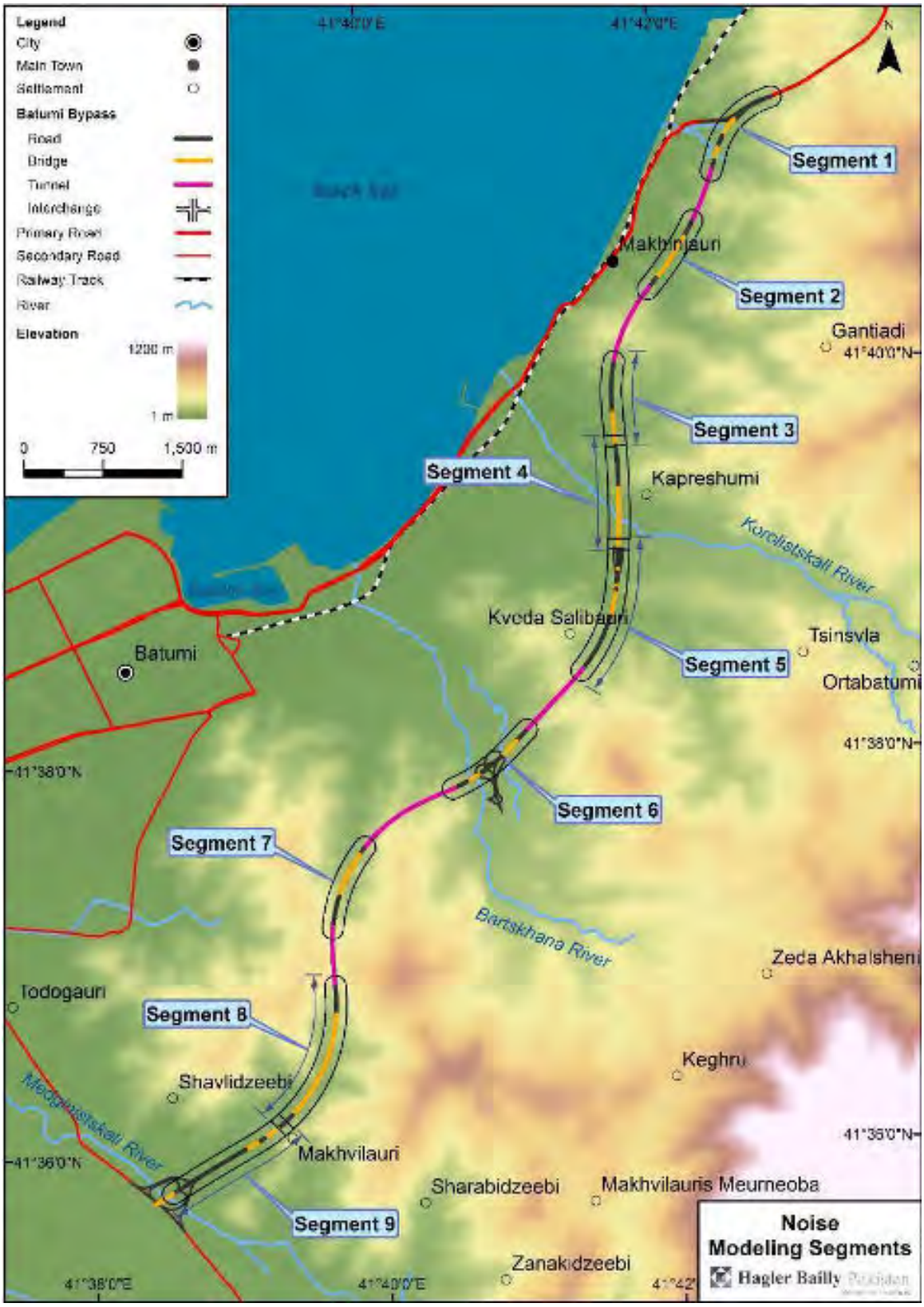


Figure 8-4: Noise Modeling Segments

Figure 8-5: Segment 1 Noise Modeling

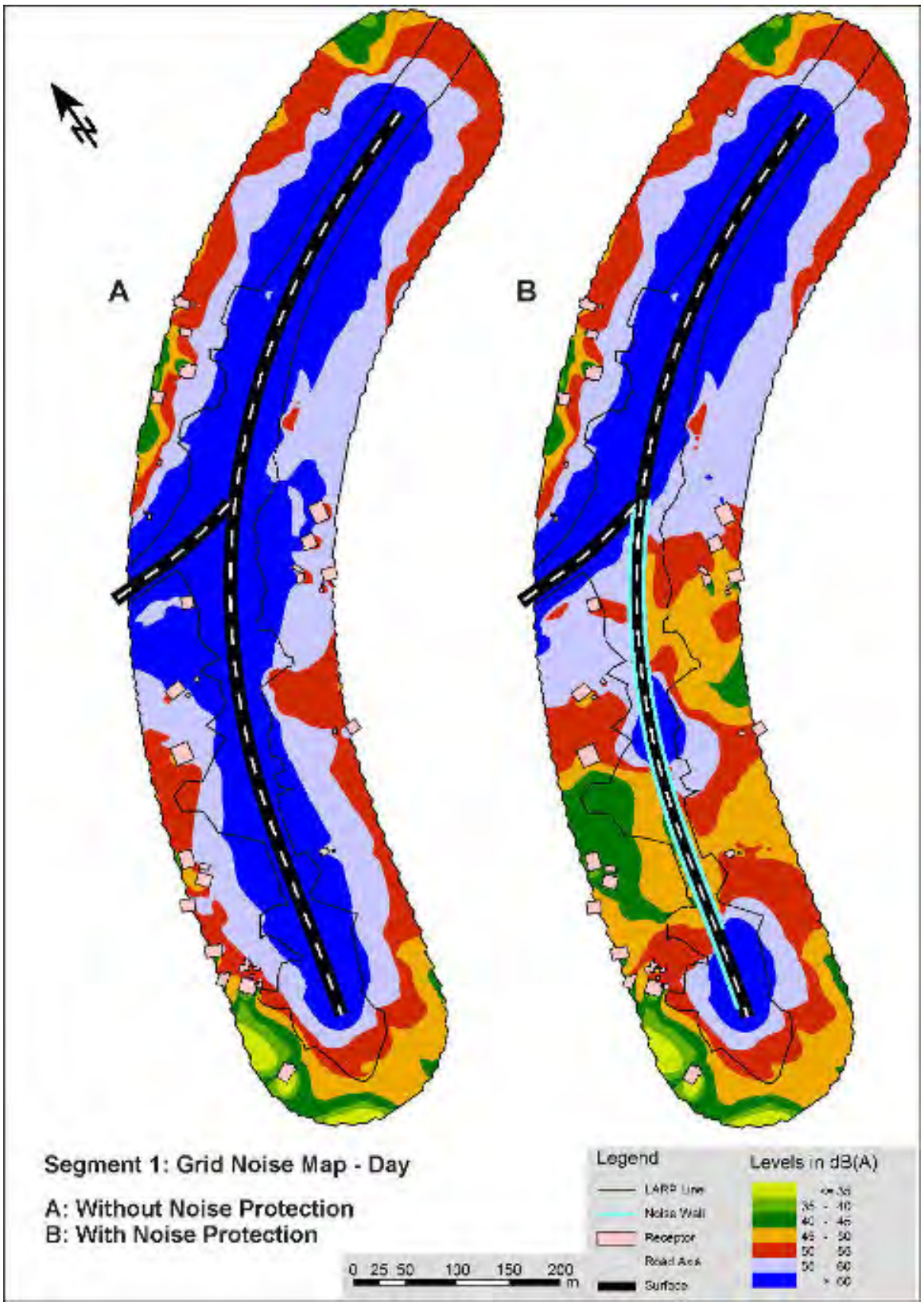


Figure 8-6: Segment 1 Grid Noise Map – Daytime

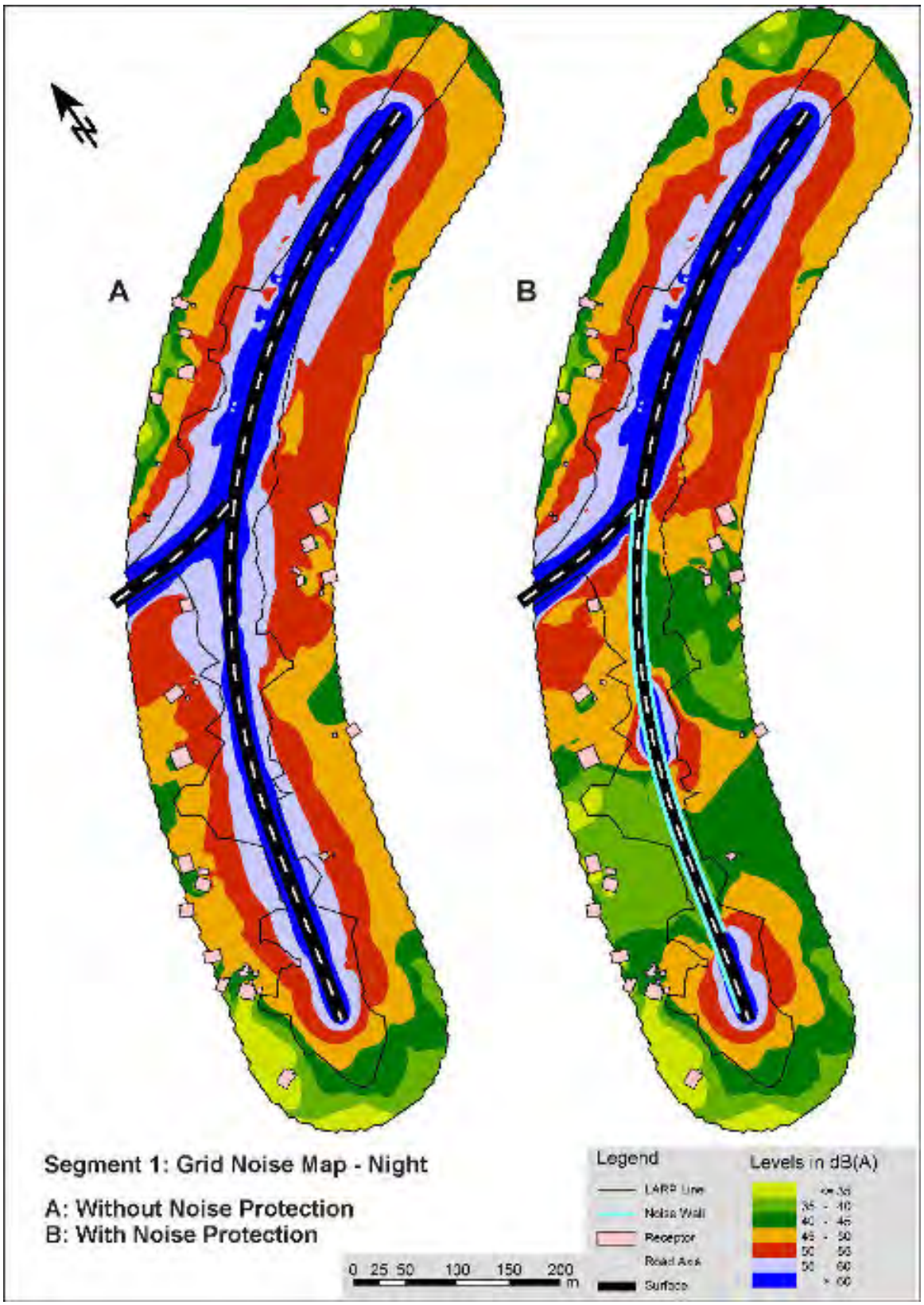


Figure 8-7: Segment 1 Grid Noise Map – Night time

Figure 8-8: Segment 2 Noise Modeling

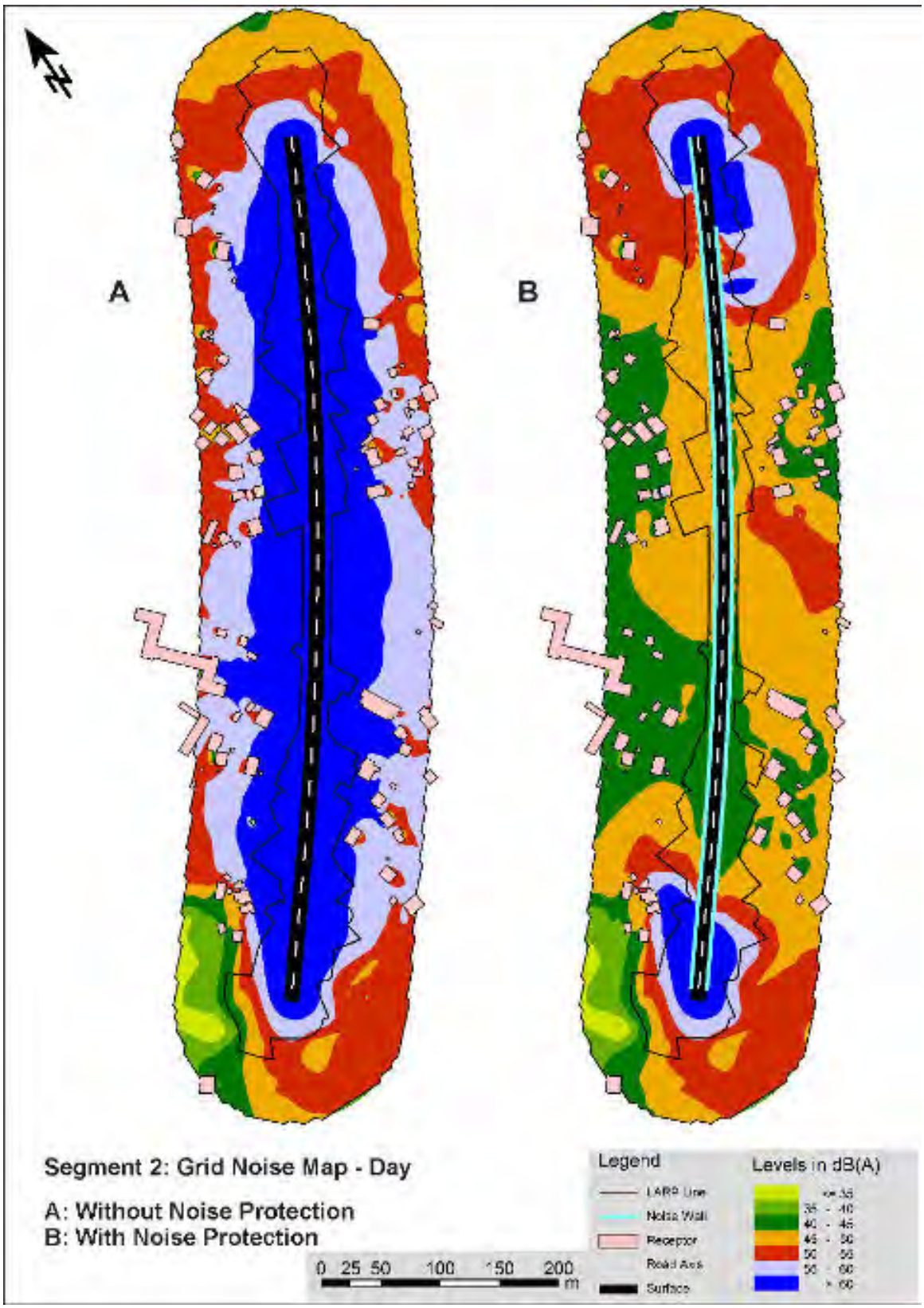


Figure 8-9: Segment 2 Grid Noise Map – Daytime

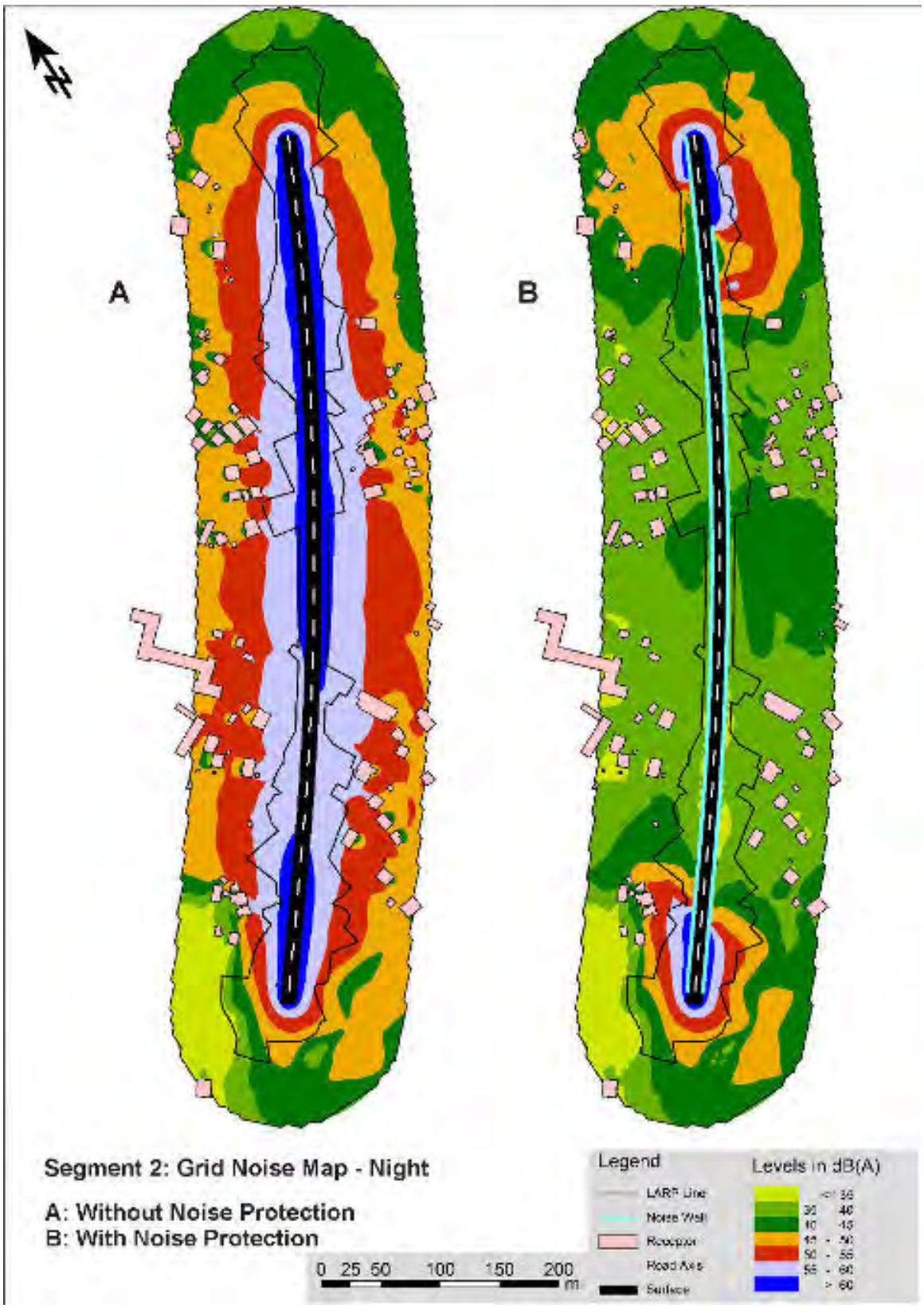


Figure 8-10: Segment 2 Grid Noise Map – Nighttime

Figure 8-11: Segment 3 Noise Modeling

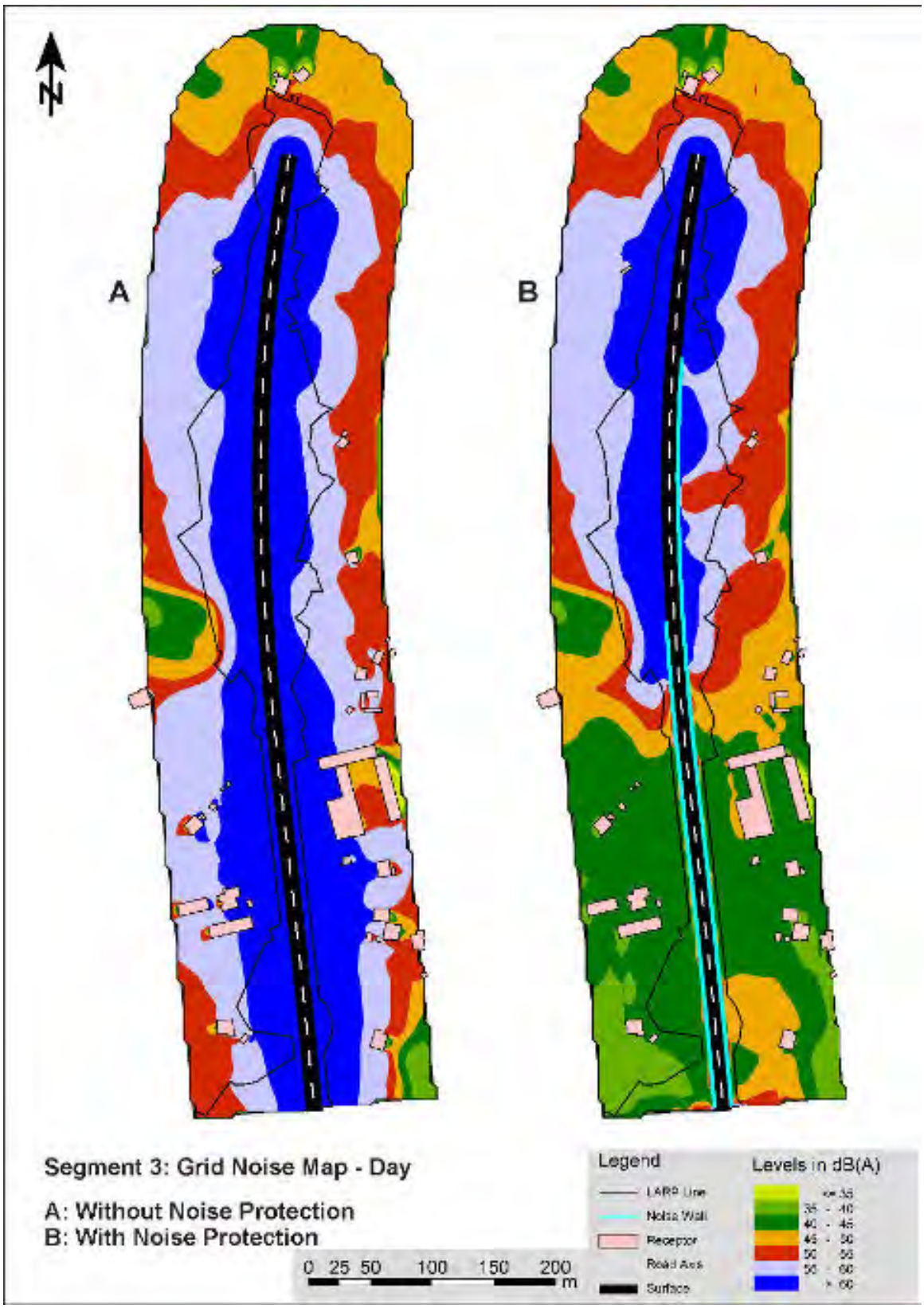


Figure 8-12: Segment 3 Grid Noise Map – Daytime

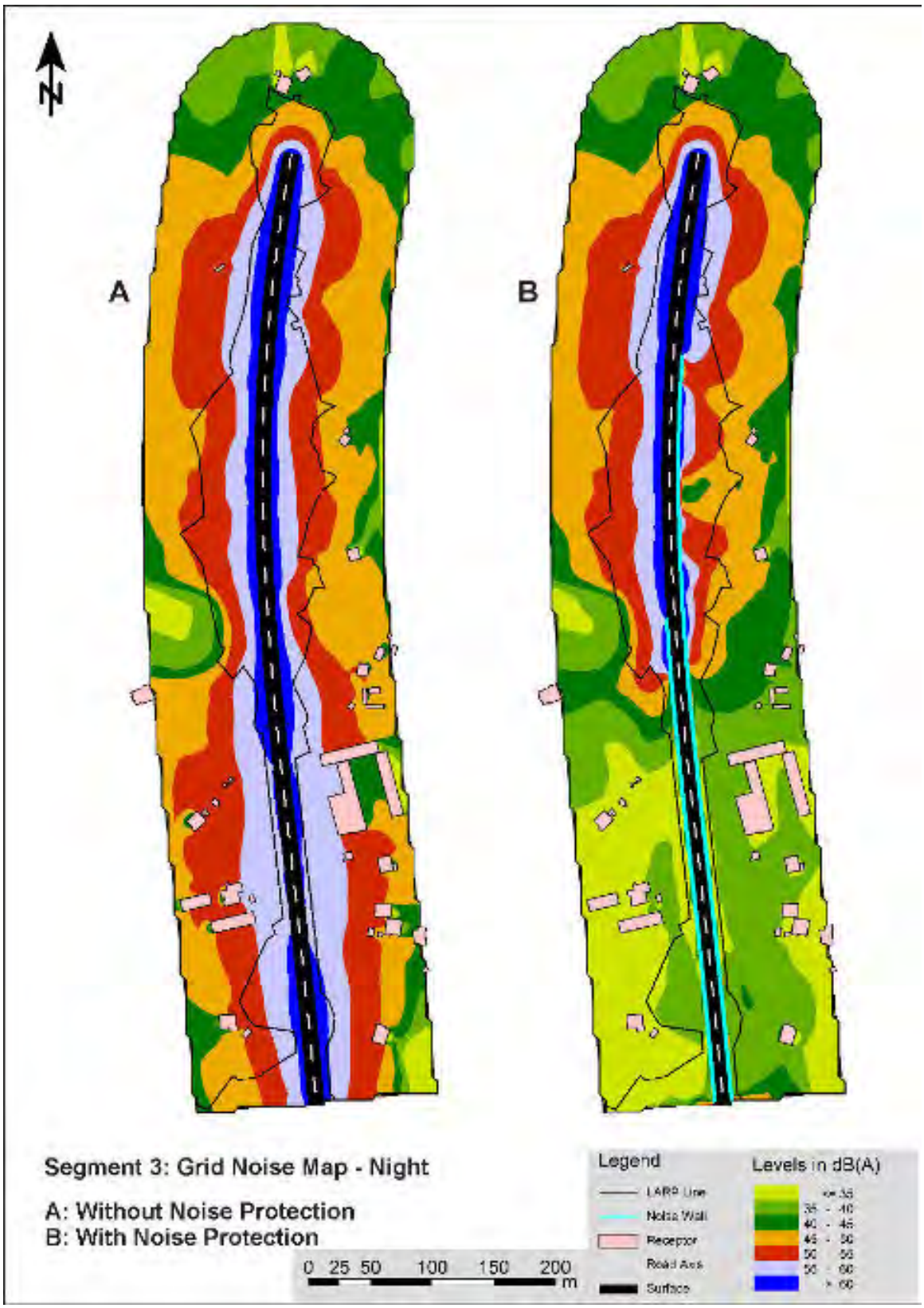


Figure 8-13: Segment 3 Grid Noise Map – Nighttime

Figure 8-14: Segment 4 Noise Modeling

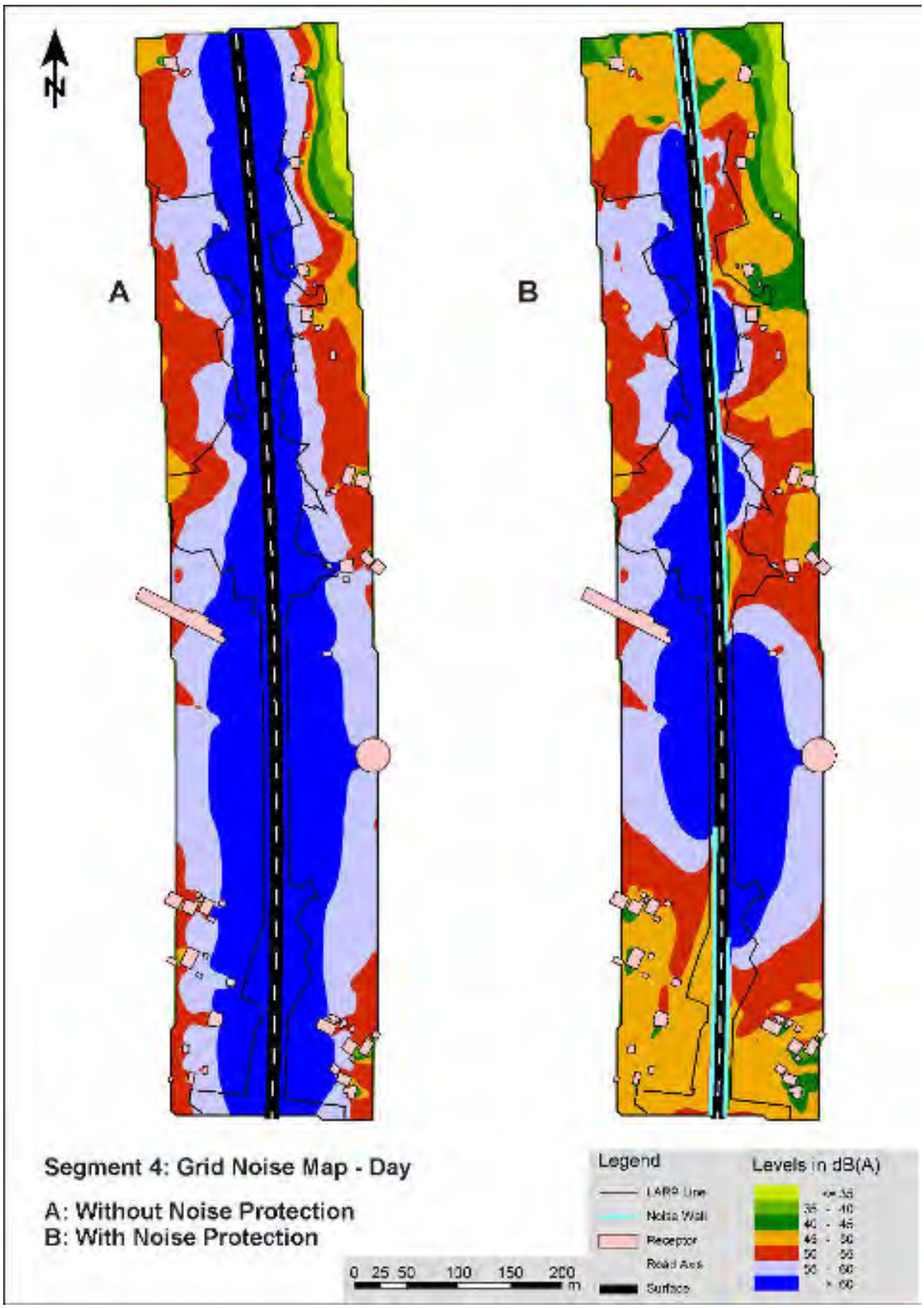


Figure 8-15: Segment 4 Grid Noise Map – Daytime

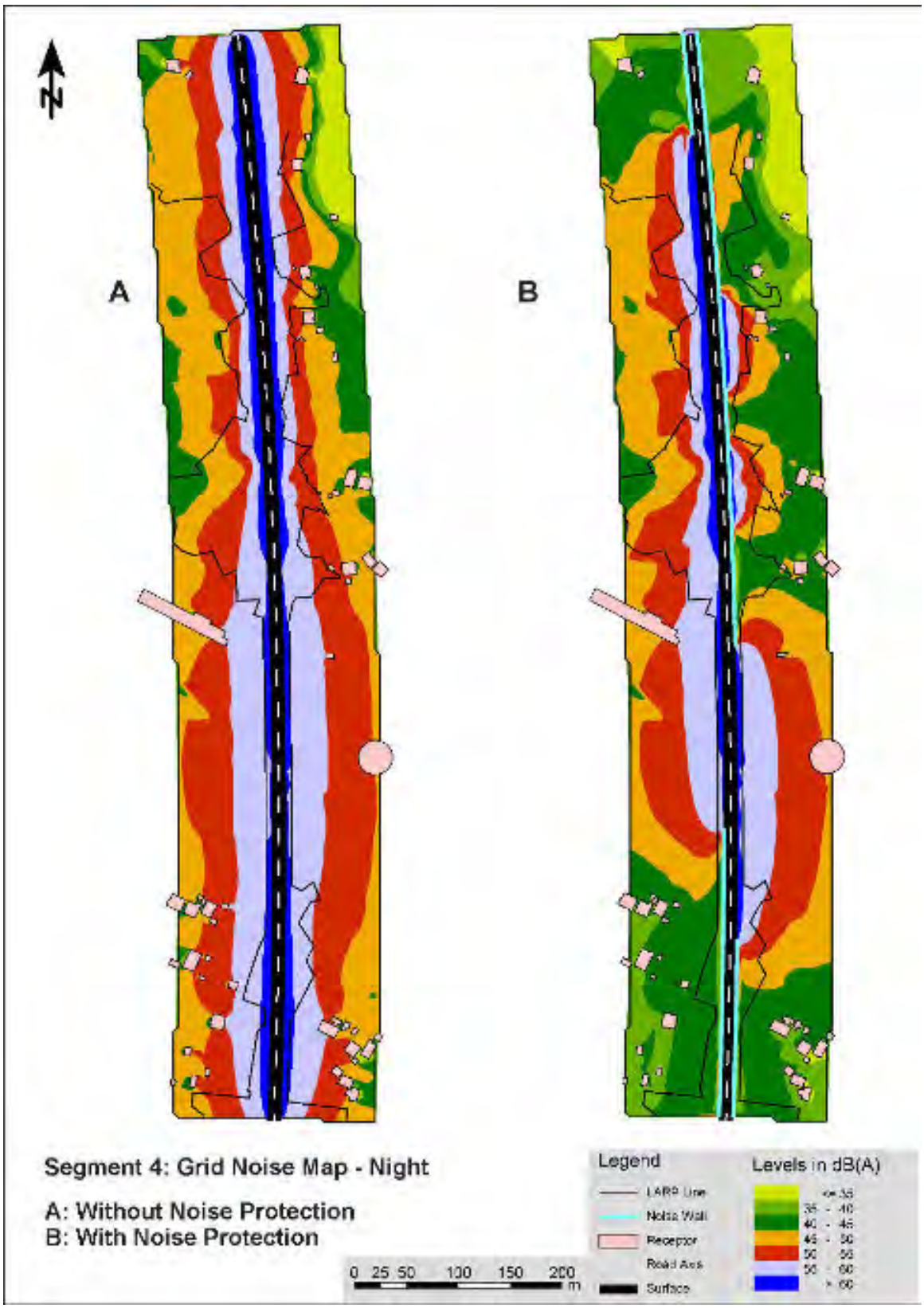


Figure 8-16: Segment 4 Grid Noise Map - Nighttime

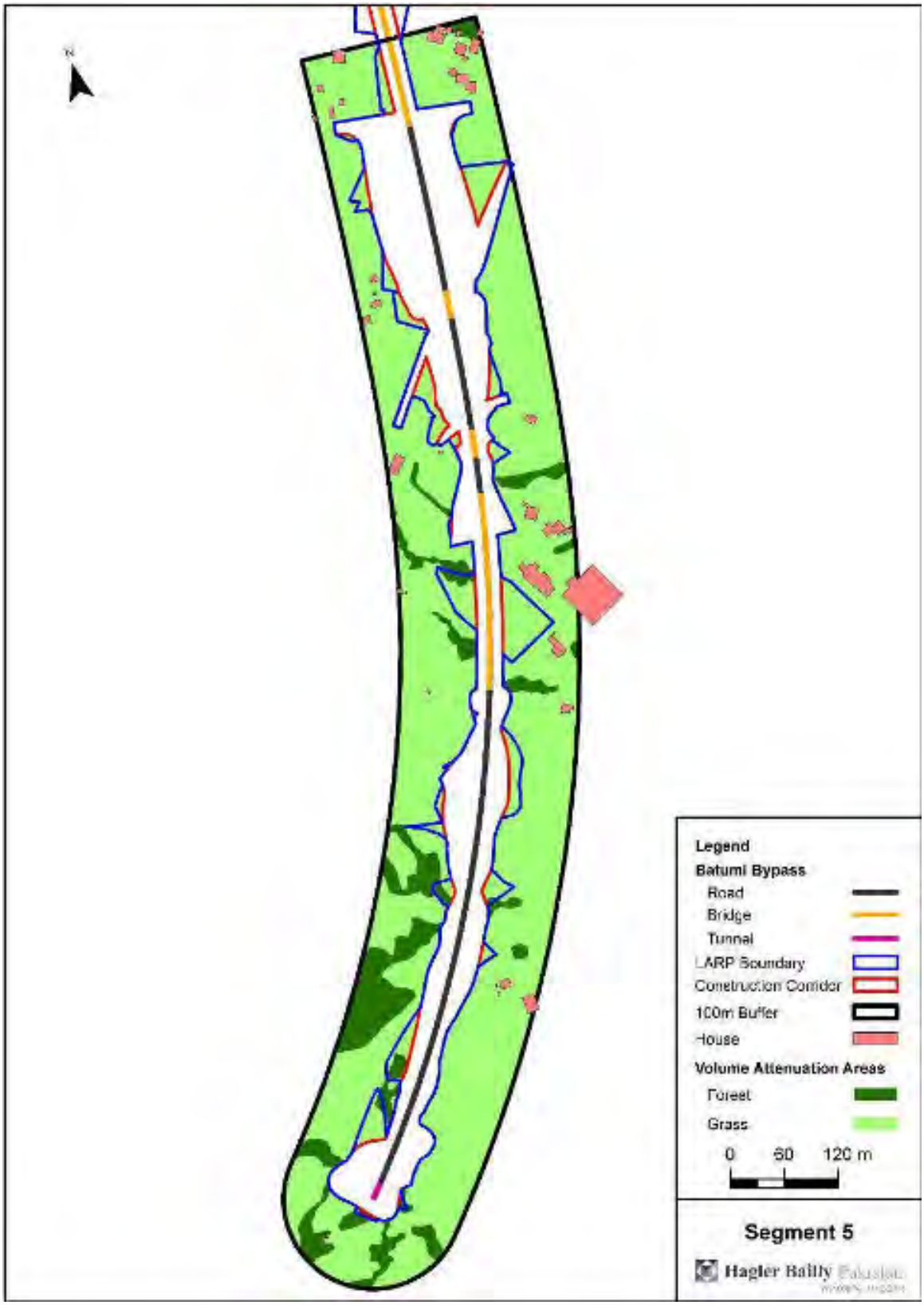


Figure 8-17: Segment 5 Noise Modeling

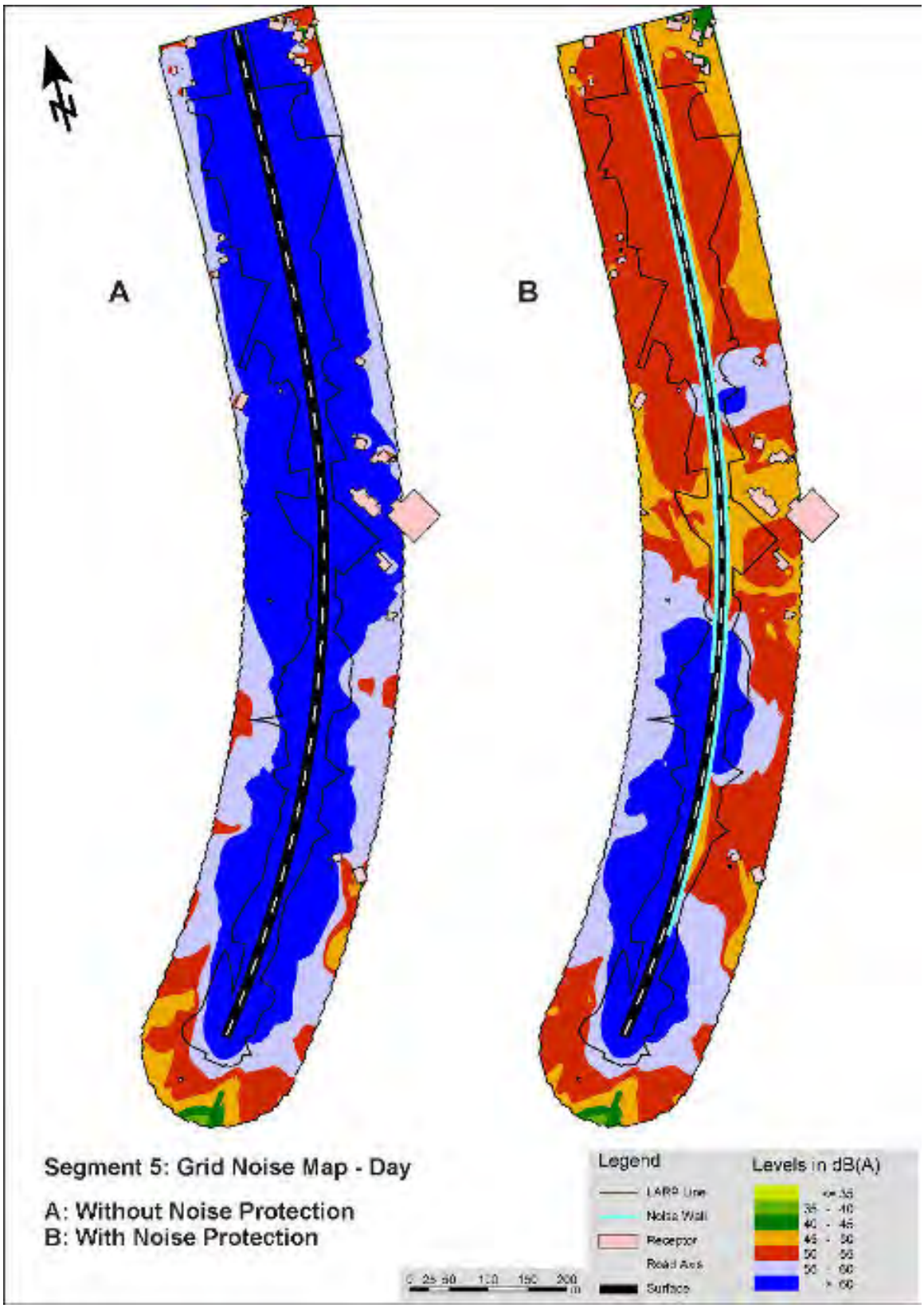


Figure 8-18: Segment 5 Grid Noise Map - Daytime

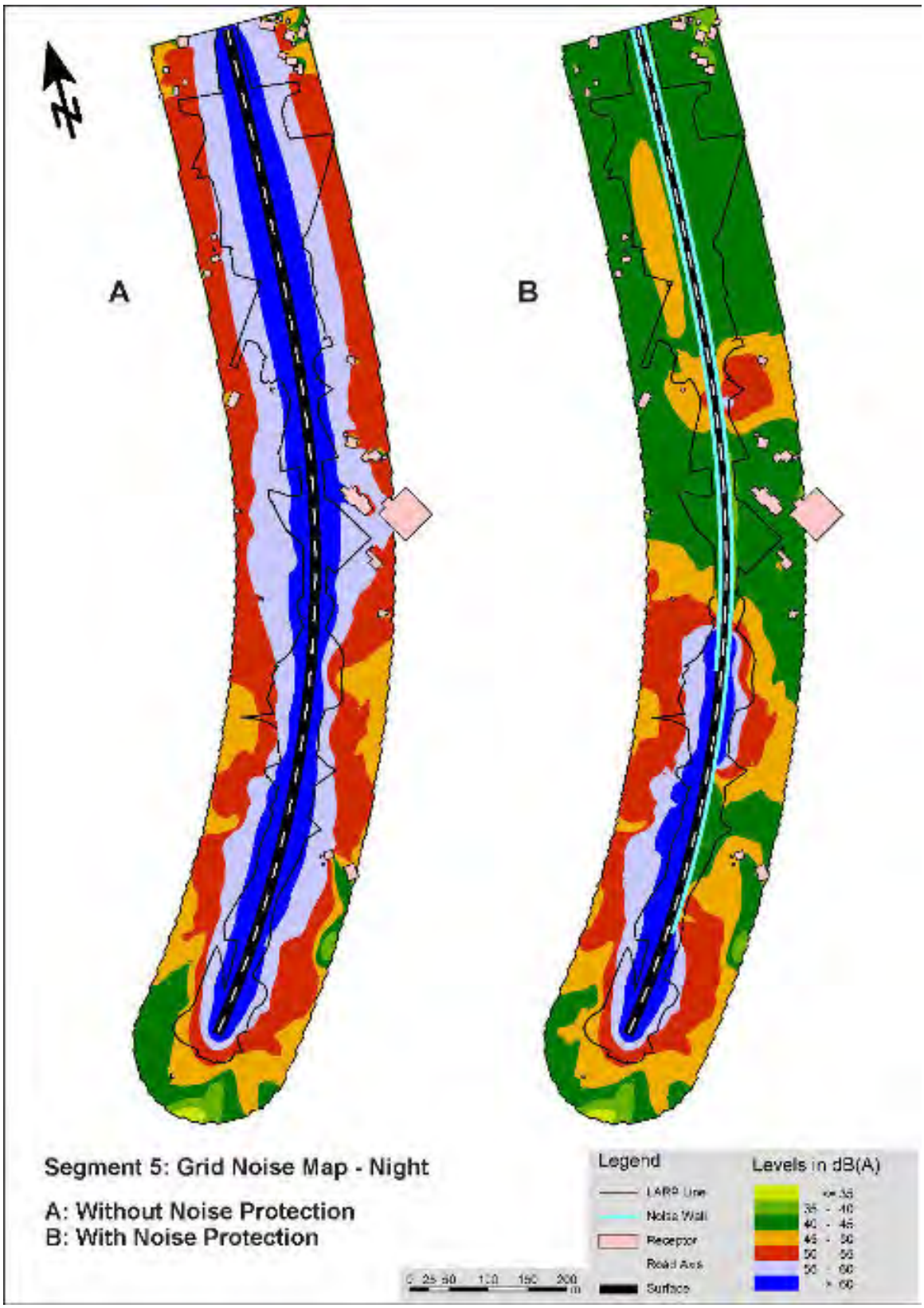


Figure 8-19: Segment 5 Grid Noise Map - Nighttime

Figure 8-20: Segment 6 Noise Modeling

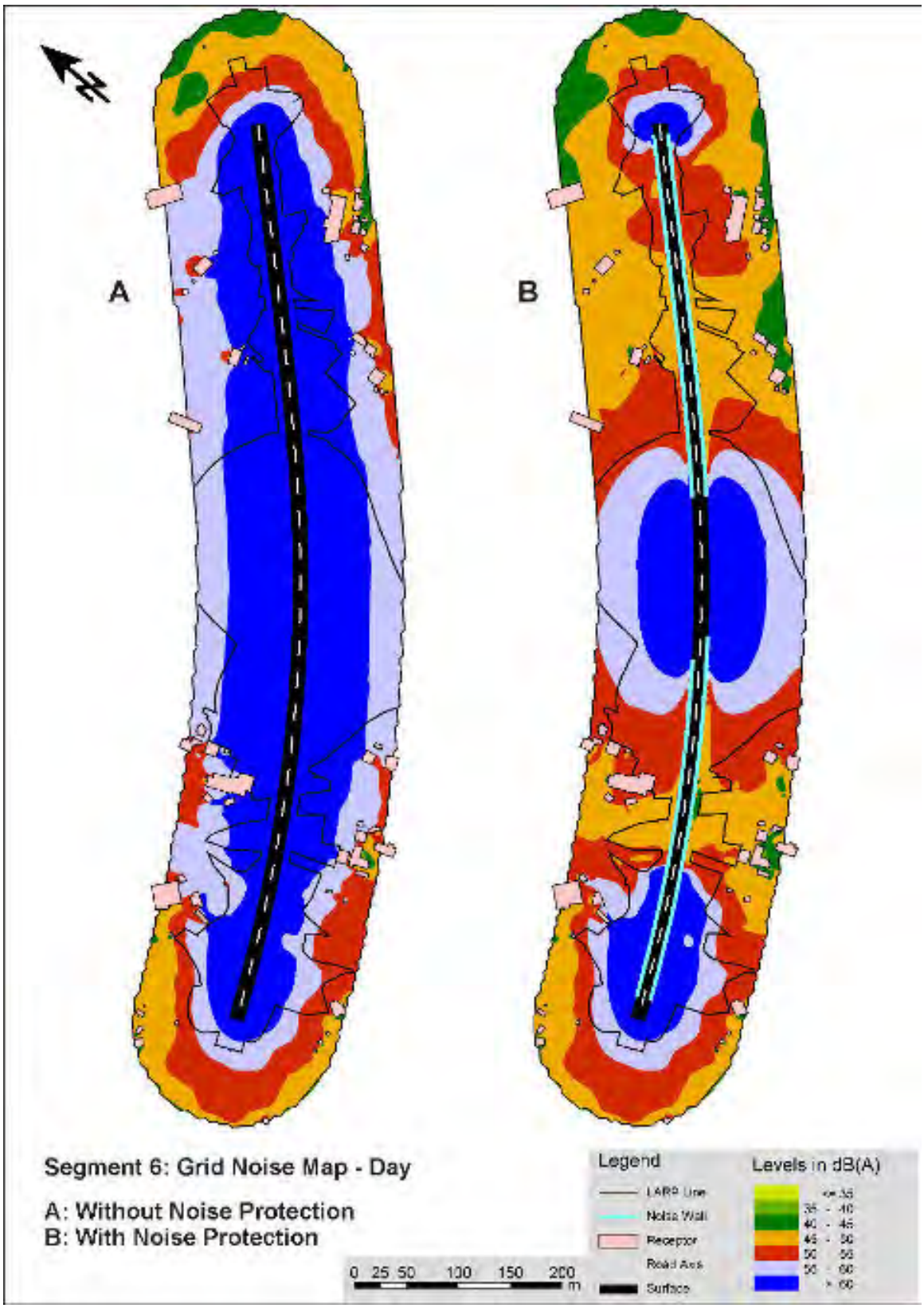


Figure 8-21: Segment 6 Grid Noise Map - Daytime

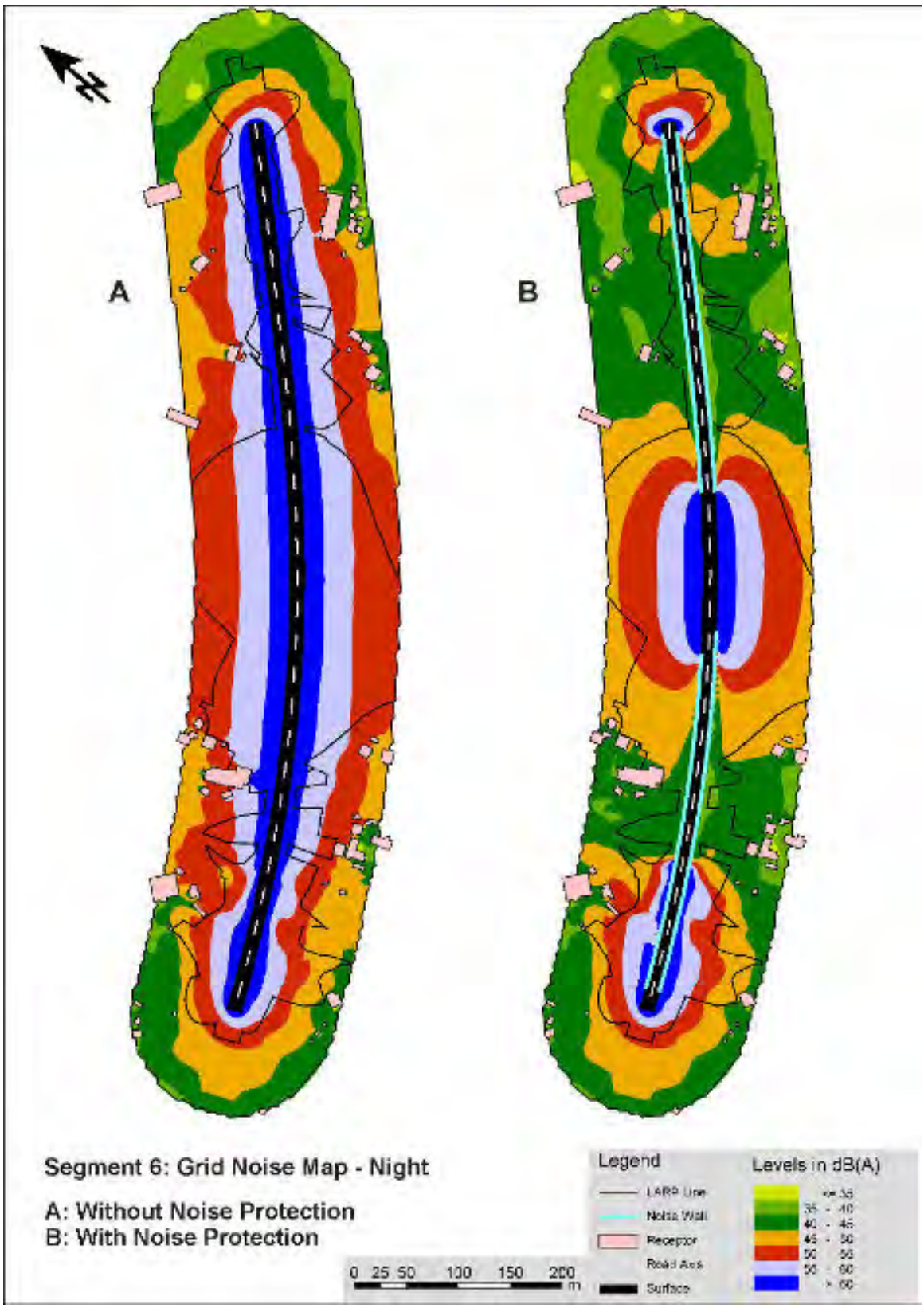


Figure 8-22: Segment 6 Grid Noise Map - Nighttime

Figure 8-23: Segment 7 Noise Modeling

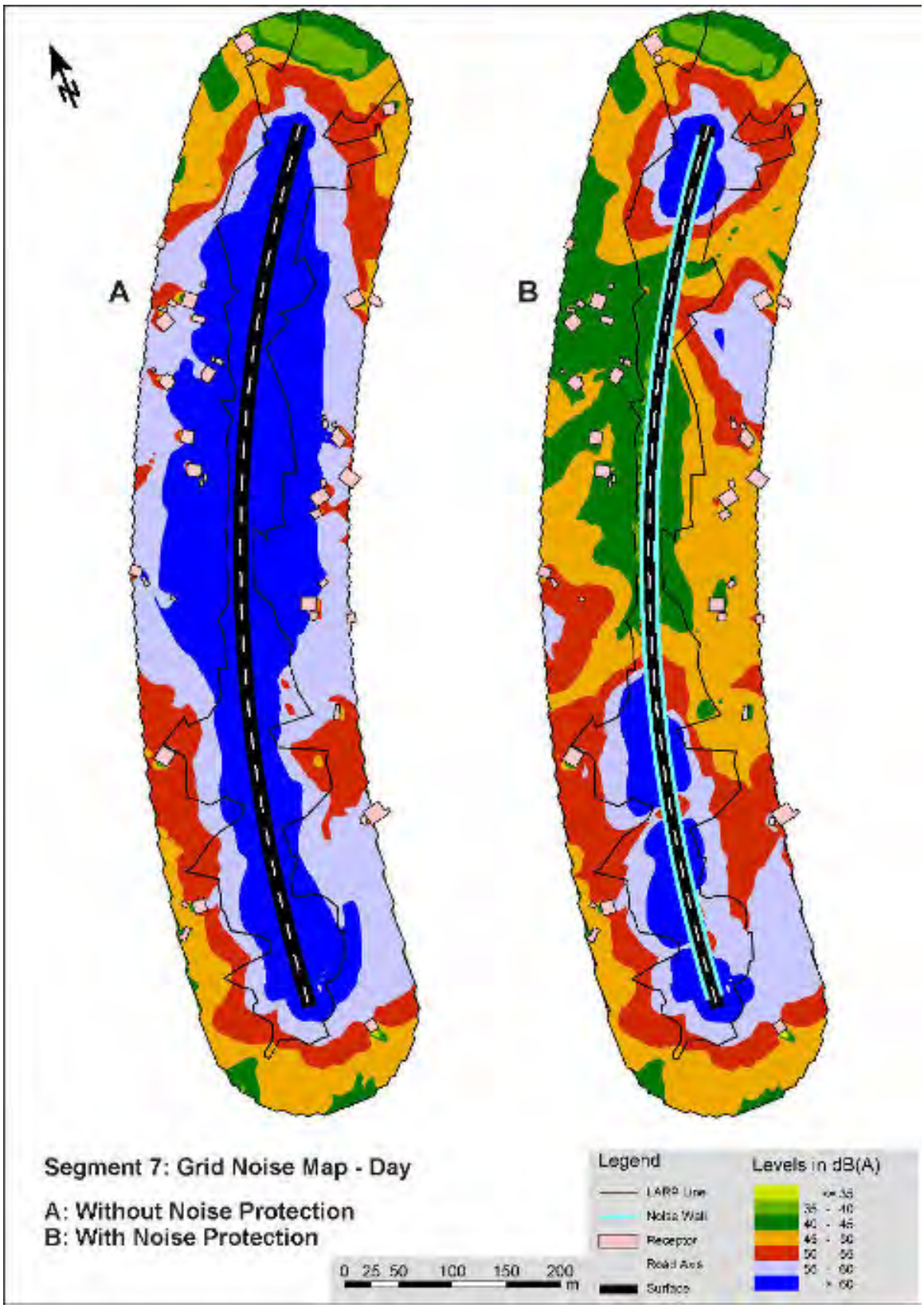


Figure 8-24: Segment 7 Grid Noise Map – Daytime

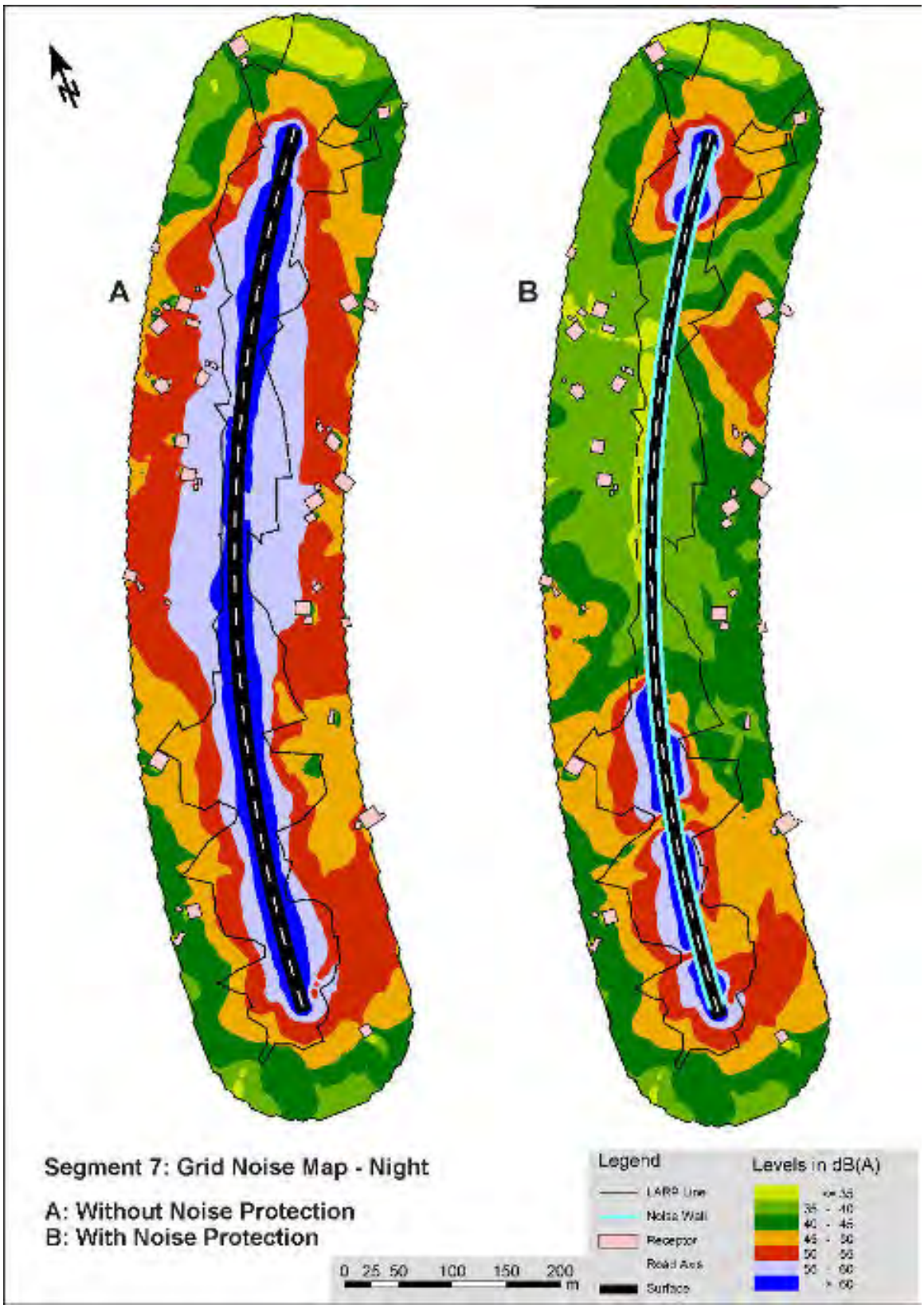


Figure 8-25: Segment 7 Grid Noise Map - Nighttime

Figure 8-26: Segment 8 Noise Modeling

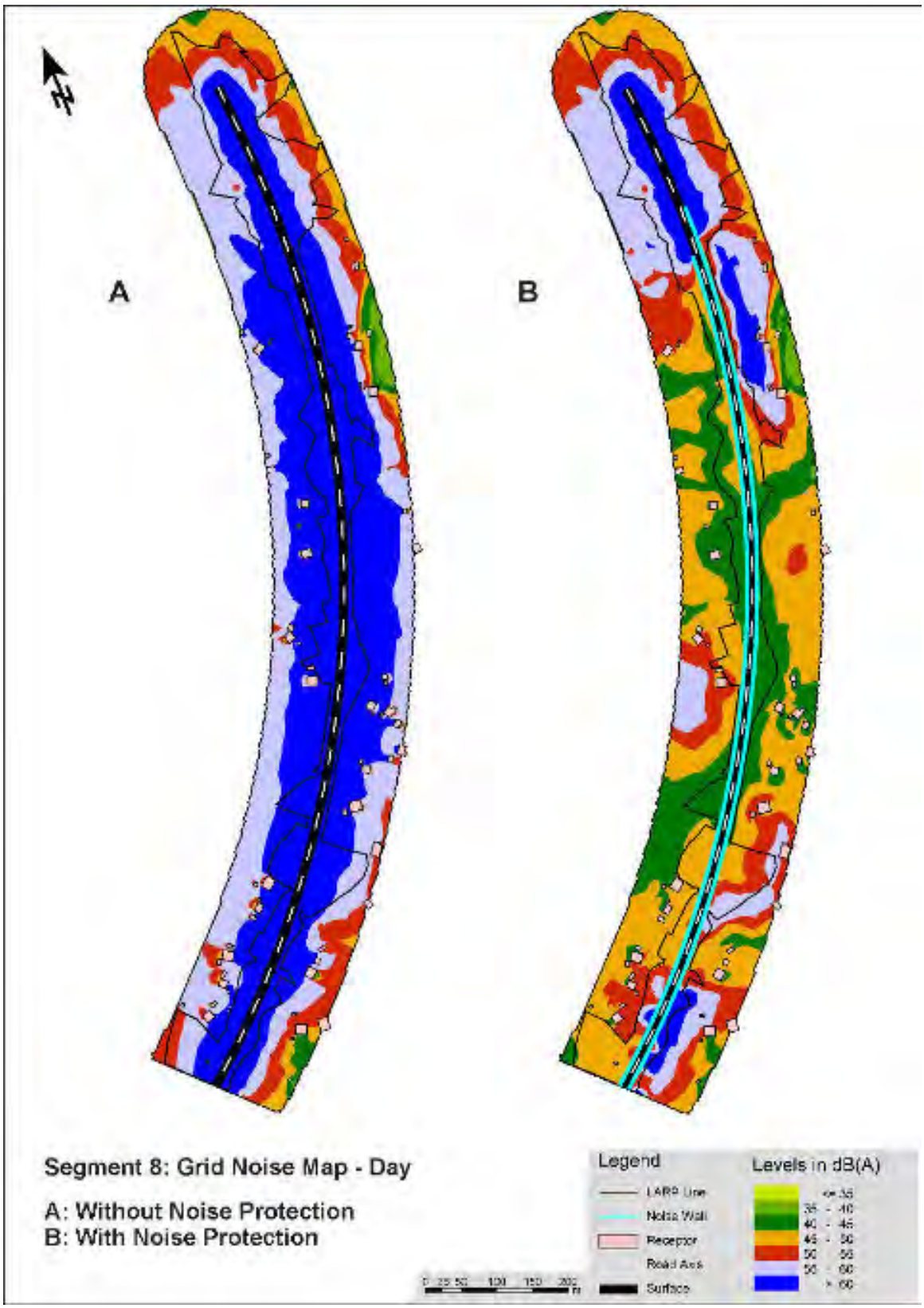


Figure 8-27: Segment 8 Grid Noise Map – Daytime

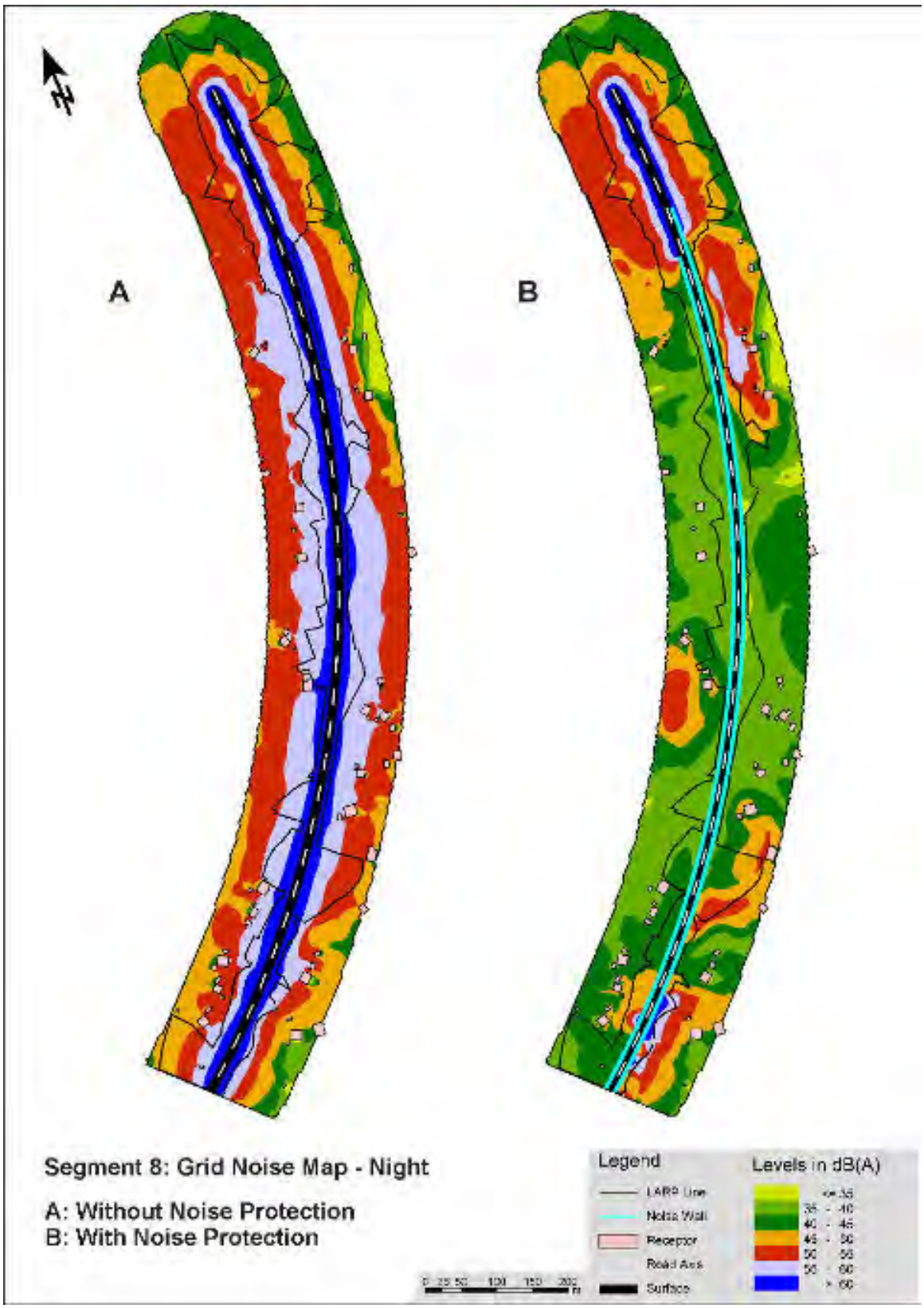


Figure 8-28: Segment 8 Grid Noise Map - Nighttime

Figure 8-29: Segment 9 Noise Modeling

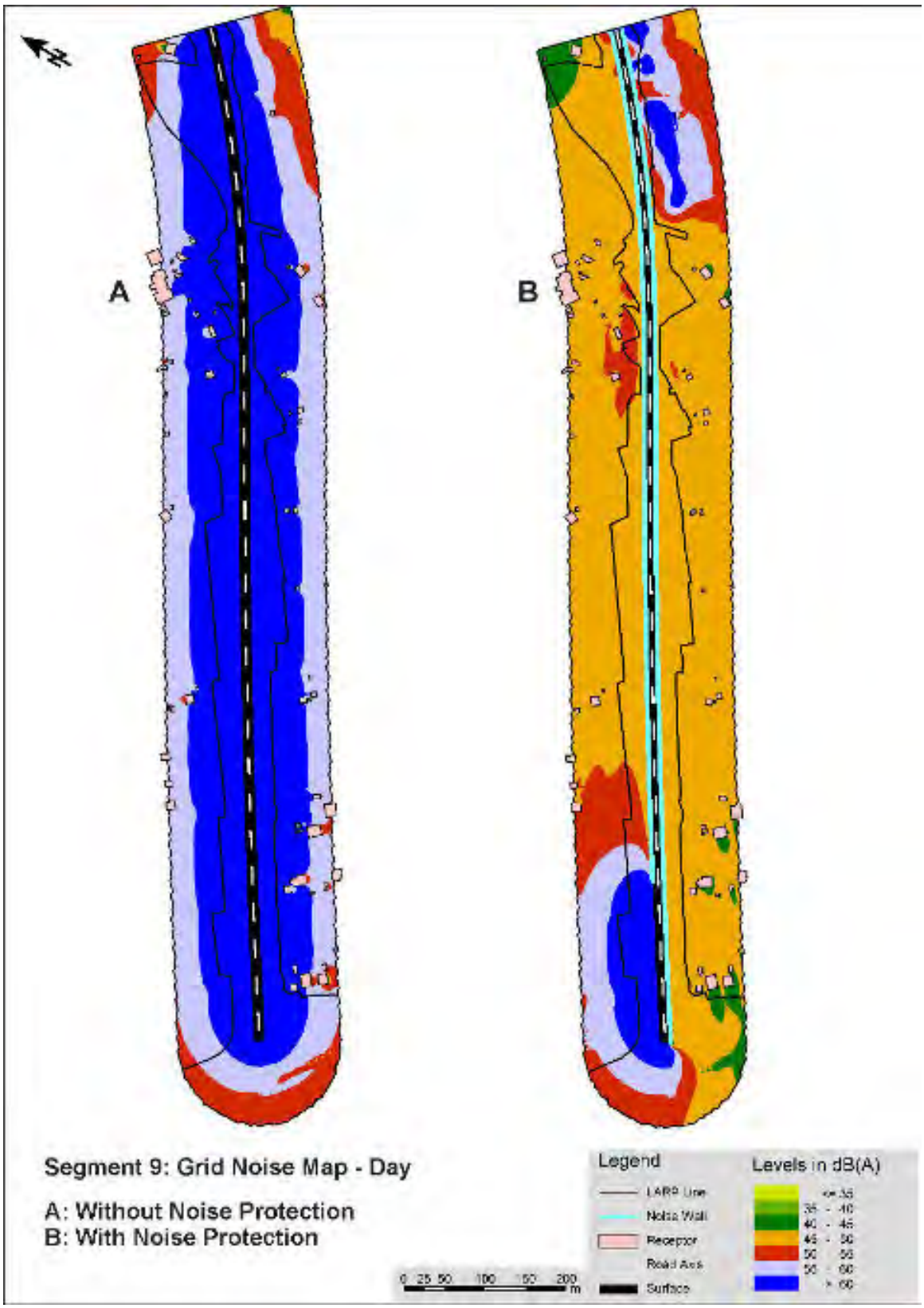


Figure 8-30: Segment 9 Grid Noise Map – Daytime

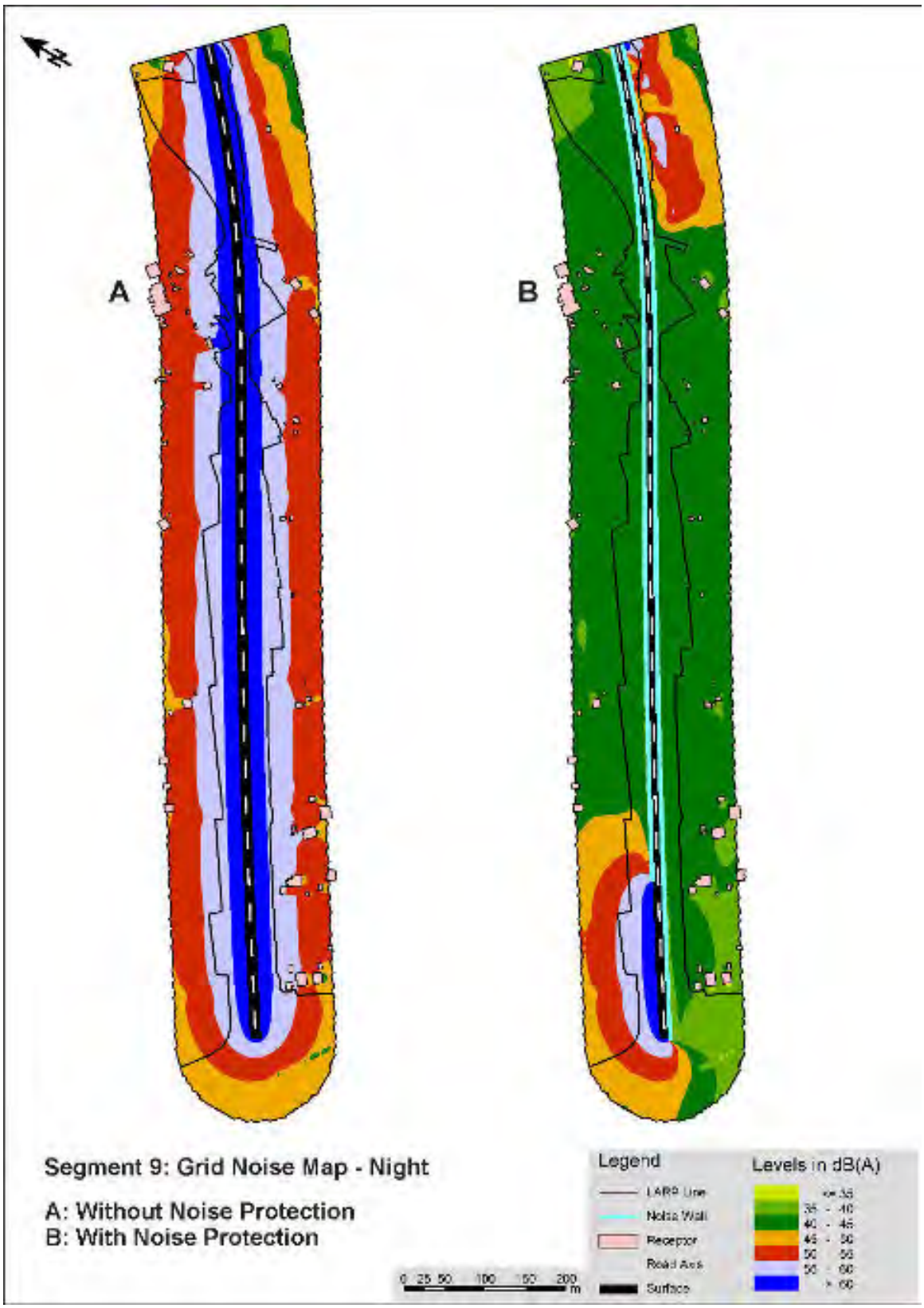


Figure 8-31: Segment 9 Grid Noise Map – Night time

Results and Discussion

479. Following the modeling of the 'without noise protection option', the noise wall was introduced in the model. The location, height and length of the wall was adjusted to achieve the reduction in order to achieve compliance with noise standards. In most of the cases, it was possible to comply with the standards. However, even after the introduction the noise wall, the noise levels for some receivers could not be mitigated **(Figure 8-32** to **Figure 8-40**) due to their location with respect to the road (see **Figure 8-41** for the relative positions of selected receiver). If the receiver is located on a hill, the noise wall is unable to shield it from the noise. The number of such receivers is 52. A summary of the modeling including mitigation is presented in **Table 8-8**.The strategy for these receivers will be as follows:

- Refined mitigation options will be considered. These may include higher walls (up to 6 m); wall and berm on the hill to provide better shielding; and plantation of 20 m wide avenue of trees to shield the houses.
- If by any of these measures noise levels for the houses cannot be mitigated, the owners of the houses will be given the option to relocate after selling their houses to the Road Department. Their properties will be included in the LARP.
- An alternate, is that some homeowners despite the high noise may want to stay in their houses. In that case, a legally binding agreement will be executed between the Roads Department and the receiver.

480. The key to implementation of the above strategy is consultations with the affected households. Early consultations with the communities will be initiated to discuss the options and the impacts of each option. The consultation will be conducted by the Roads Department with the effected households for relocation and with the entire community as the noise wall may have visual and connectivity impacts to the entire community.

481. During the operation phase, the key mitigation option will be control of speed on the road. The Roads Department will work with the traffic police to ensure that the speed limit is enforced. In this regards, additional speed monitoring equipment will be installed on the entire road.

Figure 8-32: Segment 1-Single Point with Noise Protection

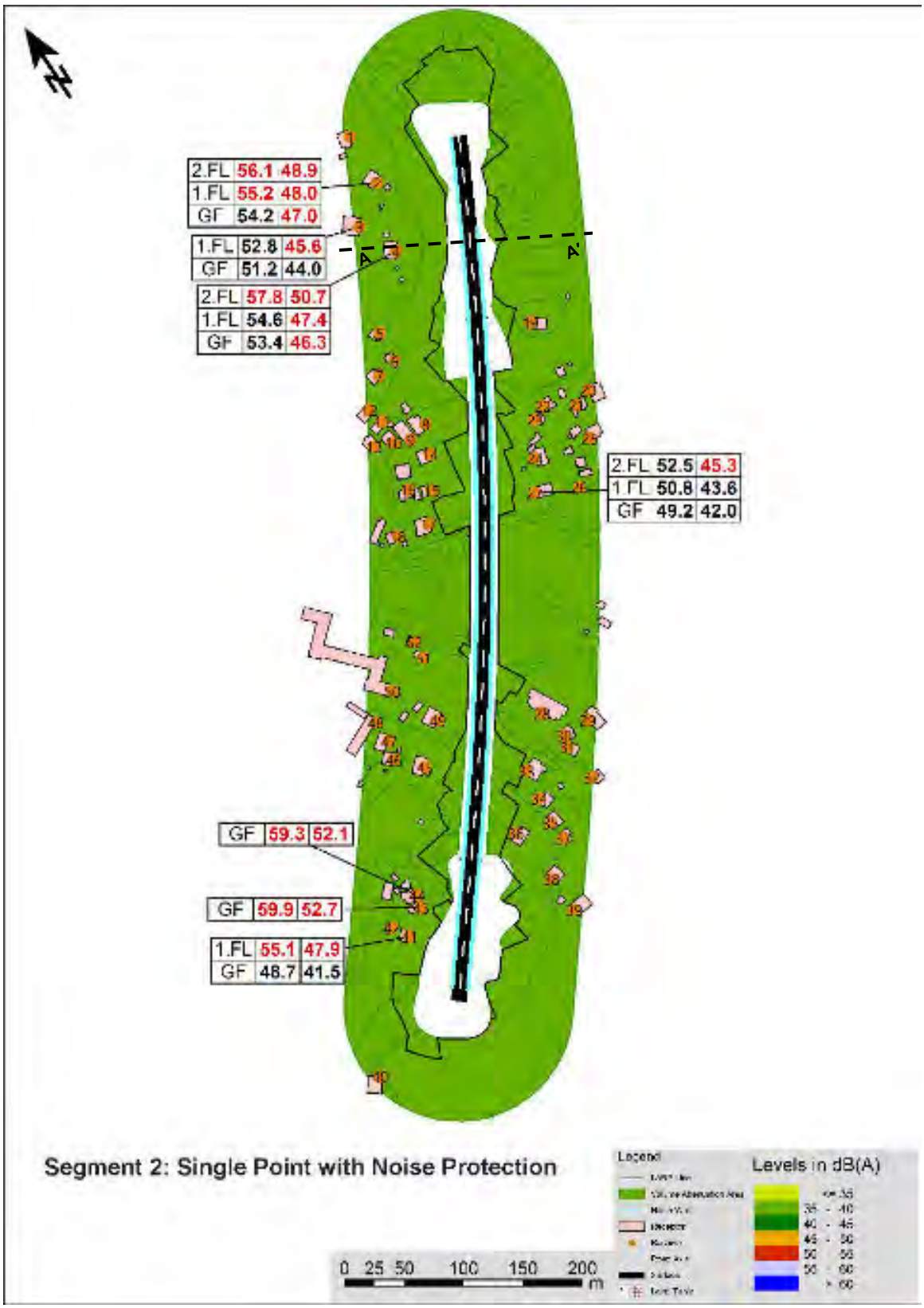


Figure 8-33: Segment 2-Single Point with Noise Protection

Figure 8-34: Segment 3-Single Point with Noise Protection

Figure 8-35: Segment 4-Single Point with Noise Protection

Figure 8-36: Segment 5-Single Point with Noise Protection

Figure 8-37: Segment 6-Single Point with Noise Protection

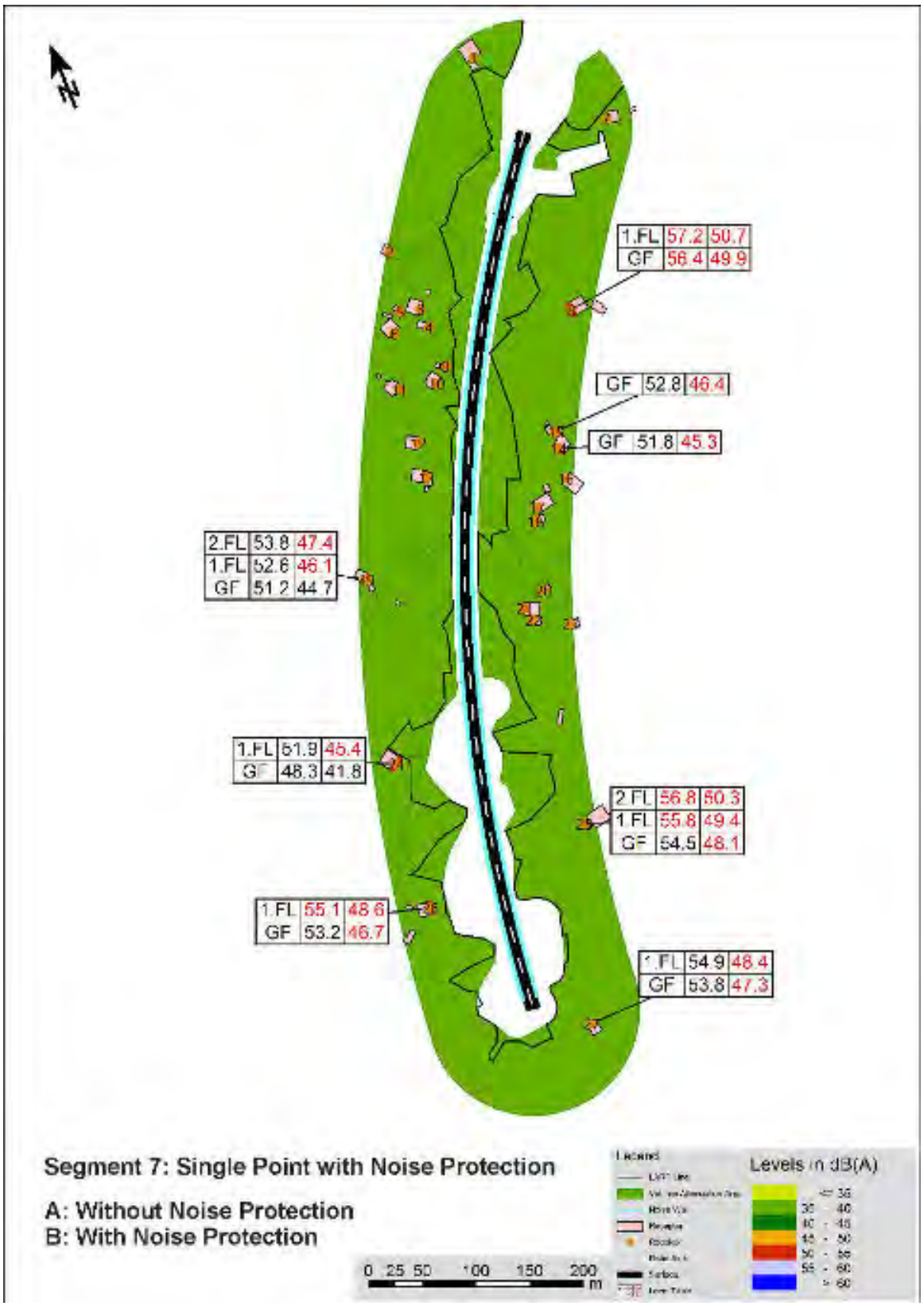


Figure 8-38: Segment 7-Single Point with Noise Protection

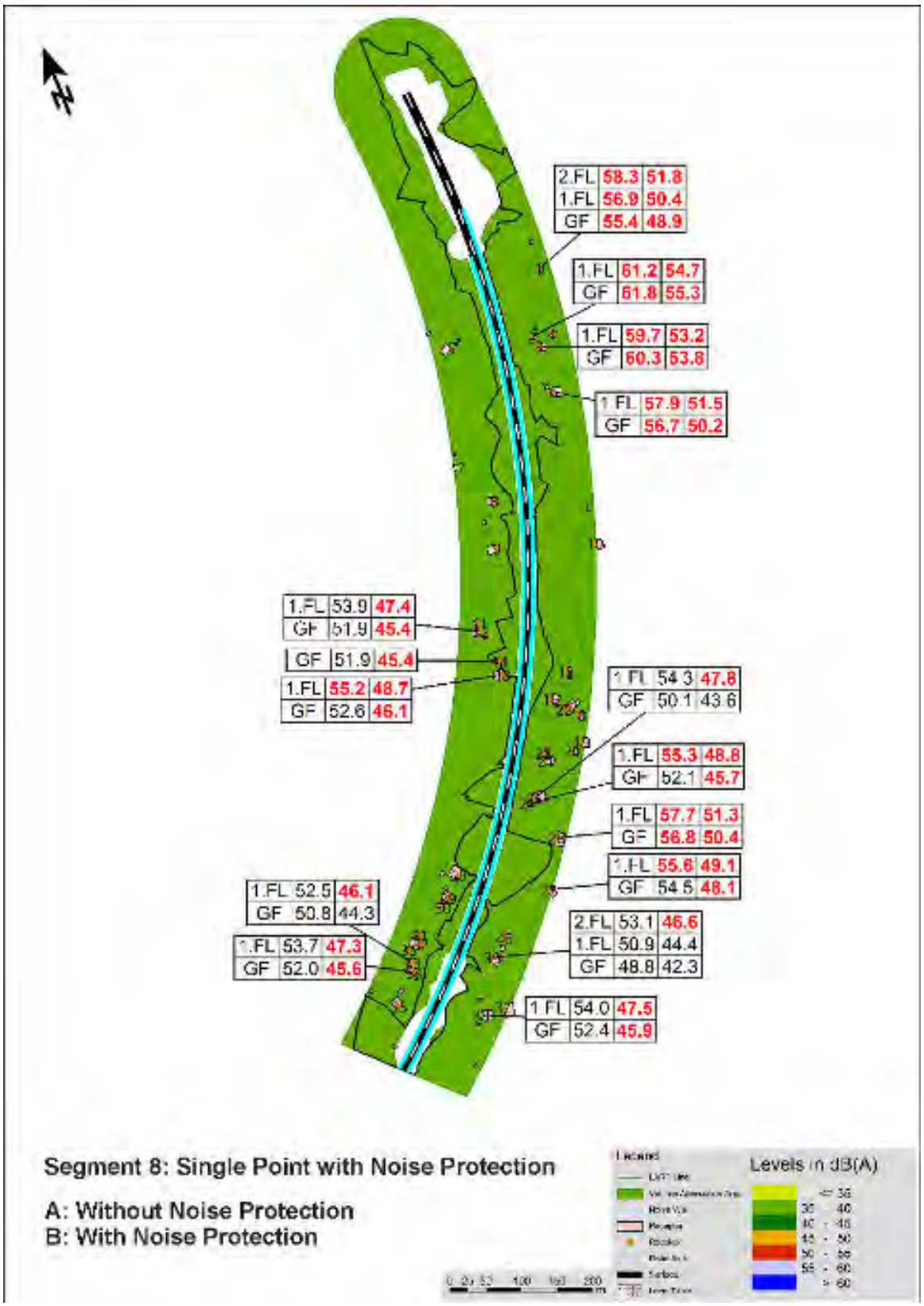
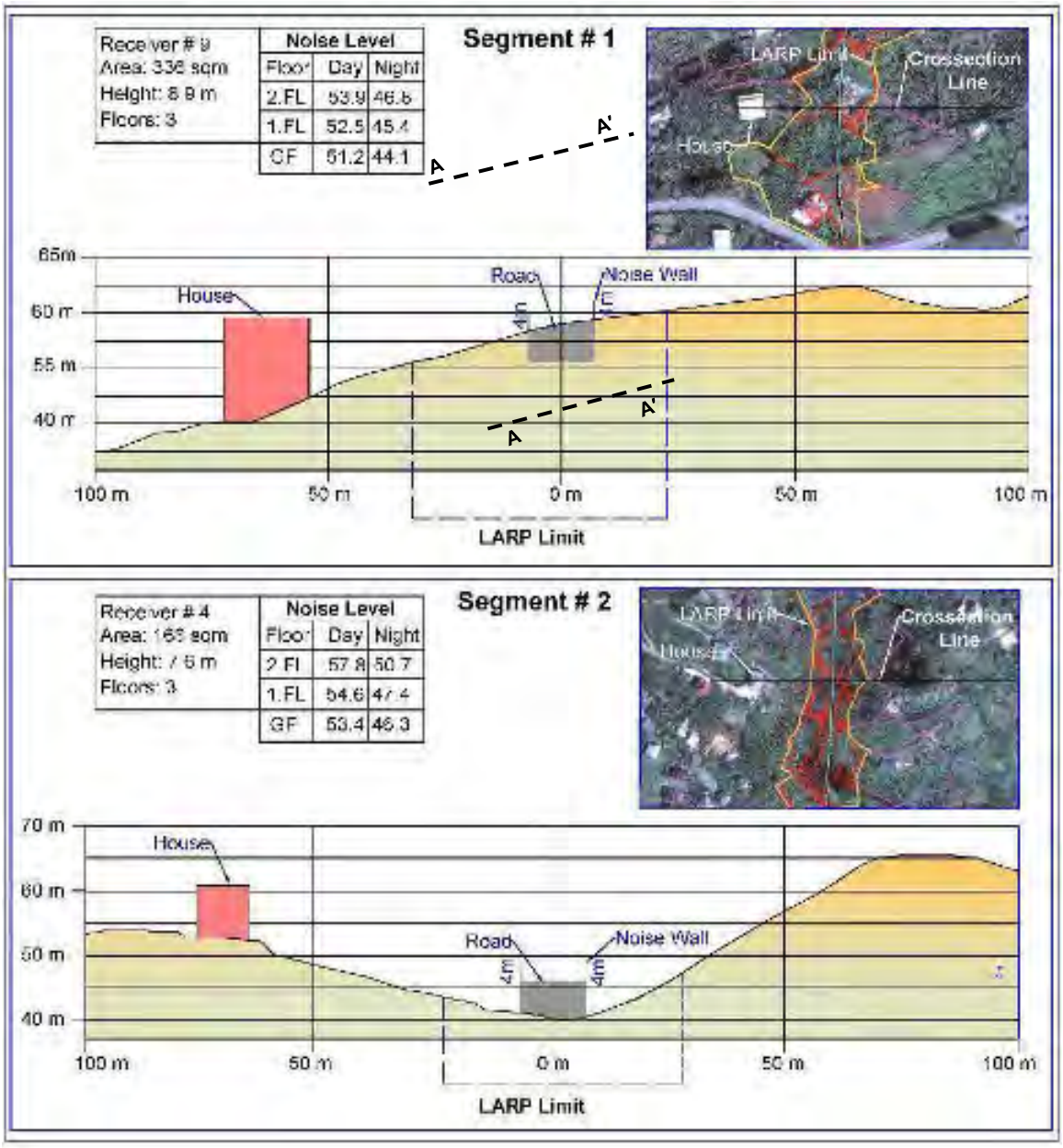
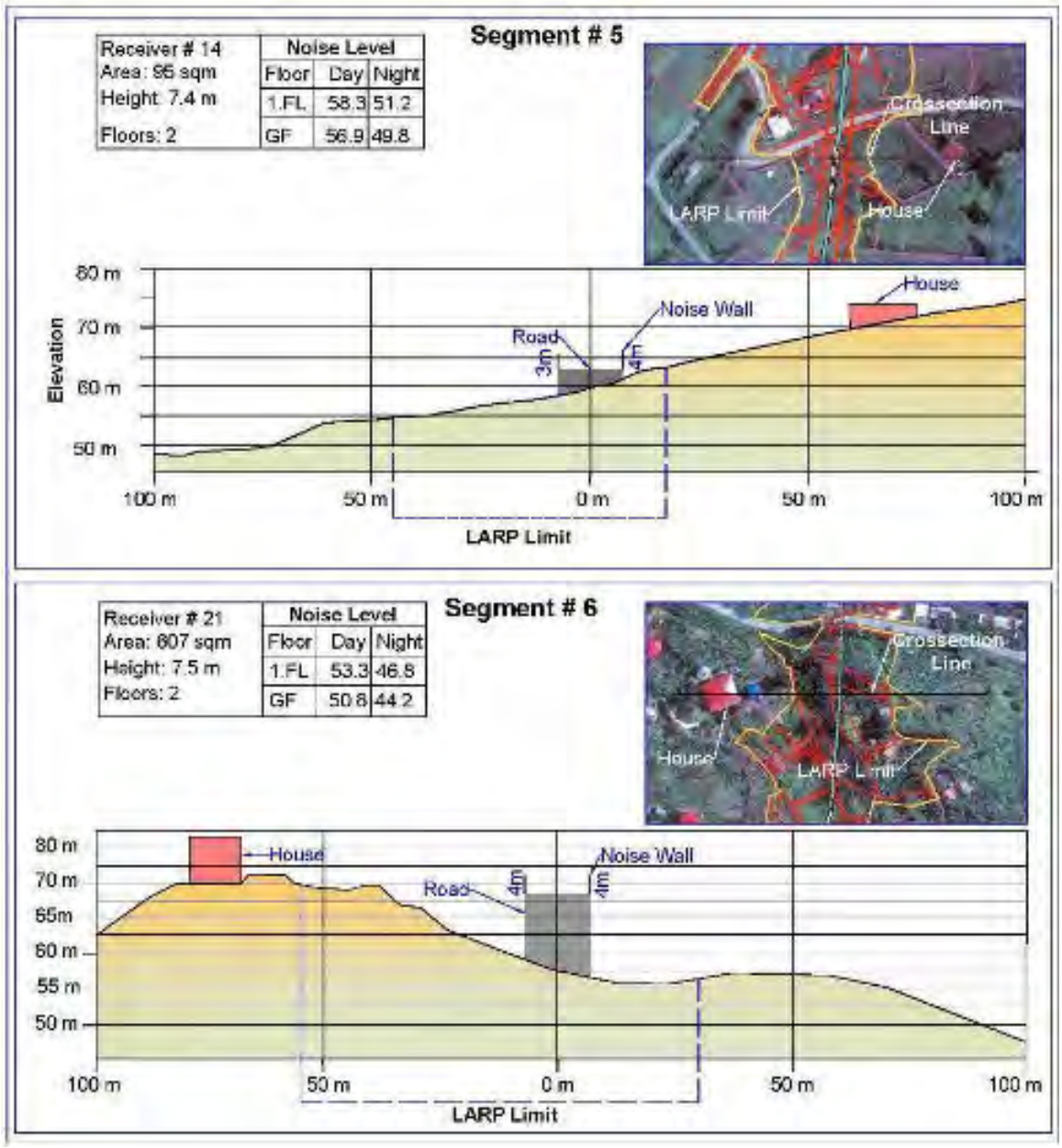


Figure 8-39: Segment 8-Single Point with Noise Protection

Figure 8-40: Segment 9-Single Point with Noise Protection


Receiver # 3
Area: 336 sqm
Height: 8.9 m
Floors: 3
Noise Level
Floor Day Night
2.FL 53.9 46.6
1.FL 52.5 45.4
GF 51.2 44.1
Segment # 1
LARP Limit
Crossection Line
House
A
A'
65m
60 m
55 m
40 m
House
Road
Noise Wall
4m
4m
100 m
50 m
0 m
50 m
100 m
LARP Limit
Receiver # 4
Area: 163 sqm
Height: 7.6 m
Floors: 3
Noise Level
Floor Day Night
2 Fl 57.8 50.7
1.FL 54.6 47.4
GF 53.4 46.3
Segment # 2
LARP Limit
House
Crossection Line
70 m
60 m
50 m
40 m
House
Road
Noise Wall
4m
4m
100 m
50 m
0 m
50 m
100 m
LARP Limit


Segment # 5
Receiver # 14
Area: 95 sqm
Height: 7.4 m
Floors: 2
Noise Level
Floor | Day | Night
1.FL | 58.3 | 51.2
GF | 56.9 | 49.8
Crossection Line
LARP Limit
House
80 m
70 m
60 m
50 m
Elevation
Road
Noise Wall
3m
4m
House
100 m
50 m
0 m
50 m
100 m
LARP Limit
Segment # 6
Receiver # 21
Area: 807 sqm
Height: 7.5 m
Floors: 2
Noise Level
Floor | Day | Night
1.FL | 53.3 | 46.8
GF | 50.8 | 44.2
Crossection Line
House
LARP Limit
80 m
70 m
65m
60 m
55 m
50 m
House
Road
Noise Wall
4m
4m
100 m
50 m
0 m
50 m
100 m
LARP Limit

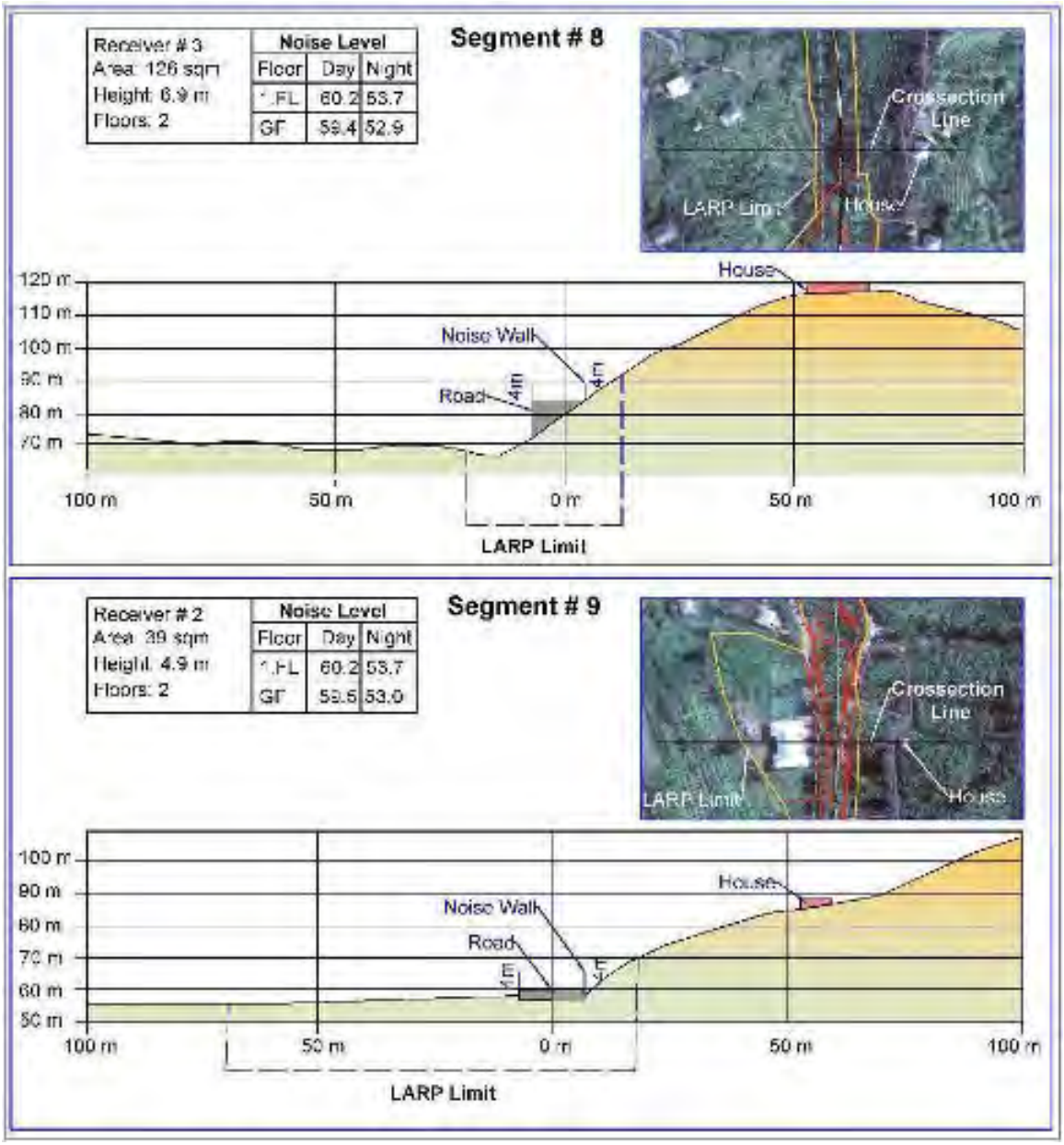
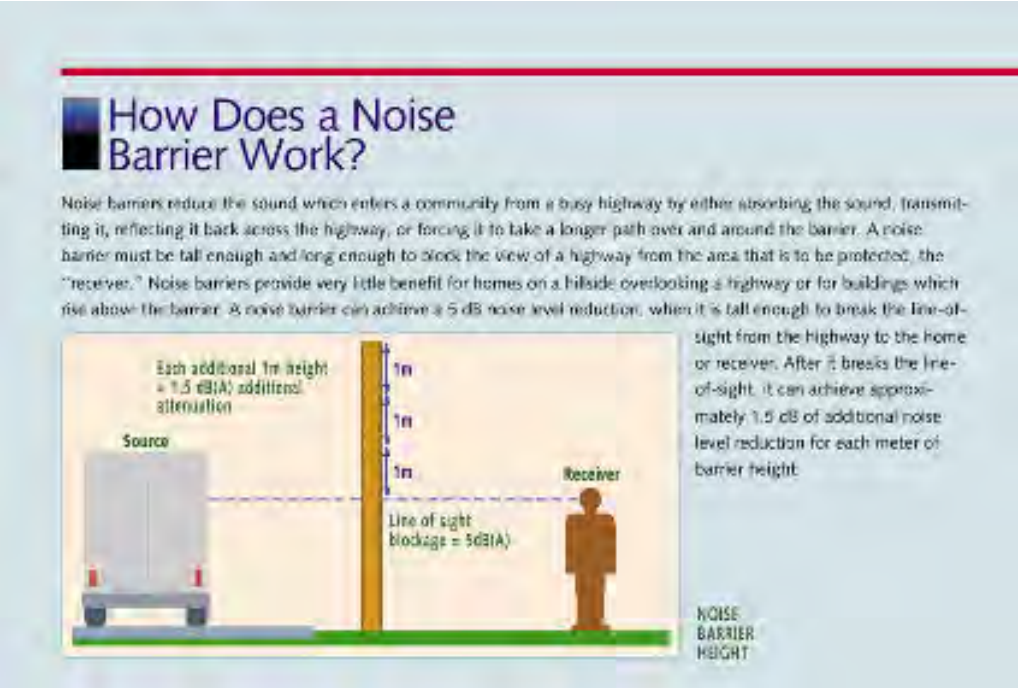


Figure 8-41: Relative Positions of Selected Receiver

Table 8-8: Result of Noise Modeling

	Section 1					Section 2				
	Segment 1	**Segment 2**	**Segment 3**	**Segment 4**	**Segment 5**	**Segment 6**	**Segment 7**	**Segment 8**	**Segment 9**	
Length of Segment (m)	521	735	785	980	1207	864	805	1493	1174	**8,563**
Surface Road (m)	205	260	468	400	923	534	362	433	888	**4,473**
Bridge (m)	316	475	316	580	284	330	443	1060	286	**4,091**
No of receptors	38	97	37	53	41	61	42	59	62	**490**
No of receivers	21	52	13	30	20	22	27	40	31	**256**
Structures removed, 25 m from Edge	3	7	3	2	3	–	1	5	1	**25**
Total Length of the Noise walls (m)	951	1,420	1,033	1,181	2,008	1,400	1,639	2,550	2,343	**14,525**
Total Area of Noise Walls (m^2)	3,805	5,679	4,131	4,723	7,200	5,600	6,555	10,201	9,374	**57,267**
Houses that may have the option of relocating for noise	6	7	2	3	2	7	8	15	2	**52**

482. The noise control strategy involves construction of noise barriers. In addition to absorbing and reflecting the noise, as shown in **Figure 8-42**, noise is "diffracted" over the barrier, thus increasing the distance it travel to the listener.



Source: FHWA, "Keeping the Noise Down, Highway Traffic Noise Barriers

Figure 8-42: How Noise Barriers Work


EARTH BERM NOISE BARRIER


WALL NOISE BARRIER


COMBINATION NOISE BARRIER


CONCRETE NOISE BARRIER


BRICK NOISE BARRIER

Figure 8-43: Absorbing and Reflecting the Noise

8.7 Vibration

Phase	ID	Impact
Construction	09	Construction activities will generate vibration which may result in annoyance, disturbance, stress and damage to structure.
Operation	10	Vibration impacts unlikely of Project operation

8.7.1 Construction Phase Impacts

483. Ground-borne vibration is the oscillatory motion of the ground about some equilibrium position, and can be described in terms either of displacement, velocity or acceleration. Because human sensitivity to vibration typically corresponds best to the amplitude of vibration velocity within the low frequency range of most concern (roughly 5-100 Hertz), vibration velocity is the preferred measure for evaluating ground-borne vibration from transit projects.

484. Vibration from the construction activities is a cause concern to the community. The effects of vibration varies and depends on the magnitude of the vibration source, the particular ground conditions between the source and receiver, presence of rocks or other large structures in the area. The intensity, duration, frequency and number of occurrences of a vibration all play an important role in both the annoyance levels caused and the strains induced in structures.

485. The effects of vibration includes annoyance, sleep disturbance, and potential damage to structures. The Georgian Standards for vibration are provided in **Table 3-9**.

486. The proposed criteria for damage to buildings are shown in **Table 8-9**. These are derived from British Standard BS 6472 and are German Standards DIN 4150-3:1999. The details are provided in **Appendix 7**.

Table 8-9: Criteria for Structural Damage Due to Vibration

No Damage Likely	PPV < 5 mm/s
Cosmetic damage risk	PPV 5 to 15 mm/s
Structural damage risk	PPV > 15 mm/s

487. Sources of vibration includes construction equipment movement, pile driving, compaction, hammering (hydraulic or pneumatic), operation of batching plant and generators. Another source of vibration will be the blasting to be undertaken for tunneling. The propagation of vibration from construction activities are different in nature from the vibration from blasting. The construction activities are undertaken essentially on ground surface and spreads basically as two-dimensional waves. In contrast, the tunneling is undertaken below the surface and spreads in three-dimension. For this reason, the impact of the two is assessed separately.

Vibration Impact of Construction Activities on the Surface

488. **Table 8-10** provides an indication of the approximate vibration levels that may be expected for various vibration sources.

Table 8-10: Approximate Vibration Levels for Various Sources

Activity	Typical levels of ground vibration
Vibratory rollers	Up to 1.5 mm/s at distances of 25 m Higher levels could occur at closer distances; however, no damage would be expected for any building at distances greater than approximately 12 m (for a medium to heavy roller)
Hydraulic rock breakers (levels typical of a large rock breaker operating in hard sandstone)	4.50 mm/s at 5 m 1.30 mm/s at 10 m 0.4 mm/s at 20 m 0.10 mm/s at 50 m
Compactor	20 mm/s at distances of approximately 5 m, 2 mm/s at distances of 15m. at distances greater than 30 m, vibration is usually below 0.3 mm/s
Pile driving/removal	1 to 3 mm/s at distances of 25 m to 50 m depending on soil conditions and the energy of the pile driving hammer
Bulldozers	1 to 2 mm/s at distances of approximately 5 m. at distances greater than 20 m. vibration is usually below 0.32 mm/s
Air track drill	4 to 5 mm/s at a distance of approximately 5 m, and 1.5 mm/s at 10 m. at distances greater than 25 m, vibration is usually below 0.6 mm/s and at 50 m or more, vibration is usually below 0.1 mms
Truck traffic (over normal (smooth) road surfaces)	0.01 to 0.2 mm/s at the footing of buildings located 10 to 20 m from a roadway
Truck traffic (over irregular surfaces)	0.1 to 2.0 mm/s at the footings of buildings located 10 m to 20 m from a roadway

Source: Northern Expressway Environmental Report: Noise and Vibration technical Paper. 2007. http://www.southroad.sa.gov.au/__data/assets/file/0019/13780/Noise_and_Vibration_Technical_Paper.pdf

489. These levels are well below the threshold of any possibility of damage to structures due to vibrations from typical construction activities related to roller, compactors, and movement of construction equipment.

490. The piling for the bridge piers are likely to generate relatively more vibrations which depends on soil condition. However, even under extreme conditions, the vibration is unlikely to exceed 10 mm/s beyond 25 m. However, there are several old residences in the Study Area that may be prone to damage. Mitigations measures are described later in this section to ensure that no damage to structures take place due to the piling operation and in case of a damage appropriate compensation is made.

Vibration Impact of Tunnel Construction

491. Tunnels will be excavated using two methods: a) excavators of 0.5 cubic meter (m^3) capacity, excavators and jackhammers and b) drilling and blasting. The first method will be used for Category II-III[182] soils and for Category V soils near the tunnel mouth. The second method will be used for Category V rock away from the tunnel mouth. With reference to Soils Types (**Table 4-4**), Soil Type 4, 13 and 14 fall in Categories II and III whereas Soil Type 15 and 16 fall in Category V. A breakdown of estimated excavation volume by tunnel and method is provided in **4-10.** These are estimated volumes based on available information. The actual volume is likely to differ from these estimated. In addition to the main tunnel, about 118 m^3 of soil and rock will be removed near mouth of the tunnel. The linear cross-sections of the tunnels and the type of soils is shown in **Figure 4-8** to **Figure 4-12**.

492. The airborne shockwaves are generated mainly if the blast is carried out on the surface or near the surface. As all blasting will be undertaken in the tunnel, airborne shockwaves are not considered as a serious concern.

493. A second source of concern is flying rocks from the blast. Depending in the rock type and explosive strength, these rocks can go up to 50 m and can potentially damage structures. For the above reason, surface blasting or blasting near the mouth of the tunnel is not recommended.

494. Underground blasting results in ground vibrations that cannot be confined to the site. The Project will conduct construction blasting consistent with Georgian and international safety standards. Blasting will be conducted using standard mining industry practices and procedures to ensure safety of personnel and equipment. This includes establishing a safety zone around the blast area, say to a distance of 500 m (actual distance will be established by the contractor based on the safety standards) and evacuating it.

Prediction Model

495. Prediction of vibration levels at a location away from the blasting site is a complex function of blasting parameters and rocks through which the waves propagate. A number

[182] Here rock categories are defined with respect to the volume that they will take after removal. Category II is defined as *fragmented rock but the muck pile is "frozen"*; Category III as *fragmented rock pile with mucking difficulties*; Category V is Fragmented rock. https://books.google.com.pk/books?id=8NHKBQAAQBAJ&pg=PA13&lpg=PA13&dq=Blasting+Category+V+Rocks&source=bl&ots=_APKZS89cx&sig=DkeqfS2s5OHHnrSaMy6WcoQutHU&hl=en&sa=X&ved=0ahUKEwiE9uOTqfDQAhXJPBoKHTuuDlUQ6AEIHTAB#v=onepage&q=Blasting%20Category%20V%20Rocks&f=false

of site specific experimental formulae have been developed to predict and control blasting effects. All of these formulae have the same form:

$$PPV = k \left(\frac{R}{Q^n}\right)^{-b} \qquad \text{Equation 1}$$

where:

PPV = peak particle velocity (mm/s);

k = site constant

R = distance to the point of concern (m);

Q = maximum instantaneous charge weight;

b = rock properties constant; and

n = constant that depends on the geometry of the explosive.

496. Zhou et al (2000) have identified 8 different formulae from various studies. Similarly, Kumar et al (2016) have listed 23 different formulae.

497. The constant n is generally taken as ½ in most of the studies. The predicted value of PPV critically depends on the empirical constants, k and b. These are considered site specific and are normally determined by blast experiments. In the absence of experimental data, as is the case with this Project, empirical models can be used to evaluate these constants. Because of wide variation in site condition—charge per delay, vibration frequency, rock characteristics (type, unit weight, layering, slope of layers), blast hole conditions, presence of water, propagation of surface and body waves in the ground, and method of initiation—the site-specific empirical equations, if used at other sites are likely to have large errors.

498. Kumar et al (2016), have studied the effects of important engineering properties of rock and have developed an empirical model that relates the unit weight, uniaxial compressive strength (UCS) and rock quality designation (RQD) with the PPV. The present study uses the Kumar model for predicting the vibration levels.

499. According to Kumar's model,

$$PPV = \frac{f_c^{0.642}}{\gamma} \left(\frac{R}{Q^{1/2}}\right)^{-1.463} \qquad \text{Equation 2}$$

where:

PPV = peak particle velocity (mm/s);

f_c = UCS of rock

R = distance to the point of concern (m);

Q = maximum instantaneous charge weight (kg);

γ = unit weight (kN/m^3).

The value of f_c is proposed as follows:

For RQD less than or equal to 75 $\quad f_c = 0.59476\ RQD + 0.00893\ RQD^2$

For RQD Greater than 75 $\quad f_c = -7.91562\ RQD + 0.12152\ RQD^2$

Composite Rock Property

500. The vibration from blasting will propagate through the rocks in the surrounding hills. Geological information on the rocks is not available. However, given that the rocks in the five tunnels are of similar nature, it is reasonable to assume that similar rocks will be present in the surrounding areas also. For the purpose of calculating the PPV of the vibration, a composite rock property has been the developed. Five different types of rocks have been identified in the Project Area as shown in **Figures 4-8** to **Figure 4-12**. Using the cross-sectional area of the rocks in these figures, the proportion of each type of rock has been calculated. All properties are then calculated by taking weighted average of the individual rock type. The result is shown in **Table 8-11**.

Table 8-11: Composite Rock Property Calculation

	Rock Category 4, 3, and 14	Rock Category 15	Rock Category 16	Composite
Volume fraction (%)	67	9	24	100
RQD (%)	10	68	91	34.7
f_c (MPa)	6.84	81.74	286.0	31.3
γ (kN/m^3)	26	27	27	26.3

501. RQD has been obtained from the geotechnical engineering report[183] whereas for γ the density of predominant rocks, andesite and basalt has been used. Both have a density of about 2.7 g/cm^3. To obtain, unit weight it has been multiplied by the value of g, the acceleration due to gravity (9.81 m/s^2).

Maximum Instantaneous Charge Weight

502. The mass of explosives required to break a unit volume of rocks, called the powder factor, depends on the strength of rocks and the type of explosives. The recommended typical powder factor for different types of rocks are given in **Table 8-12**.[184]

Table 8-12: Powder Factor for Different Hardness of Rocks

Rock Type	Powder Factor (kg/m^3)
Hard	0.7 – 0.8
Medium	0.4 – 0.5
Soft	0.25 – 0.35
Very Soft	0.15 – 0.25

503. As basalt and andesite are both categorized as hard rocks,[185] for this analysis the mean value for hard rock as shown in **Table 8-12** is taken.

504. In the standard drilling and blasting tunneling method, the sequence of activities in one cycle is shown in **Figure 8-44**.[186] After one cycle, a slice of the rock is removed. The

[183] Ministry of Regional Development and Infrastructure of Georgia, Road Department. Bidding Documents for Construction of Batumi Bypass Road Section Km. -1 +000~km. 13+325. Volume 3.2 Supplementary Information Geotechnical Engineering Report, Material Sources. October 2016.

[184] Dyno Nobel. Blasting and Explosives Quick Reference Guide. 2010.

[185] *Hard Rock Miner's Handbook Edition 5*. Jack de la Verne, Stantec Consulting, 2014.

[186] *Rock Excavation Handbook*. Sandvik Tamrock Corp. 1999

thickness of the slice depends on the depth of borehole. The total volume of rock removed in one cycle is equal to the cross-sectional area of the tunnel multiplied by the depth of the borehole. Once the volume is known the total quantity charge to be used in one cycle can be calculated by using the powder factor.

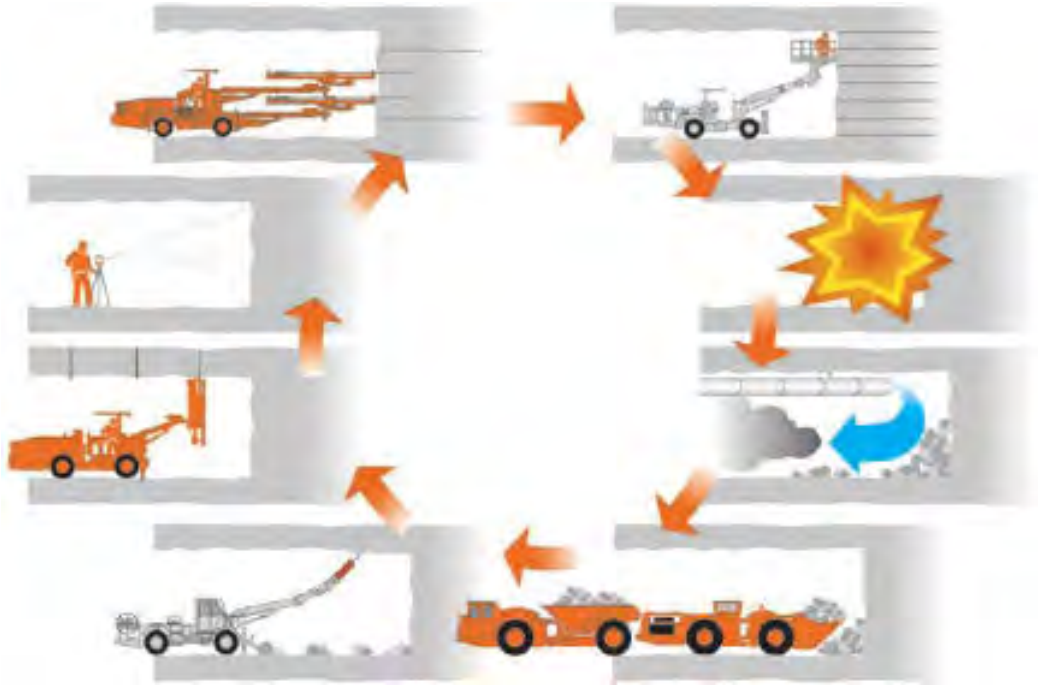


Figure 8-44: Drilling and Blasting Method

505. The total quantity of charge is different from that of the maximum instantaneous charge. One blast cycle may include a number of boreholes. A typical pattern is shown in **Figure 8-45**.[187] The detonation of the explosive starts from the center and after brief delays, lasting not more a fraction of a second, progresses outward in concentric circle. The quantity of charge in each delay is the instantaneous charge. The number of boreholes blasted, and hence quantity of instantaneous charge, increases as the blast progresses radially. It may be noted that the charge in the perimeter holes is typically less than those in the holes in the center to prevent damage to the walls. Thus the maximum instantaneous charge is not when the outer most ring of boreholes is detonated.[188]

[187] Dyno Nobel. Blasting and Explosives Quick Reference Guide. 2010.

[188] Personal communication with road construction engineer

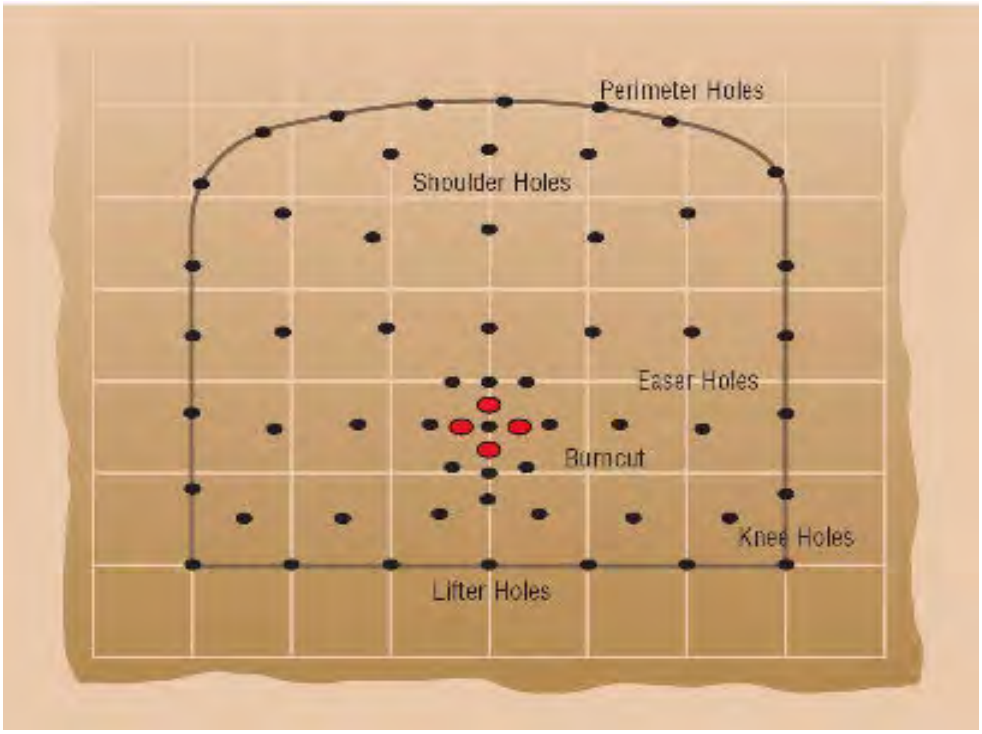


Figure 8-45: Typical Borehole Pattern

506. Based on the above considerations, the maximum instantaneous charge weight is calculated as shown in **Table 8-13**.

Table 8-13: Instantaneous Charge Weight Calculation

Parameter	Value	Explanation
Tunnel cross-section (m^2)	92	Calculated from drawings
Borehole depth (m)	5	Assumed, based on personal communication with road construction engineer
Rock removed in one blast cycle (m^3)	460	
Rock type	Hard	
Powder factor (kg/m^3)	0.75	See **Table 8-12**.
Total charge weight (kg)	345	
Maximum instantaneous charge weight (kg)	50	Estimated from typical borehole pattern and personal communication with road construction engineer

Results of Modeling

507. Using the rock parameters and instantaneous charge weight calculated above, the PPV at intervals of 10 m from the blasting site is calculated. The results are shown in **Table 8-14**.

Table 8-14: Calculated PPV as Function of Distance from Blast Site

Distance from Blast Site (m)	PPV (mm/s)
10	208.9
20	75.8
30	41.9
40	27.5
50	19.8
60	15.2
70	12.1
80	10.0
90	8.4
100	7.2
110	6.3
120	5.5
130	4.9
140	4.4
150	4.0
160	3.6
170	3.3
180	3.0
190	2.8
200	2.6

508. The results indicate that for the given configuration, the applicable criteria of no damage (5 m/s) will be met at a distance of 130 from the blasting site. Further the PPV will exceed the threshold for structural damage at a distance of 60 m from the blasting site.

509. The above results are based on certain key assumptions and understanding. These are:

- The accuracy and representativeness of information in the Feasibility Study. This includes the rock type, rock type distribution, and RQD;
- The tunnel composition of rock type is representative of the entire area to allow developing property of composite rock;
- The assumptions about borehole depth (5 m), total rock blasted in one cycle (460 m^3), powder factor (0.75) and maximum instantaneous charge (50 kg) are reasonable.

510. It is emphasized that these are assumptions and shall not be considered as binding. They are based on available information and have been selected as indicative of

typical conditions that are likely to be encountered in the actual tunneling. In selection of the numbers, a reasonable level of conservative approach has been taken. Therefore, chances are that the actual level of PPV will be less than the level shown in **Table 8-14**.

511. It is, therefore, believed that during the blasting for tunnels it shall be possible to meet the evaluation criteria (**Section 2.4**) which shall be considered binding on Construction Contractor.

Sensitivity Analysis

512. A sensitivity analysis was undertaken to ascertain the variation in distance at which the threshold values are exceeded. For this, the calculations were repeated for possible extremes values of the rock and blasting parameters, and the resulting change in the distance to threshold values was calculated. The results are shown are **Table 8-15**. This indicates that if Q is increased to 70 kg, the structural damage risk will increase to 72 m. Similarly, if RQD is increased to 55% or the unit weight is decreased to 24, the structural damage risk will increase to 80 and 64 m, respectively.

513. To investigate the impact of simultaneous variation in the three parameters, random variation about the mean values of the three parameters (±40% in Q, ±50% in RQD, ±10% in γ) was generated. The calculated distance to structural damage risk was calculated to be 59 ± 13 m, and to the cosmetic damage risk was calculated to be 126 ± 28 m.

Table 8-15: Sensitivity Analysis

Condition			Distance to Threshold (m)	
Q (kg)	**RQD (%)**	**γ (kN/m^3)**	**PPV > 15 m/s**	**PPV < 5 m/s**
50	35	26	60	130
30	35	26	47	101
70	35	26	72	154
50	15	26	38	82
50	55	26	80	172
50	35	24	64	137
50	35	28	58	123

Impacts on Houses

514. **Figure 8-46** through **Figure 8-50** show the tunnels and the risk zones around the tunnels. It may be noted that:

- The boundaries of risk zones are drawn without taking into consideration the variation in elevation of the terrain. The actual boundaries are likely to be closer to the tunnels.
- Based on the current information, no blasting is anticipated for Tunnel 1. However, recognizing that the actual distribution of rocks may differ from that shown in **Figures 4-8** to **4-12**, it is possible that some hard rock may be encountered during drilling and necessity of blasting may arise. Therefore, Tunnel 1 is also include in the Risk Area maps.

- Emergency tunnels and shafts will be constructed in Tunnels 2, 3, and 4 (2 tunnels). The risk zones boundaries also take into considerations, the location of the surface opening of the emergency tunnels and shafts.

515. Based on this analysis, the number of houses that are at risk in each of the five tunnels are shown in **Table 8-16**. An indexed list of structures located within the risk zones, along with coordinates and corresponding maps are provided in **Appendix 8**.

Table 8-16: Houses in Risk Zones

Tunnel	Structural Damage Risk Zone	Cosmetic Damage Risk Zone
1	11	15
2	20	17
3	3	9
4	25	30
5	5	9
Total	64	80

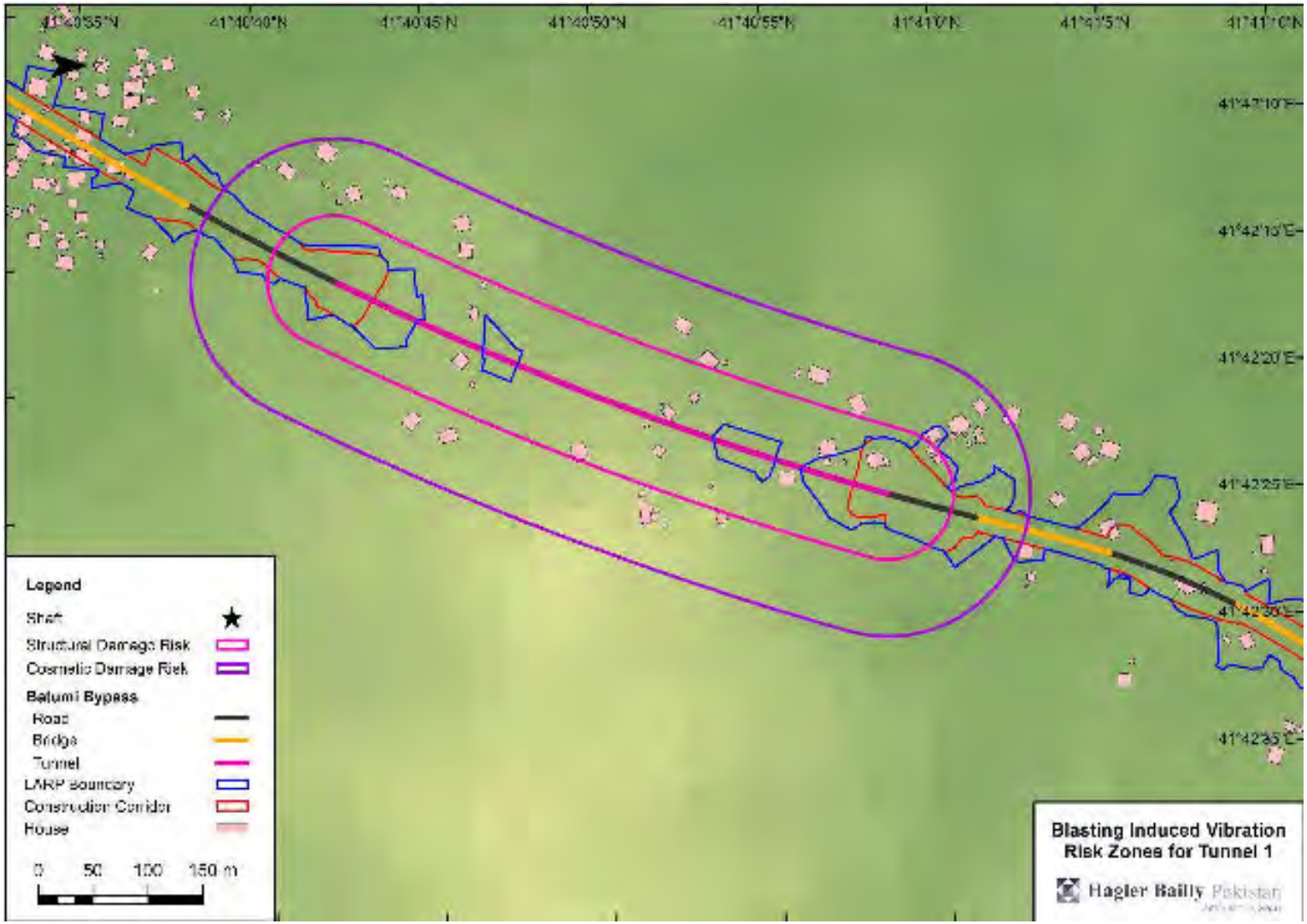


Figure 8-46: Blasting Induced Vibration Risk Zones for Tunnel 1

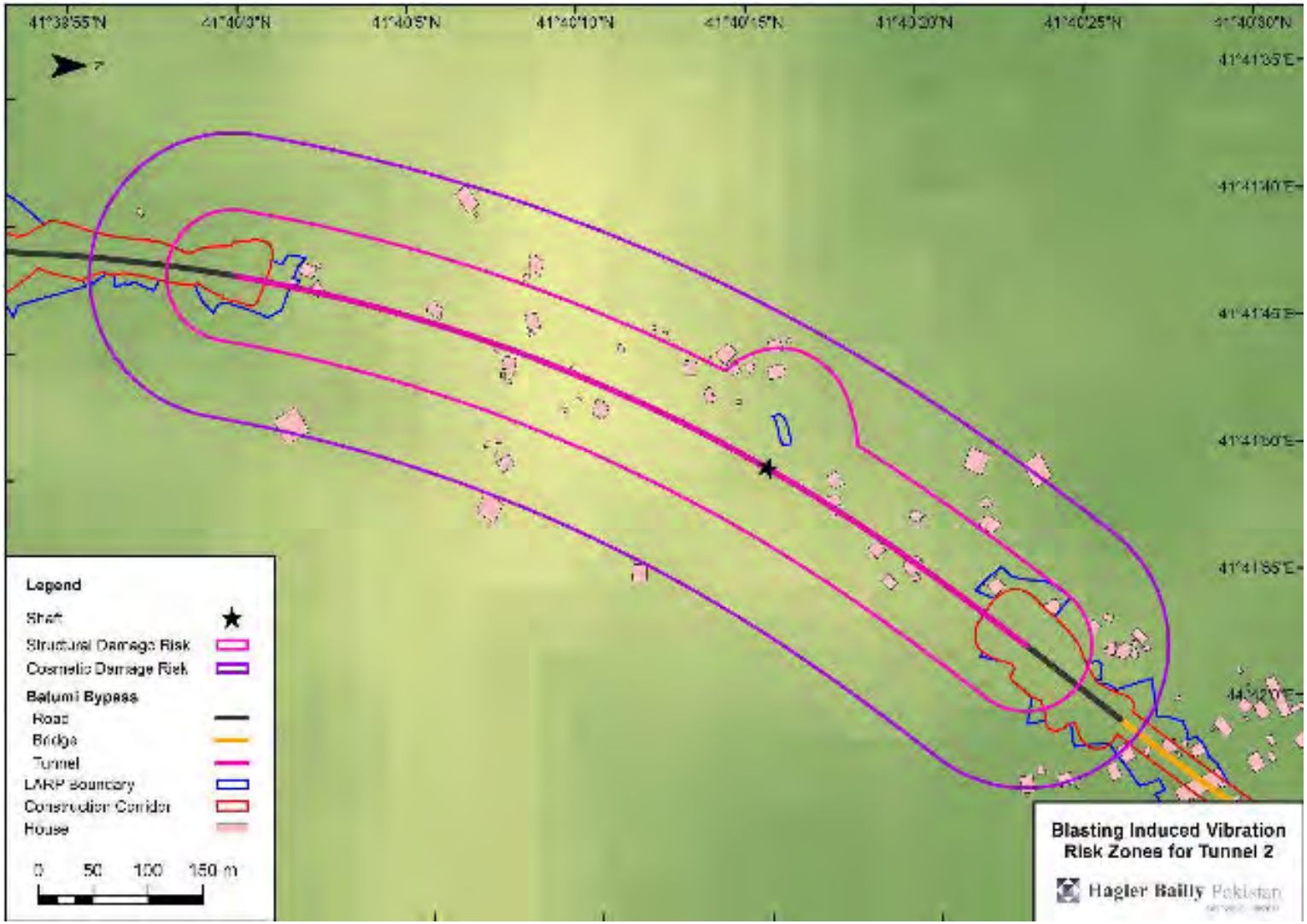


Figure 8-47: Blasting Induced Vibration Risk Zones for Tunnel 2

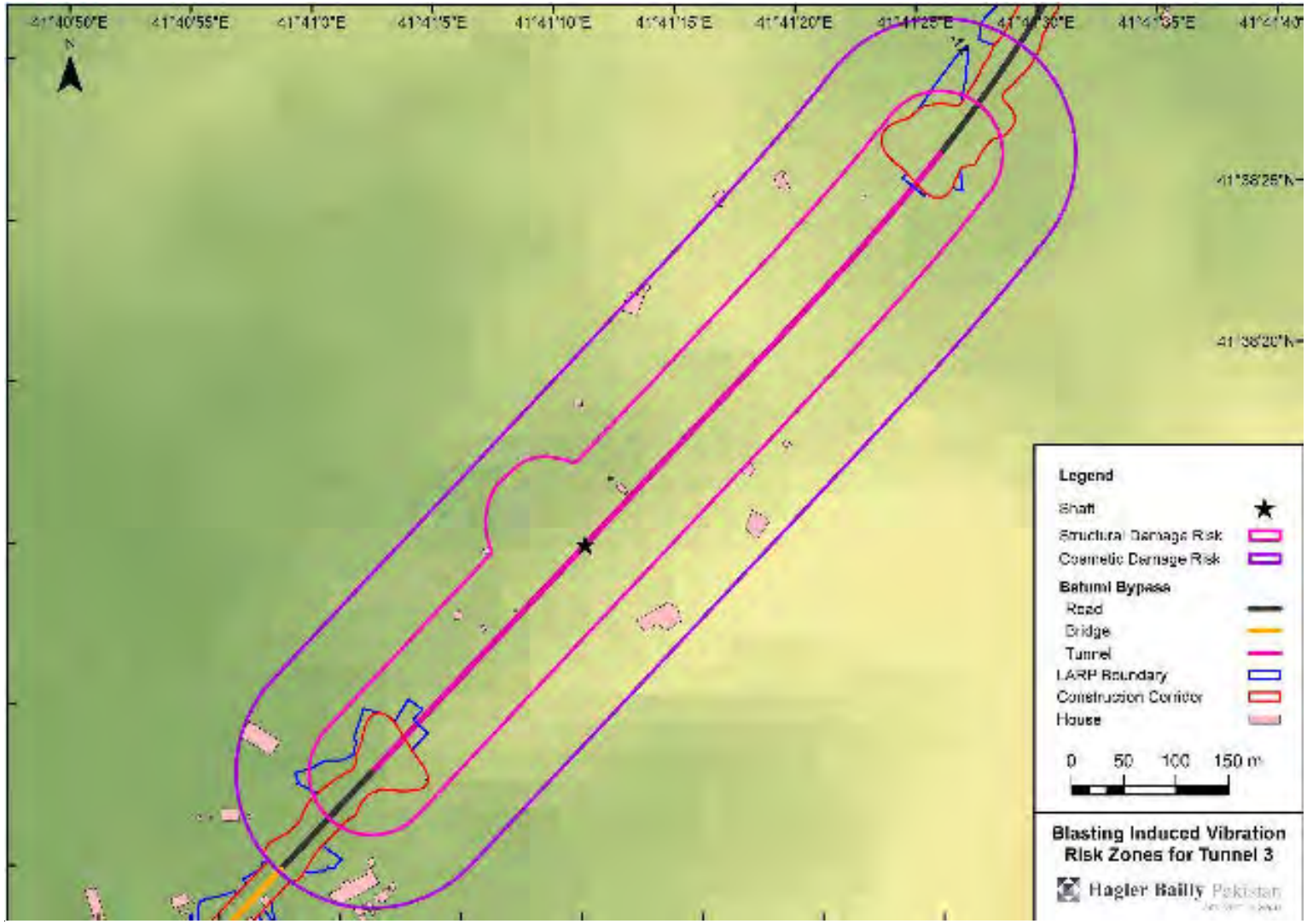


Figure 8-48: Blasting Induced Vibration Risk Zones for Tunnel 3

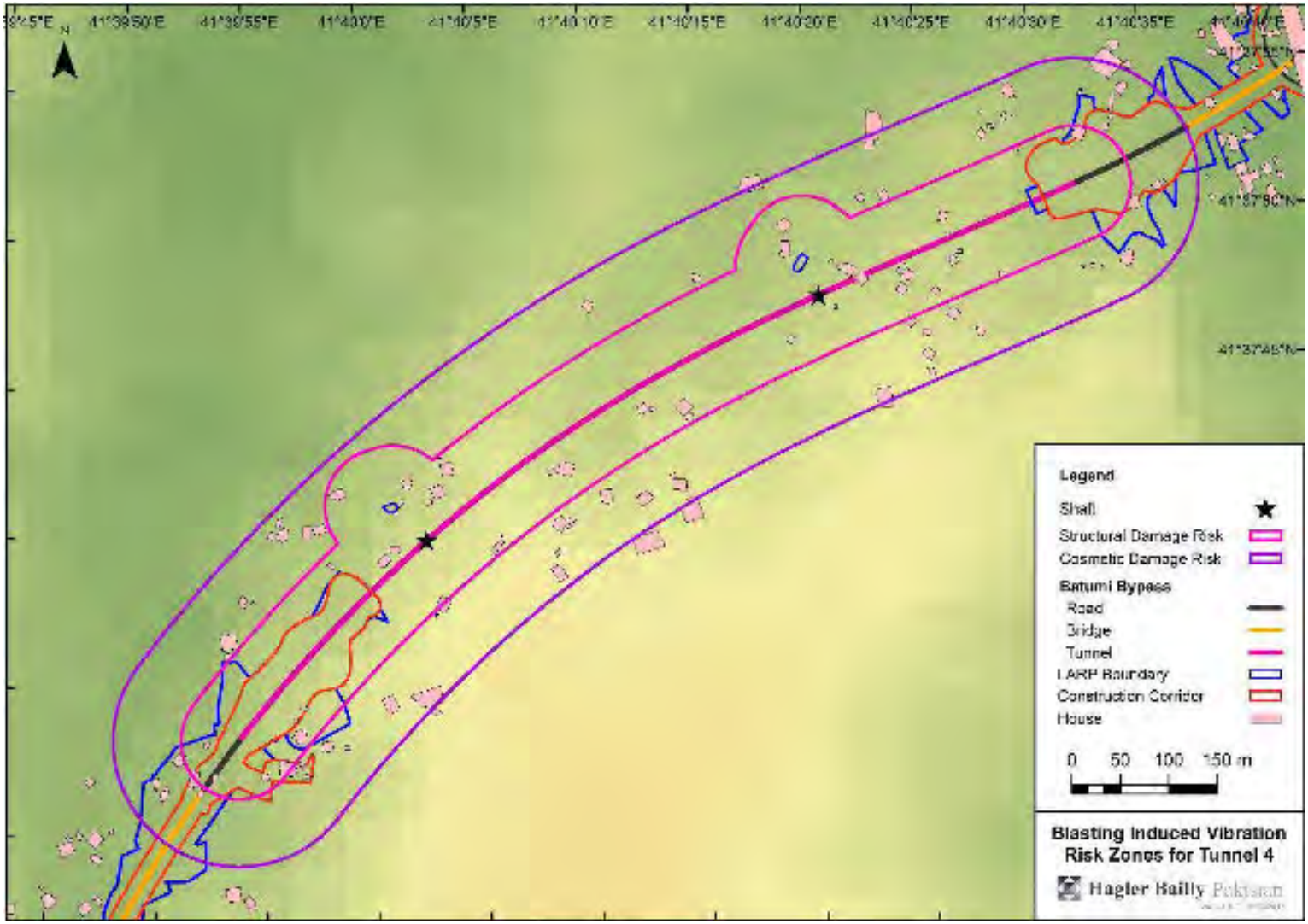


Figure 8-49: Blasting Induced Vibration Risk Zones for Tunnel 4

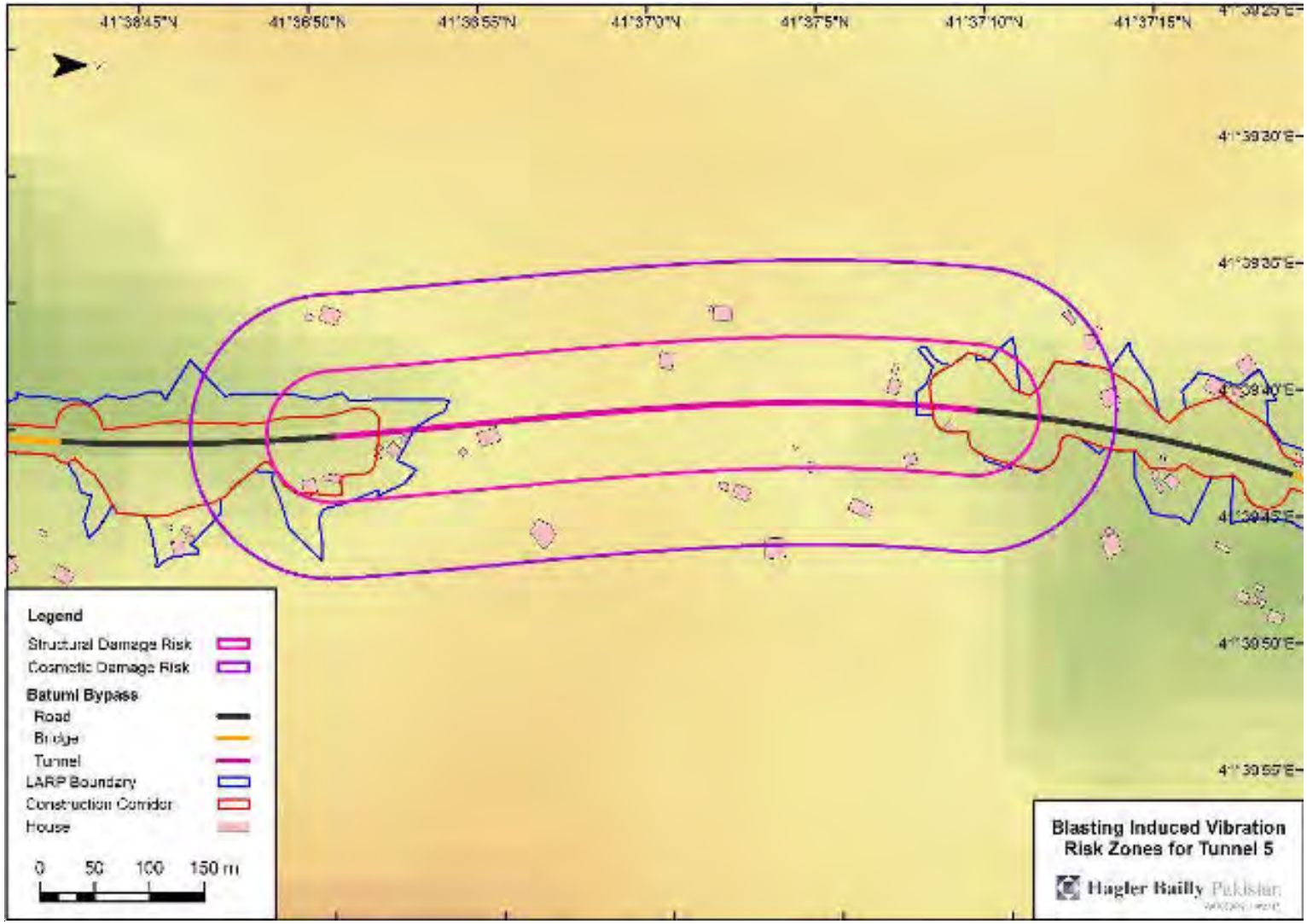


Figure 8-50: Blasting Induced Vibration Risk Zones for Tunnel 5

Mitigations Measures

Overall Approach

516. The PPV is predicted using a semi-empirical model which is the best alternate in the absence of measured field data. Although, there is reasonable confidence in the predicted value, but the norm is to measure field data to assess vibration levels. It is therefore proposed that the tunneling shall start from a tunnel with sparse population in the surrounding (for example, Tunnel 3). In the initial stages, the blasting induced vibration shall be measured as a function of maximum instantaneous charge and distance from the blasting site. This data shall be then used to refine the damage risk zones on the basis of the adopted criteria.

517. Early during the construction phase, the construction contractor shall develop a detailed tunnel blasting plan as part of the overall construction schedule. The plan shall specify, to a reasonable level of accuracy, the schedule for boring of each tunnel.

518. Using, the refined damage risk map and the tunnel boring schedule, the Supervision Consultant in consultation with the Roads Department and the Construction Contractor, shall identify the houses that will be affected and the impact duration and schedule.

519. For the houses that will fall in the Structural Damage Risk Zone, a temporary relocation plan will be developed. An amendment to the Land Acquisition and Resettlement Plan (LARP) will be commissioned for this purpose. Before start of blasting, all residents of houses in the Structural Damage Risk Zone will be relocated as per the LARP.

520. A survey will be undertaken in both zones, to determine the pre-blasting conditions of the buildings. The survey will be commissioned by the Supervision Consultant and will identify and record any existing damage to the structures. The survey will cover the following aspects:

a. Overall condition of the structures, both exterior and interior.
b. Documentation of defects observed in the structure using digital imagery along with notes, measurements and sketches.
c. Documentation of pre-existing cracks using digital imagery along with notes, measurements and sketches.

521. The survey will be accompanied with consultations with the affected household to explain the extent and reason for the survey, and the process for reporting any grievances regarding vibration impacts. The households should be provided with materials that summarize the grievance redress process.

522. Following completion of the blasting, the survey will be repeated in the Structural Damage Risk Zone to determine the condition of the buildings and verify that they are safe for re-occupation. If the buildings are safe, the residents will be allowed to return to their houses following any necessary damage repairs. If the buildings are damaged beyond repair, compensation will be paid to the owners as per the LARP.

523. If there are any claims or reports of damage in the Cosmetic Damage Risk Zone, the affected house will be surveyed against the pre-Project survey and repairs will be undertaken as appropriate.

Mitigation Plan

524. Following are key mitigation measures for the management of blasting:

- No blasting will be carried out within 100 m of the portal of the tunnel.
- Blasting will be scheduled during the day only.
- Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule.
- A Blasting Management Plan will be developed by the Construction Contractor. The Plan will be reviewed and approved by the Supervision Contractor before the initiation of the blasting work.
- Throughout the blasting activity, vibration sensors will be installed at strategic location to monitor the impact of blasting and to ensure that the vibration levels are within the adopted criteria. The monitoring plan will be part of the Blasting Management Plan.

525. Unlike other construction activities, it is recognized that the impact of blasting on the community can be significant or can be perceived as significant by the community. It is therefore vital that regular and meaningful contact with the community shall be maintained and their grievance shall be attended to in a timely manner. In this regard:

- A meaningful community engagement plan will be developed. The plan will cover identify the affected community; the key contact persons; frequency of engagement; the information to be shared; the responsibilities to manage the plan; and the notice period to be giving to the community for various blasting related generating activities.
- The Grievance Redress Mechanism will be used to record, investigate, and respond to any complaints. Investigation of the complaints will be undertaken by the Supervision Consultant.

Vibration Monitoring

526. Vibration Monitoring Plan will include monitoring of vibration levels and frequency around the blasting sites. The objectives of the monitoring will be to:

- Ensure that vibration levels in the communities are within the adopted criteria levels;
- Maintain record of vibration to settle any potential conflicts; and
- Monitor changes in the vibration levels due to possible changes in the rock formation and take appropriate corrective actions.

527. Vibration data will be documented, reviewed, and preserved. It will be regularly shared with the RD, ADB, ministry of Environment and the community as part of the monthly progress report.

8.7.2 Operation Phase Impacts

528. Highway traffic is not likely to have any measurable impact on the structures or on comfort. The Federal Highway Administration of the USA has determined that “All studies the highway agencies have done to assess the impact of operational traffic induced

vibrations have shown that both measured and predicted vibration levels are less than any known criteria for structural damage to buildings. In fact, normal living activities (e.g., closing doors, walking across floors, operating appliances) within a building have been shown to create greater levels of vibration than highway traffic."[189]

8.8 Air Quality

Phase	ID	Impact
Design	-	
Construction	11	Construction activities will generate pollution which will deteriorate the air quality of the area.
Operation	12	Vehicles on the Project road will generate pollution which will deteriorate the air quality of the area.

8.8.1 Construction Phase Impacts

529. The ambient air quality may be affected by the Project activities during the construction phase. In this section, the impacts of construction activities on ambient air quality are discussed.

530. The sources of emission will include point sources (a single, stationary and identified source of pollution from where pollutants can be emitted into the atmosphere instantaneously and continuously). The stacks of all the generators are an example of point source. Other point sources include the batching plant.

531. An area source is a source that is distributed in space releasing x mass of pollutant per unit area of activity not having a single identified source of emission. These are small sources of air pollution which by themselves may not emit very much but, when their emissions are added together, they account for a significant portion of the total emissions. Sand and gravel are typically mined in a moist or wet condition by open pit excavation or by dredging. After mining, the materials are transported to the processing plant where the material is dried and screened and are a source of particulate matter emissions. Temporary waste disposal or storage sites are not major emission sources but unloading the waste (dumping) onto dump sites results in emissions. Dumping activity will result in particulate matter emission.

532. Wind erosion from stockpile areas may be significant emission source. Wind erosion is a phenomenon that erodes the exposed surface, removes the soil from one point and deposits it to another point.

533. Quarry areas are the areas from which stones, rocks, sand, gravel and aggregate are excavated from ground. This include loading of excavated material from quarries to stockpiles.

534. Generally line source emissions refer to emissions from transport along a line of the road. The transport emissions include emissions from vehicles moving on roads and their exhaust emissions. As vehicle moves on the road, due to friction between vehicle's tyre and road, the dust particles comes in suspension which causes dust (PM^{10} and $PM^{2.5}$)

189 http://www.fhwa.dot.gov/environMent/noise/regulations_and_guidance/analysis_and_abatement_guidance/polguide09.cfm

emissions. Exhaust emissions include emissions attributable to engine related processes such as fuel combustion and particles that exit the tailpipe.

535. The proposed mitigation measures include:

- Dust suppression with covers on loads, water sprays, covers on long-term piles of materials when there are visible dust emissions. Minimize disturbance to, or movement of, soil and vegetation.
- Prevent soil damage and erosion.
- Retain as much natural vegetation as possible.
- Sprinkle water on all exposed surfaces, particularly those close and up-wind of the settlements.
- Site specific environmental management plan will be made for each construction site and must outline areas to be cleared, vegetated areas to be protected or fenced, solid waste disposal locations, and sprinkling locations.
- Indicate the limits of a clearing with highly visible markers.
- Erect silt fences around perimeter of works area and/or rock check dams, sedimentation ponds, and silt traps.
- Give stockpiles protective covering, e.g., revegetation, geotextiles.
- For fugitive dust control, sprinkling of water on the all unsealed roads used by the project vehicles that are within 200 m of any community will be done
- Earthwork operation to be suspended when the wind speed exceeds 20 km/hr in areas within 500 m of any community
- All stockpiles shall be adequately wetted, or covered with plastic, or provided with wind shield to reduce dust emission.
- Speed limits and defensive driving policies will be strictly implemented
- Road damage caused by project activities will be promptly attended to with proper road repair and maintenance work
- Install and maintain all vehicles and machinery with appropriate emission control equipment.
- Smoke from internal combustion engines should not be visible for more than ten seconds.
- To the extent possible, new and low emission equipment and vehicles shall be used
- Batching plants and associated machinery installed for project activities will be installed with suitable pollution control arrangements
- Best quality fuel and lubes shall be purchased where possible lead free oil and lubes should be used
- Batching plant shall be set up considering the wind direction so that the nearby communities are not affected by the emissions from batching plant
- Regular maintenance of vehicles and equipment will be conducted to keep emissions in check

- Filters will be installed wherever available in equipment. The minimum acceptable performance is obtained using a fabric filter dust collector. Whichever technology is employed, it needs to be maintained properly, in accordance with the manufacturer's instructions, to ensure adequate performance.[190] Filters will minimize dust emissions from operations.
- All stacks will be vertical and at least 3 m above ground

8.8.2 Operation Phase Impacts

536. The air quality impacts of the Project road were modeled to assess the impacts of traffic on the new road.

AERMOD Modeling System

537. AERMOD provides predicted pollutant concentrations for hourly, daily, monthly, and yearly averaging periods, and complies with the USEPA's guidelines on air quality models. The model also accounts for varying wind speeds and directions (sectors), and has the ability to model seasonal or monthly variations in emissions characteristics. It is capable of taking into account building downwash, meteorological, and surface data in its calculations. While AERMOD does not have the built-in capacity to directly process this data, it is provided with three stand-alone pre-processors to do so: BPIPPRM for building downwash, AERMET for meteorological data, and AERMAP to calculate surface characteristics. The salient features of the model are described in **Table 8-17**.

Table 8-17: Salient Features of AERMOD Air Dispersion Model

Model Name	AERMOD Modeling System
Release date	On April 21, 2000, the USEPA proposed that AERMOD to be adopted as the EPA's preferred regulatory model for both simple and complex terrain.[191] On November 9, 2005, AERMOD was adopted by the EPA and promulgated as their preferred regulatory model, effective as of December 9, 2005.[192]
Current version	Version 13350
Model source	http://www.epa.gov/scram001/dispersion_prefrec.htm
Model type	Gaussian Plume Model Gaussian plume treatment in horizontal and vertical directions for stable atmospheres. Non-Gaussian treatment in vertical for unstable atmospheres
Type of Source	*Point* such as stacks (allows multiple stacks) *Area* such as villages *Volume* such as stock piles *Line* such as roads
Source locations	Urban or rural. Urban effects are scaled by population.
Plume deposition	Dry or wet deposition of particulates and/or gases

[190] Environmental Guidelines for the Concrete Batching Industry, EPA Victoria, June 1998

[191] Federal Register: April 21, 2000 (Volume 65, Number 78) Proposed Rule

[192] Federal Register: November 9, 2006 (Volume 70, Number 216) Final Rule

Model Name	AERMOD Modeling System
Terrain types	Simple or complex terrain Requires digital elevation model for complex terrain
Building effects	Includes algorithms for building downwash
Meteorological data	Requires minimum one-year (preferably 3-year) hourly meteorological data for the site or nearby weather station
Output options	Calculates averages for specified periods (for example, annual or monthly), maximum or given percentile during the specified period, and concentration at specific locations

538. The pre-processors are discussed below.

- AERMET requires the user to input hourly surface observation data and twice-daily upper air sounding data. The program uses this data to develop the necessary boundary layer parameters for dispersion calculation by AERMOD.
- The AERMAP's pre-processor processes terrain data and prepares a grid of receptors to be used in the AERMOD program. Since the terrain in the vicinity is not much elevated and considered as flat, so the AERMAP was not used.
- The building profile input program for PRIME algorithm (BPIPPRM) requires the user to input the physical characteristics (height, length, width etc.) of buildings and stacks in the modeled area. The program then determines the emission plume disturbance due to building downwash but this pre-processor was not used as there was not disturbance from buildings.

Model Grid

539. A polar grid receptor network was used to simulate the model. The receptor locations were plotted in 36 radial directions; beginning with 10 degrees with commanded increment of 10 degrees in a clockwise fashion up to a radius of 3 km, with an interval of 100 m. Three such grids were defined to capture the entire length of the road and maintain an acceptable resolution.

Meteorological Data

540. Hourly climatic data of Batumi weather station for the years 2014 and 2015 was utilized for the air quality modeling. The data was used as both these areas share similar climatic conditions. The key parameters included in the data are wind speed, wind direction, pressure, and temperature.

Traffic Analysis

541. The traffic projection for 2033 provided in the Feasibility Study was used for the prediction.

Emission Sources

542. The Project road was modelled as a 14 m wide area source. The open areas of the Project alignment (road and bridge sections) was divided into 6 divisions, from tunnel to tunnel, as mapped in **Figure 8-51**. Emission contributions from closed section (i.e. tunnels) was divided into two and equally added to the divisions adjacent to that tunnel.

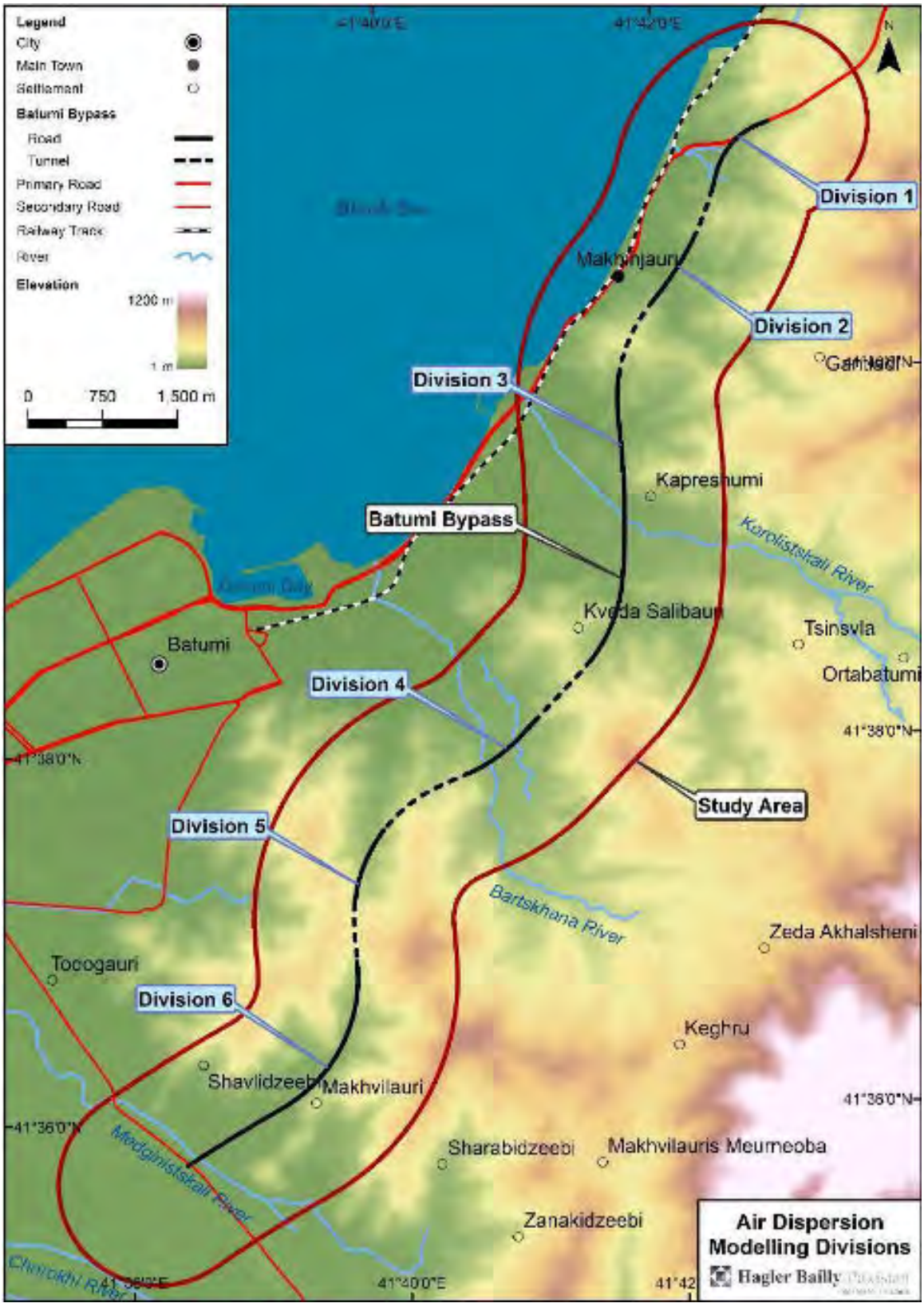


Figure 8-51: Air Dispersion Modelling Divisions

Emission Factors

543. The Updated Emission Factors of Air Pollutants from Vehicle Operations in GREET™ Using MOVES was used. The numbers used in the modelling, based on the traffic volumes for each segment, are presented in **Table 8-18**.

Table 8-18: Emission Rates used for Each Segment (µg/m_2/s)

	NO_X	SO_2	PM_{10}
Division 1	1.18	0.061	0.051
Division 2	1.76	0.091	0.076
Division 3	1.18	0.061	0.051
Division 4	2.06	0.106	0.088
Division 5	1.98	0.102	0.085
Division 6	1.08	0.056	0.046

Results

544. The results of the dispersion model is shown in **Table 8-19** and discussed below:

- Predicted incremental SO_2 concentrations are marginal at all locations. Furthermore, the baseline in **Section 5.2.6** established that SO_2 concentrations in the Study Area were very low. Therefore, this pollutant is of least concern.
- PM_{10} incremental concentrations are also marginal and much below IFC and Georgian limits. However, baseline conditions of PM_{10} adjacent to busy roads was significant as established in the baseline.
- Annual increase in NO_2 concentrations between 2.95 to 4.16 µg/m^3 are within IFC limits.

545. Pollutant dispersion maps for of vehicular emissions to a distance of 1 km, on both sides, from the centerline of the road are provided in **Figure 8-52 to Figure 8-56** for divisions 1 and 2, **Figure 8-57** to **Figure 8-61** for divisions 3 and 4; and **Figure 8-62** to **Figure 8-66** for divisions 5 and 6.

Table 8-19: Predicted Increment in Pollutant Concentrations (µg/m^3)

Sources	Averaging Period	NO_2	SO_2	PM_{10}
Division 1 & 2	24 hour Maximum	12.74	0.64	0.53
	Annual Average	4.16	0.21	0.17
Division 3 & 4	24 hour Maximum	13.76	1.15	0.57
	Annual Average	3.05	0.25	0.13
Division 5 & 6	24 hour Maximum	10.71	0.58	0.49
	Annual Average	2.95	0.16	0.13
Georgian Standard	24 hour	40	50	150
IFC (guideline)	annual	40		20
IFC (guideline)	24-hour		20	50

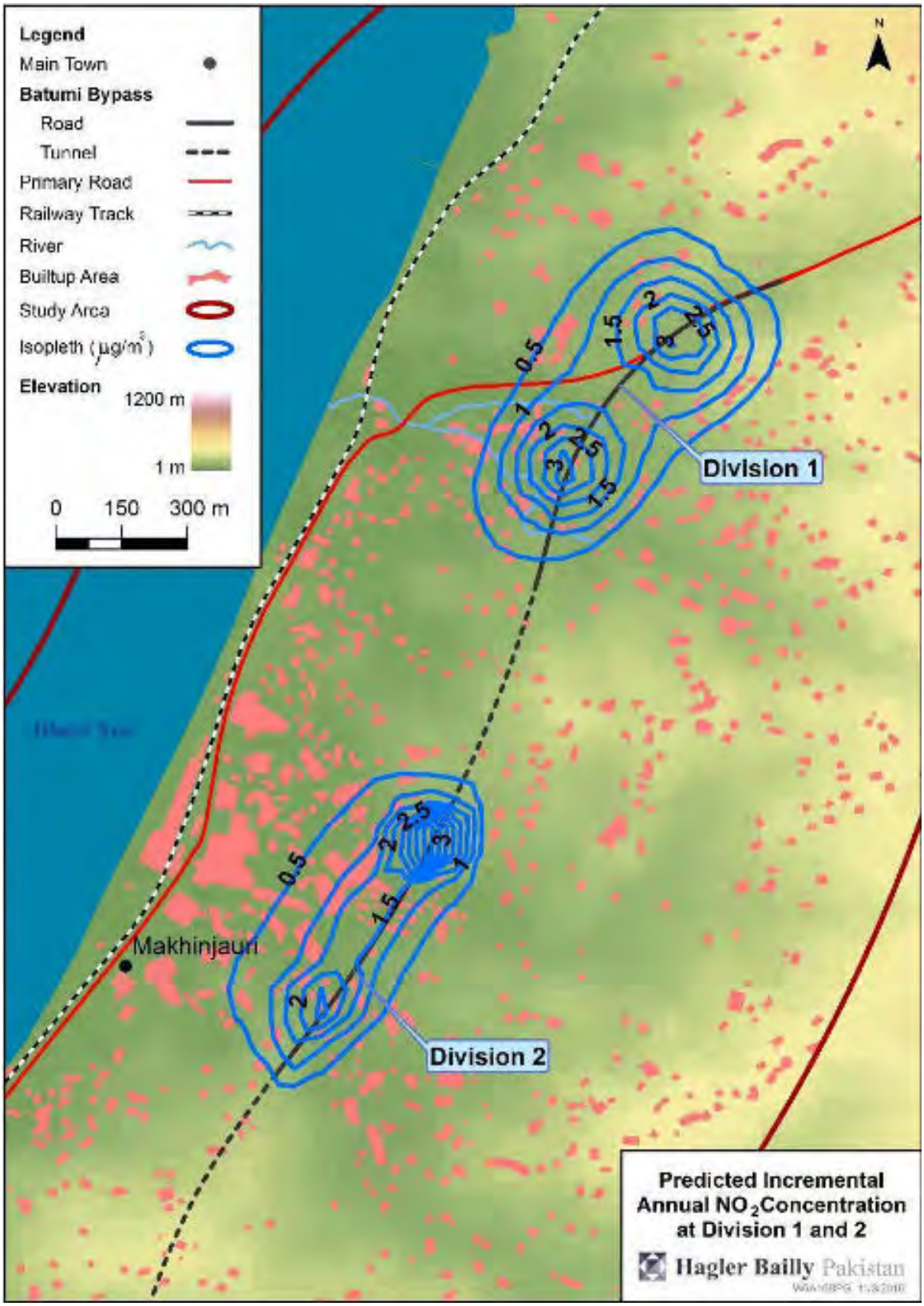


Figure 8-52: Predicted Incremental Annual NO_2 Concentration at Division 1 and 2

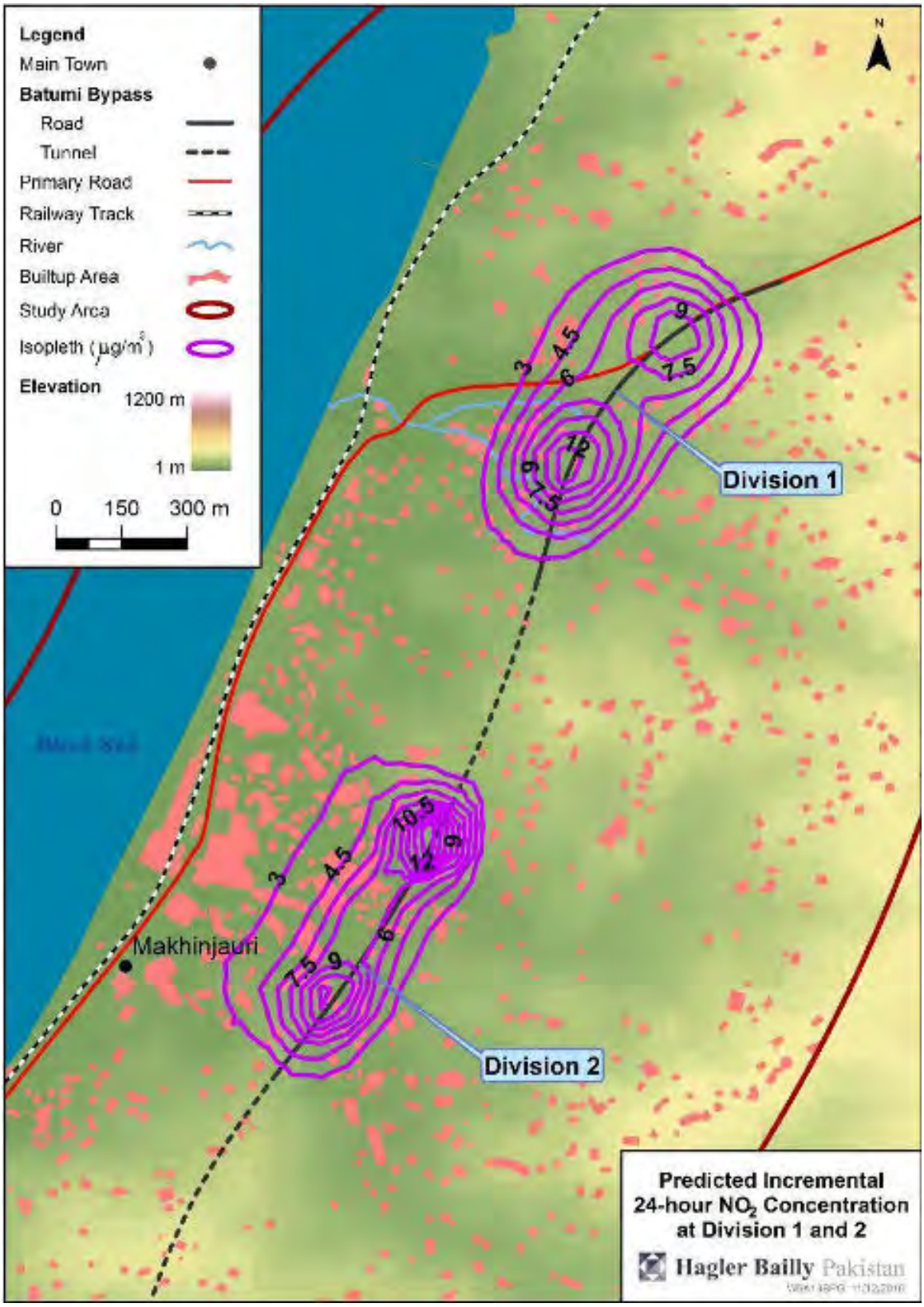


Figure 8-53: Predicted Incremental 24-hour NO_2 Concentration at Division 1 and 2

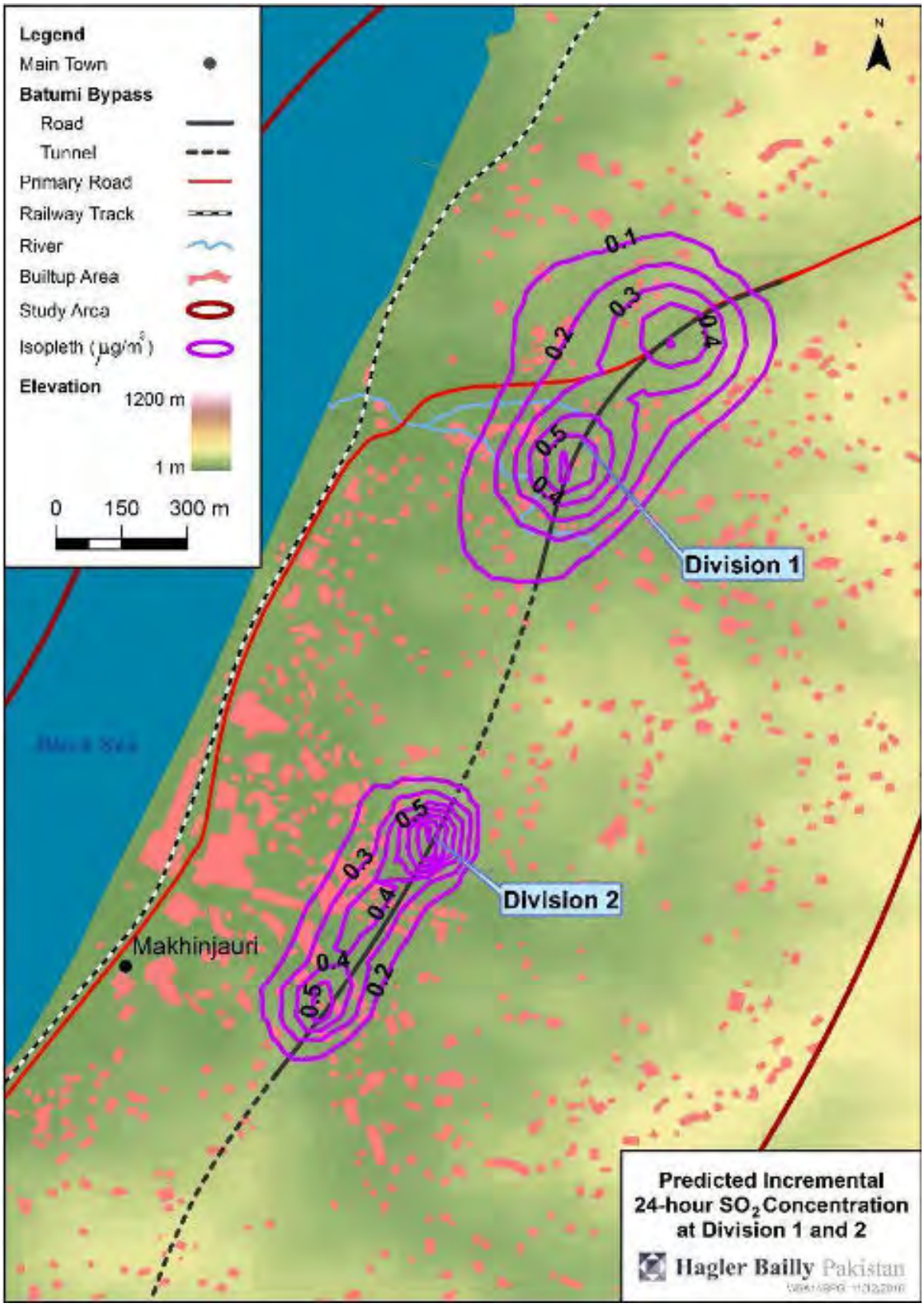


Figure 8-54: Predicted Incremental 24-hour SO_2 Concentration at Division 1 and 2

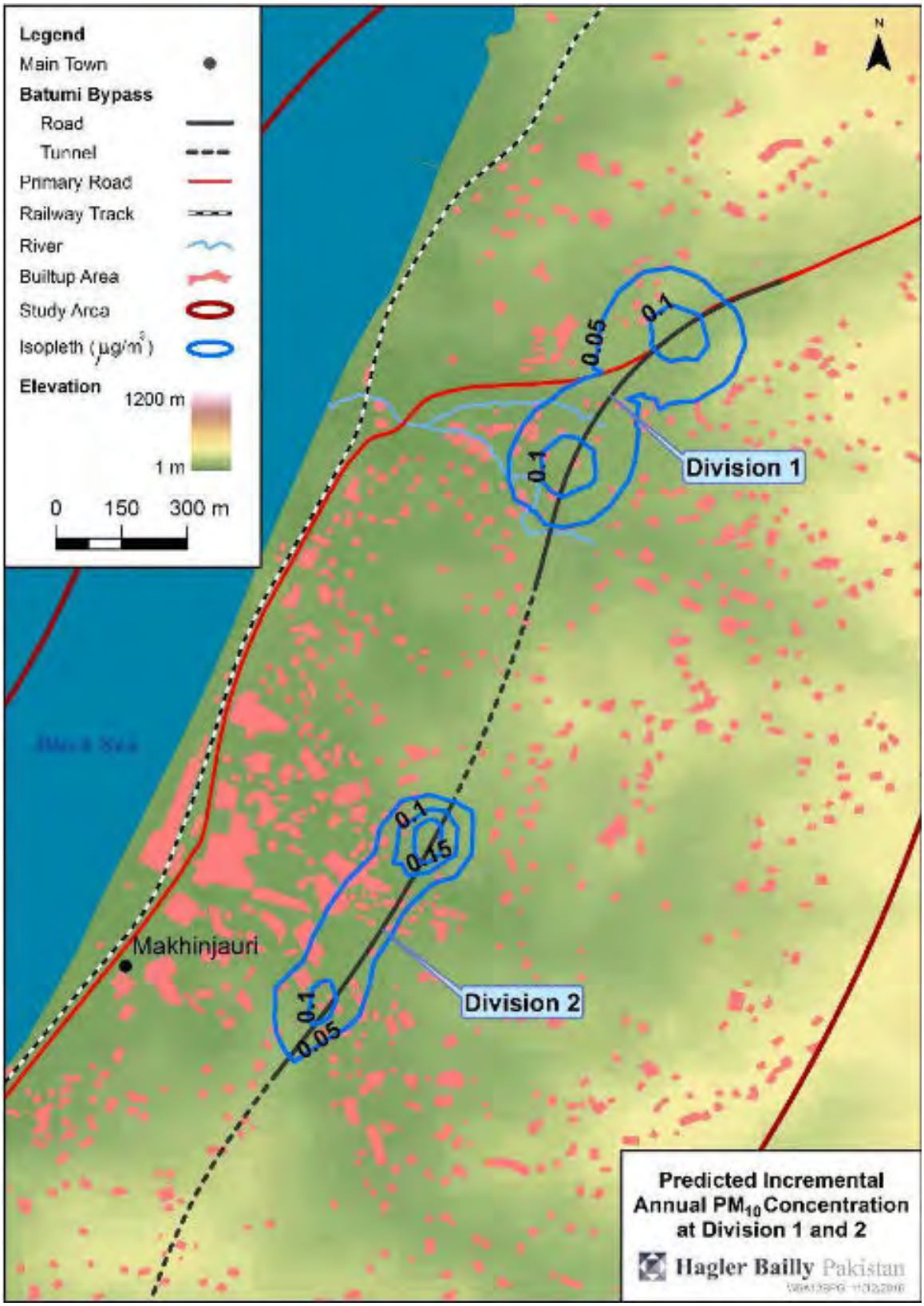


Figure 8-55: Predicted Incremental Annual PM_{10} Concentration at Division 1 and 2

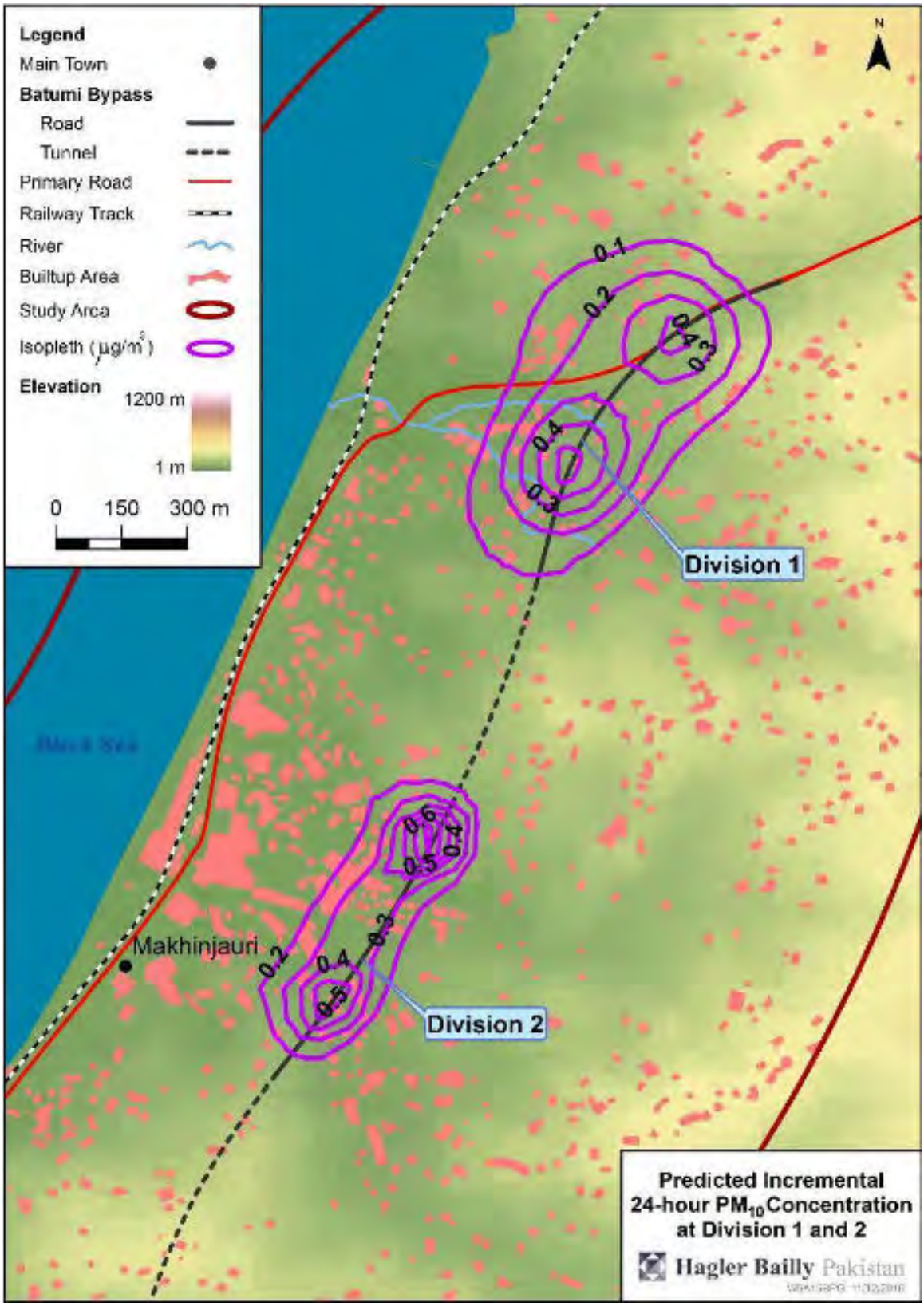


Figure 8-56: Predicted Incremental 24-hour PM_{10} Concentration at Division 1 and 2

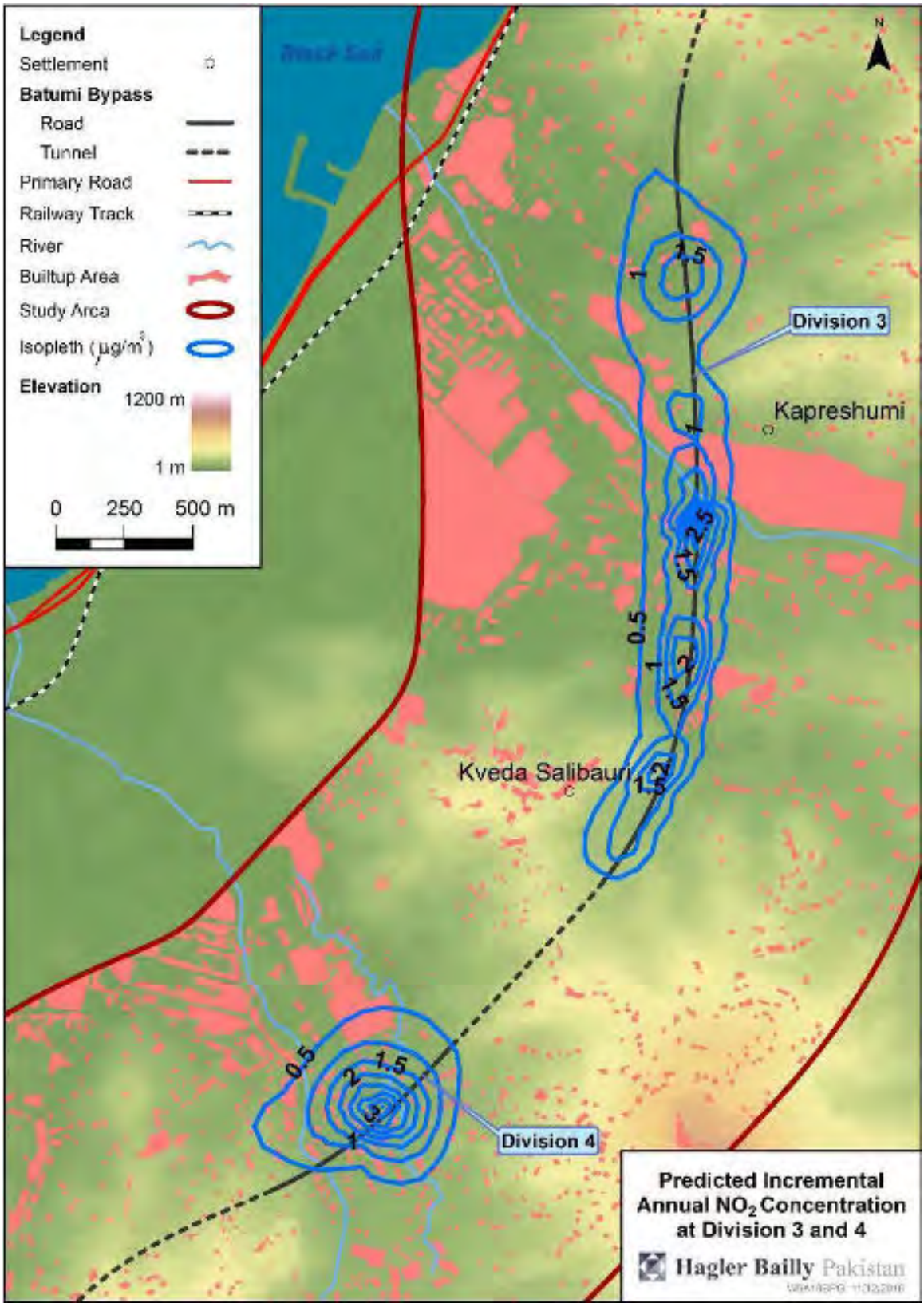


Figure 8-57: Predicted Incremental Annual NO_2 Concentration at Division 3 and 4

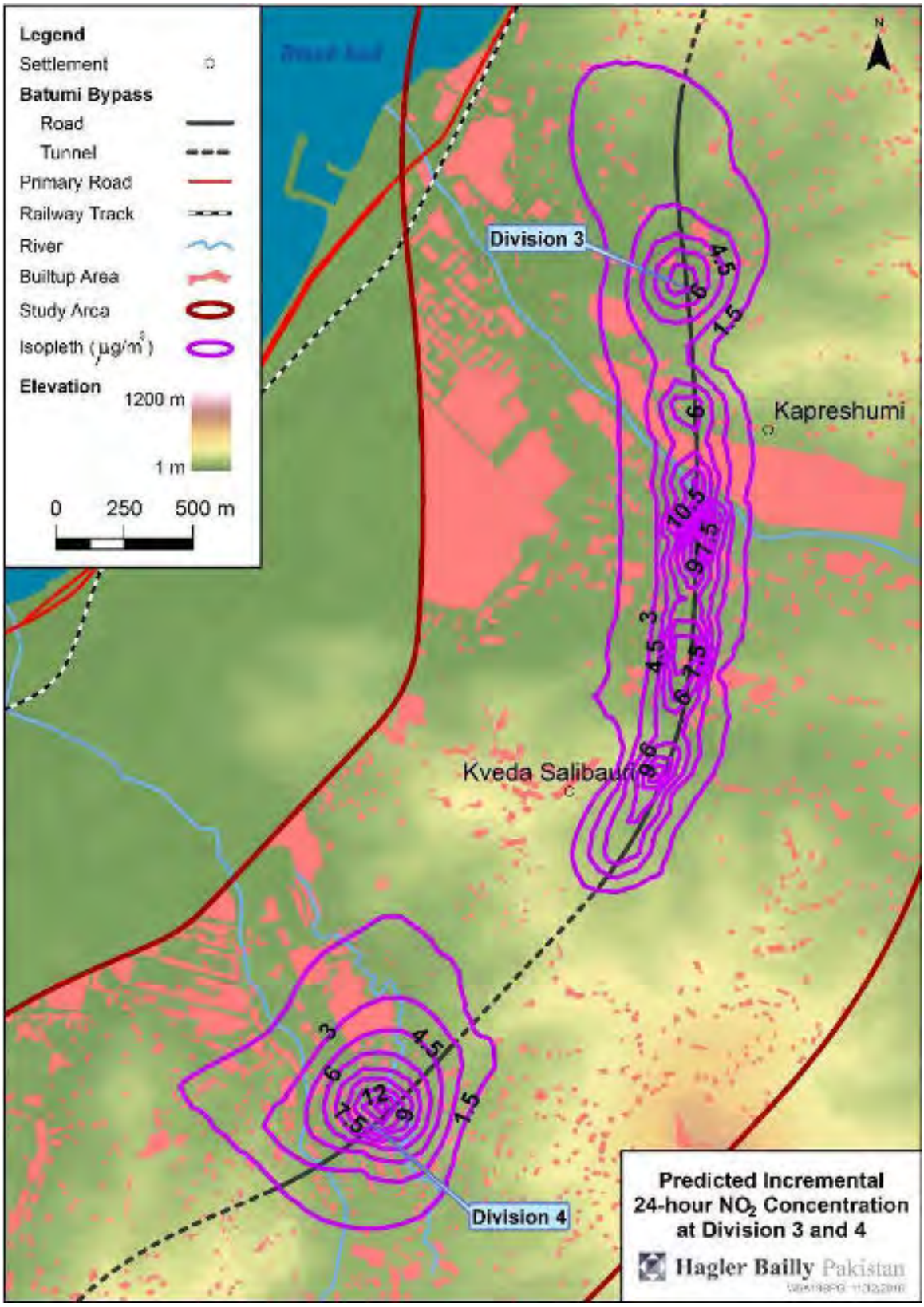


Figure 8-58: Predicted Incremental 24-hour NO_2 Concentration at Division 3 and 4

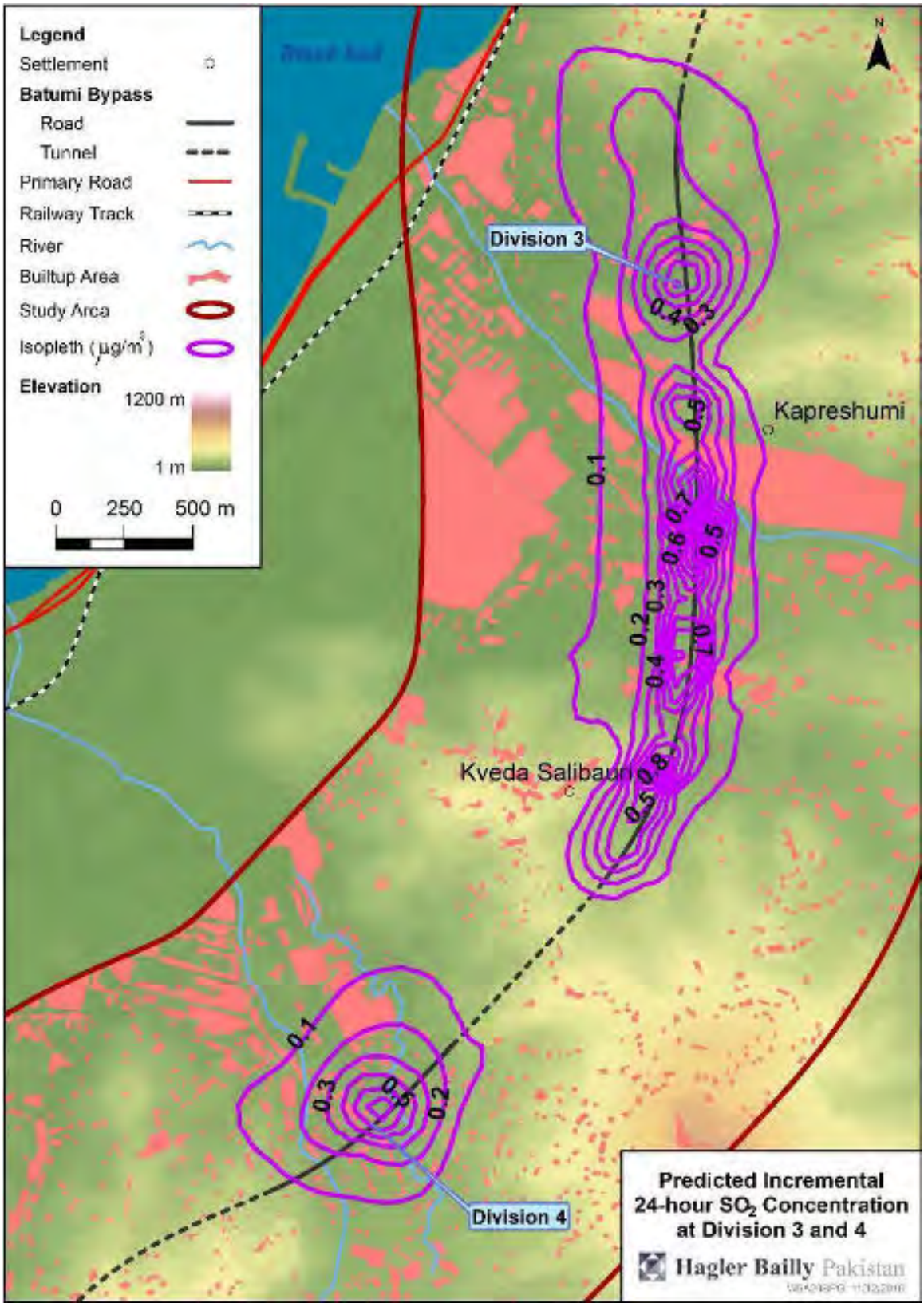


Figure 8-59: Predicted Incremental 24-hour SO_2 Concentration at Division 3 and 4

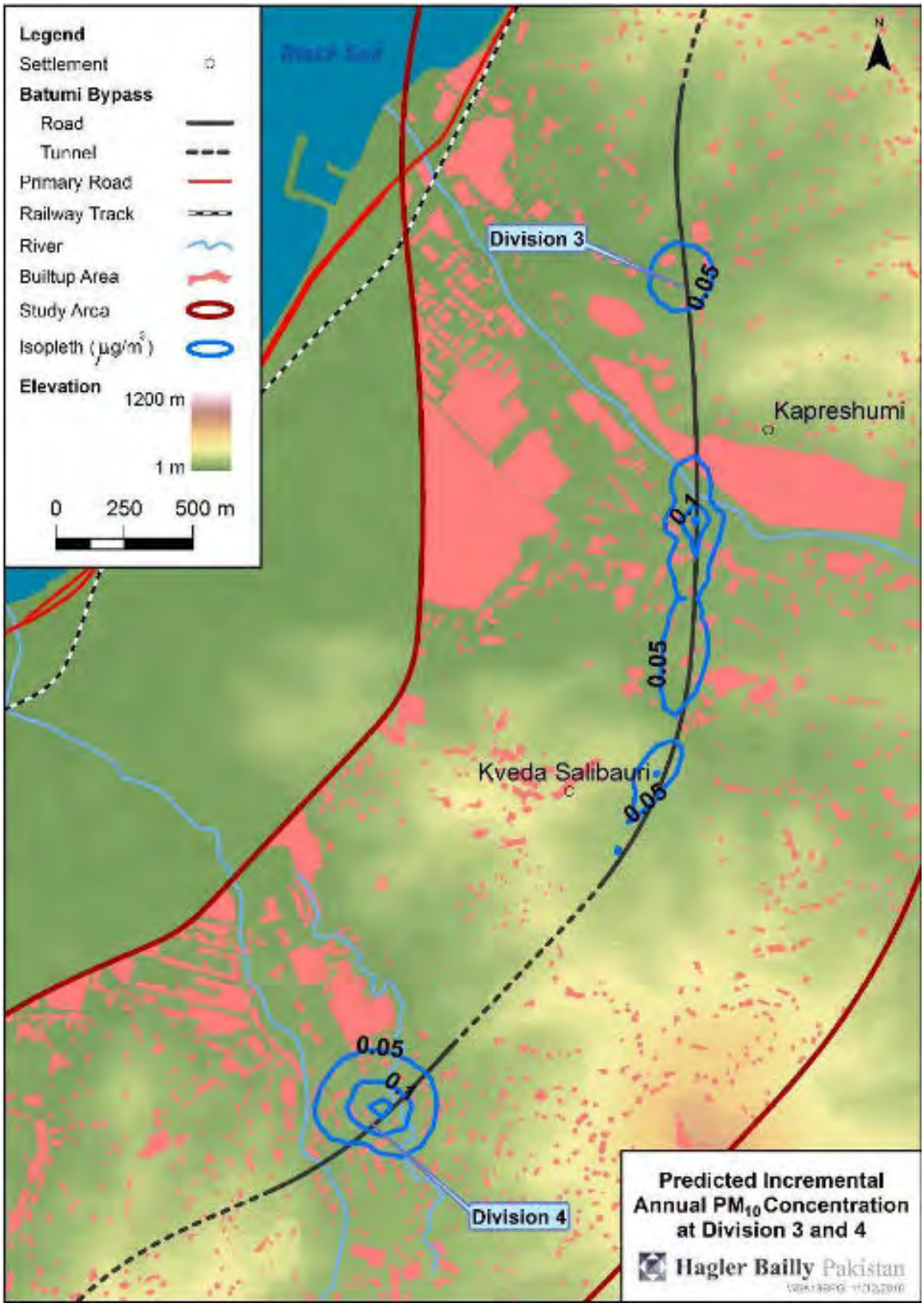


Figure 8-60: Predicted Incremental Annual PM_{10} Concentration at Division 3 and 4

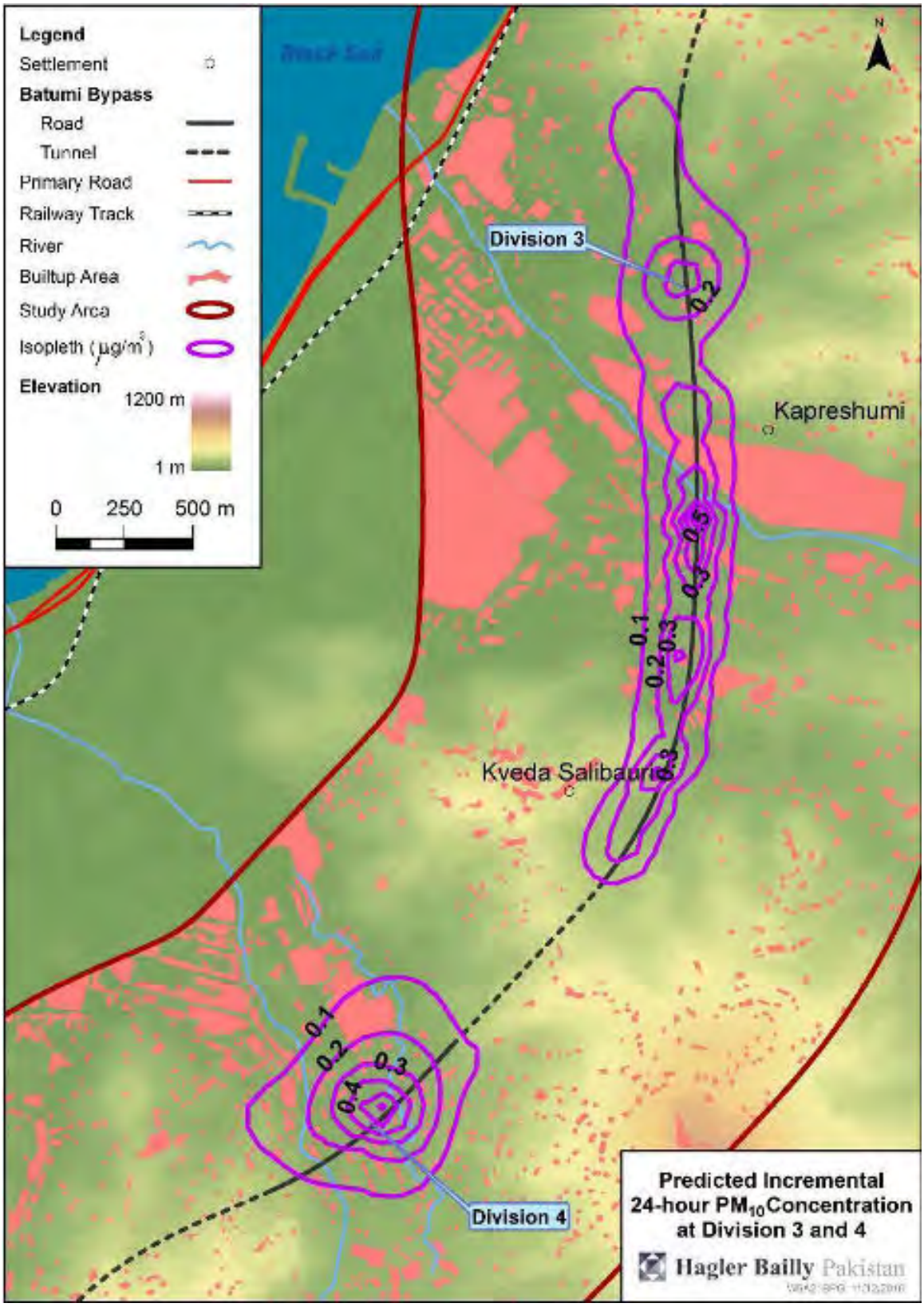


Figure 8-61: Predicted Incremental 24-hour PM_{10} Concentration at Division 3 and 4

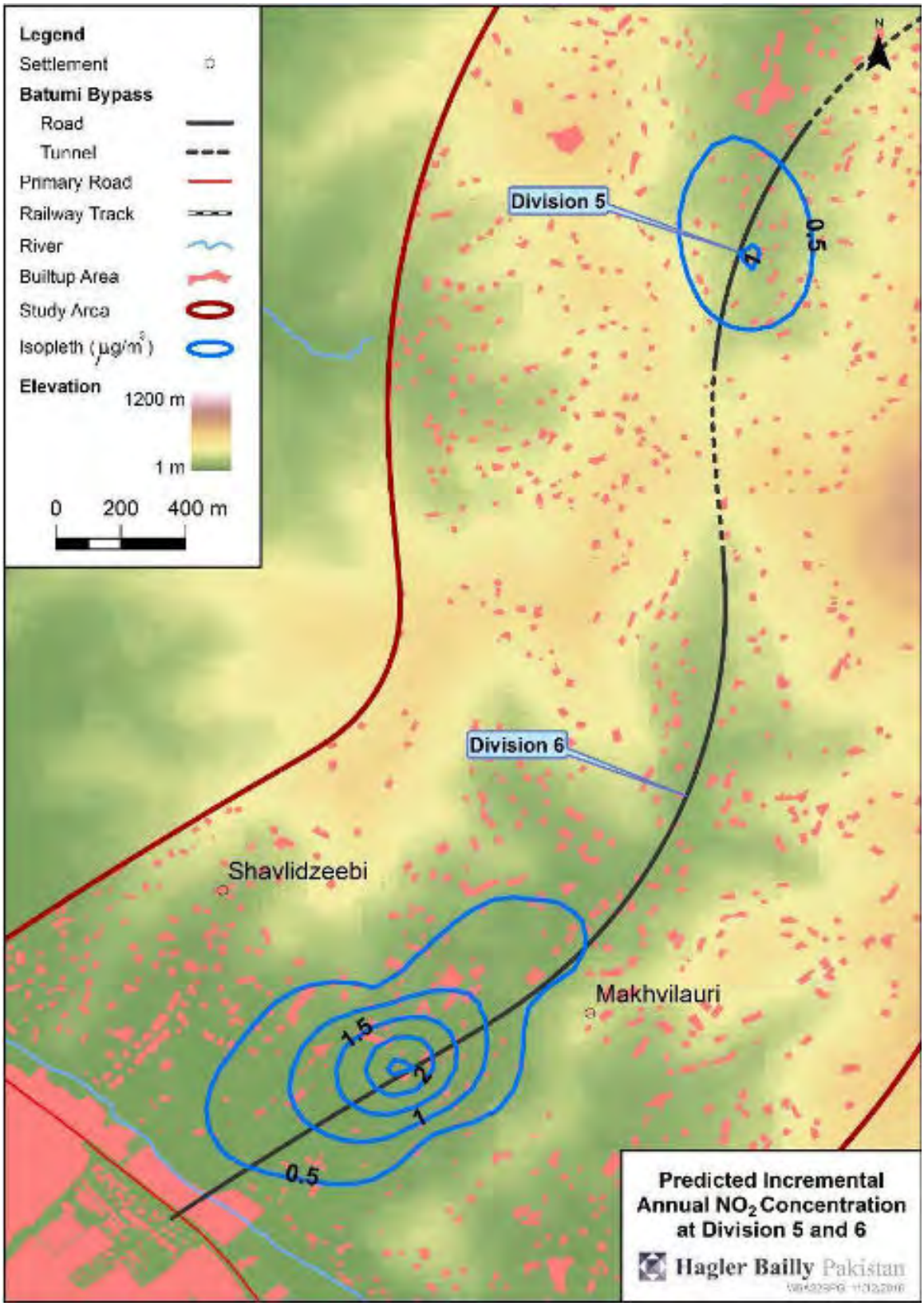


Figure 8-62: Predicted Incremental Annual NO_2 Concentration at Division 5 and 6

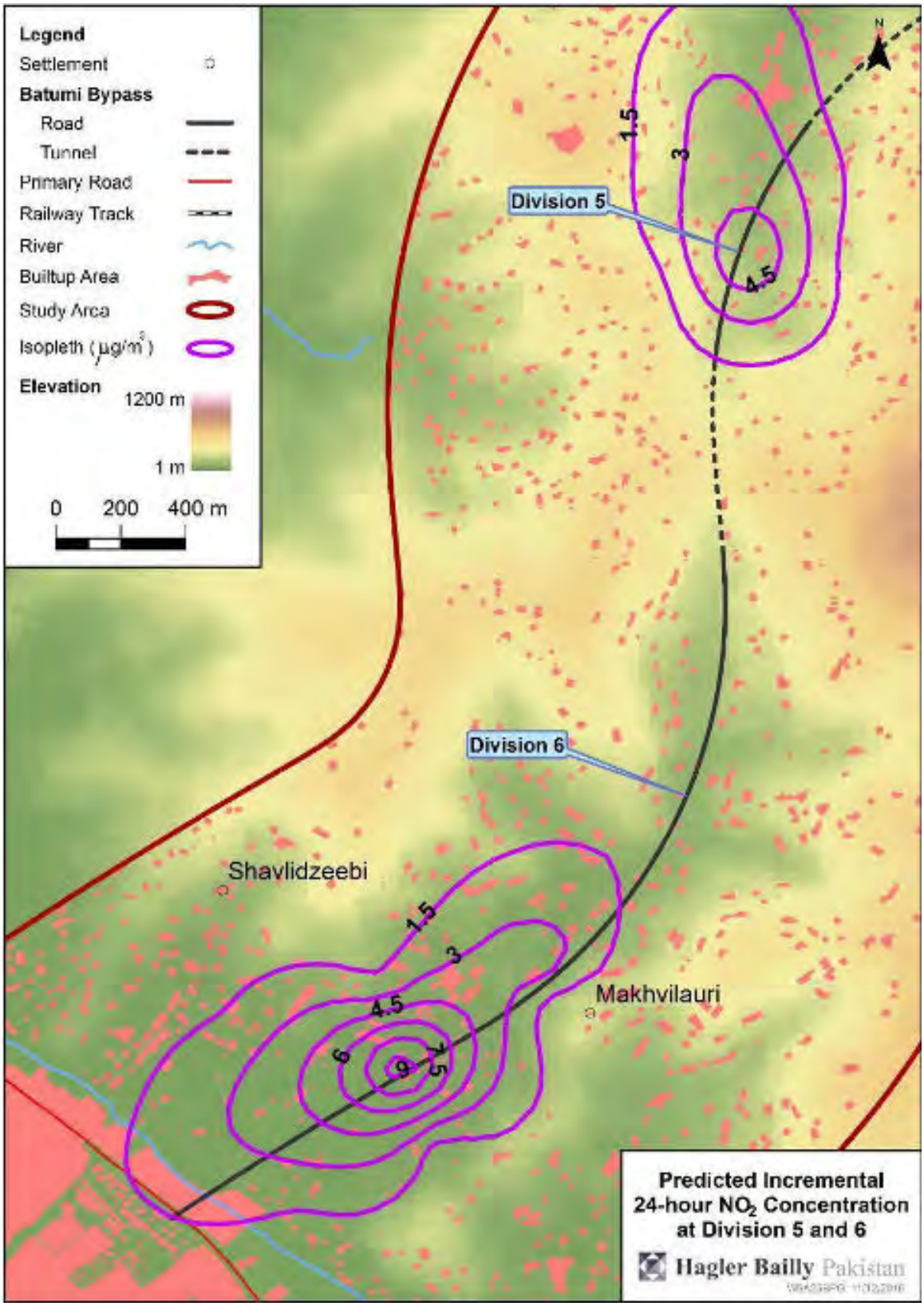


Figure 8-63: Predicted Incremental 24-hour NO_2 Concentration at Division 5 and 6

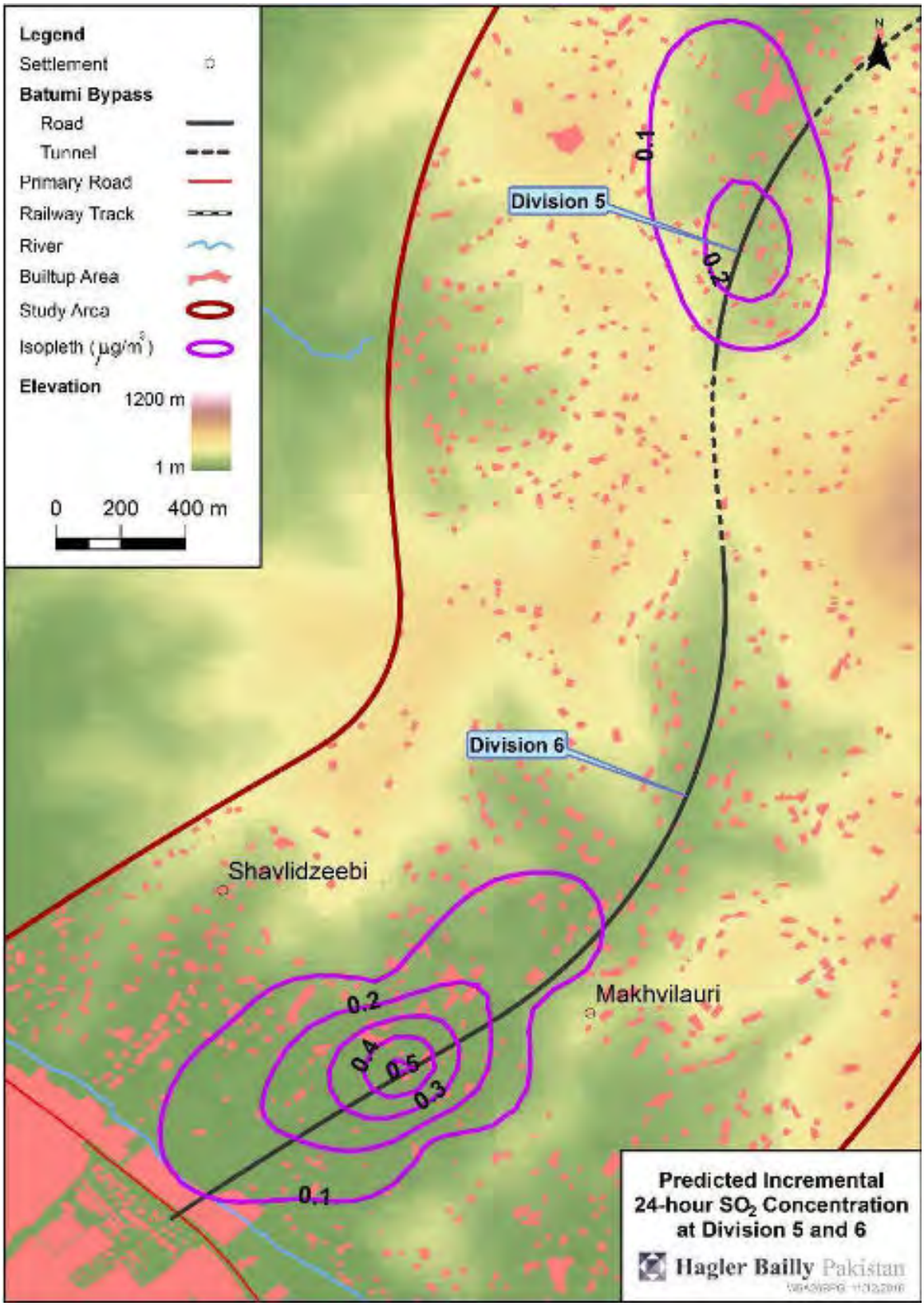


Figure 8-64: Predicted Incremental 24-hour SO_2 Concentration at Division 5 and 6

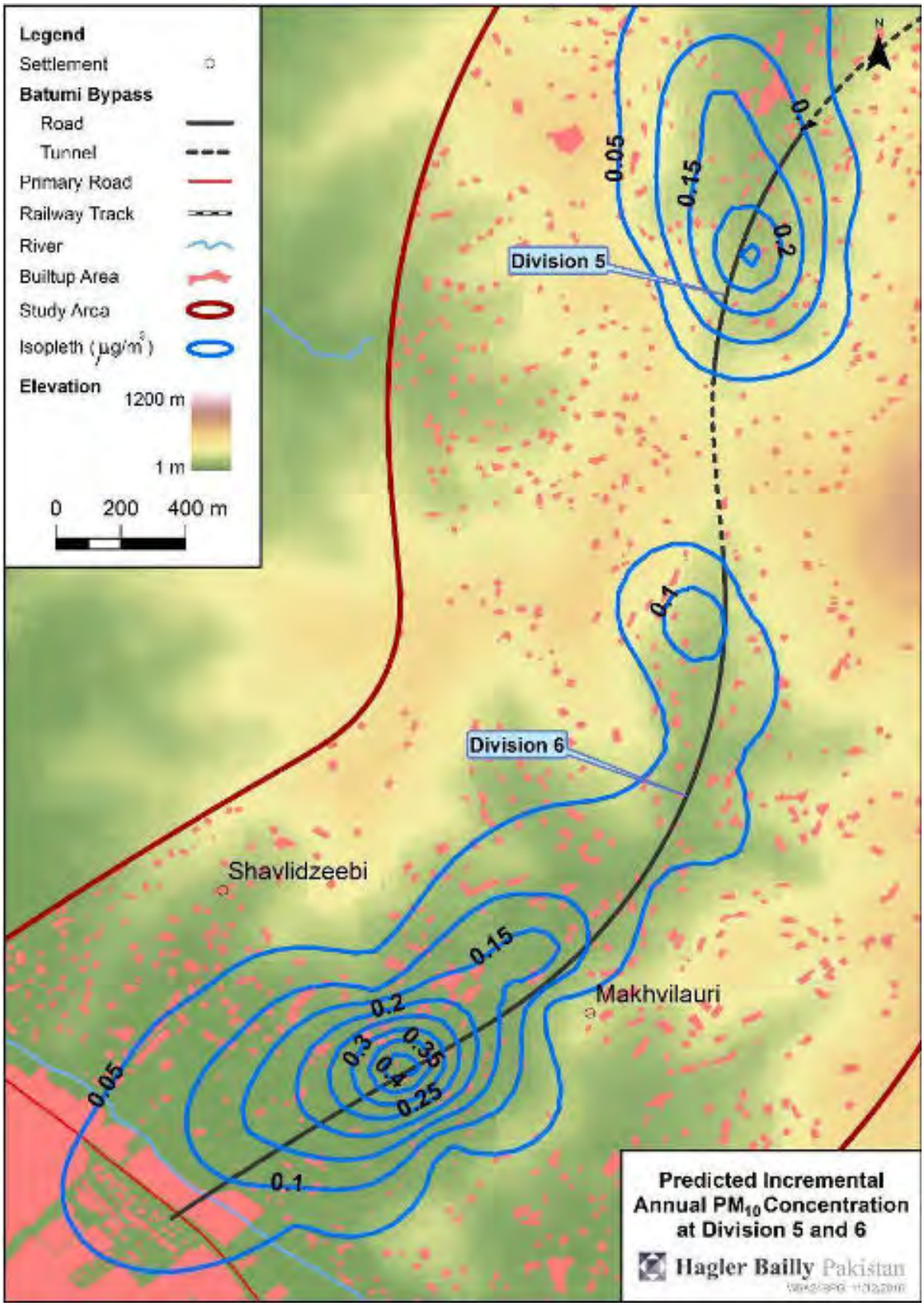


Figure 8-65: Predicted Incremental Annual PM_{10} Concentration at Division 5 and 6

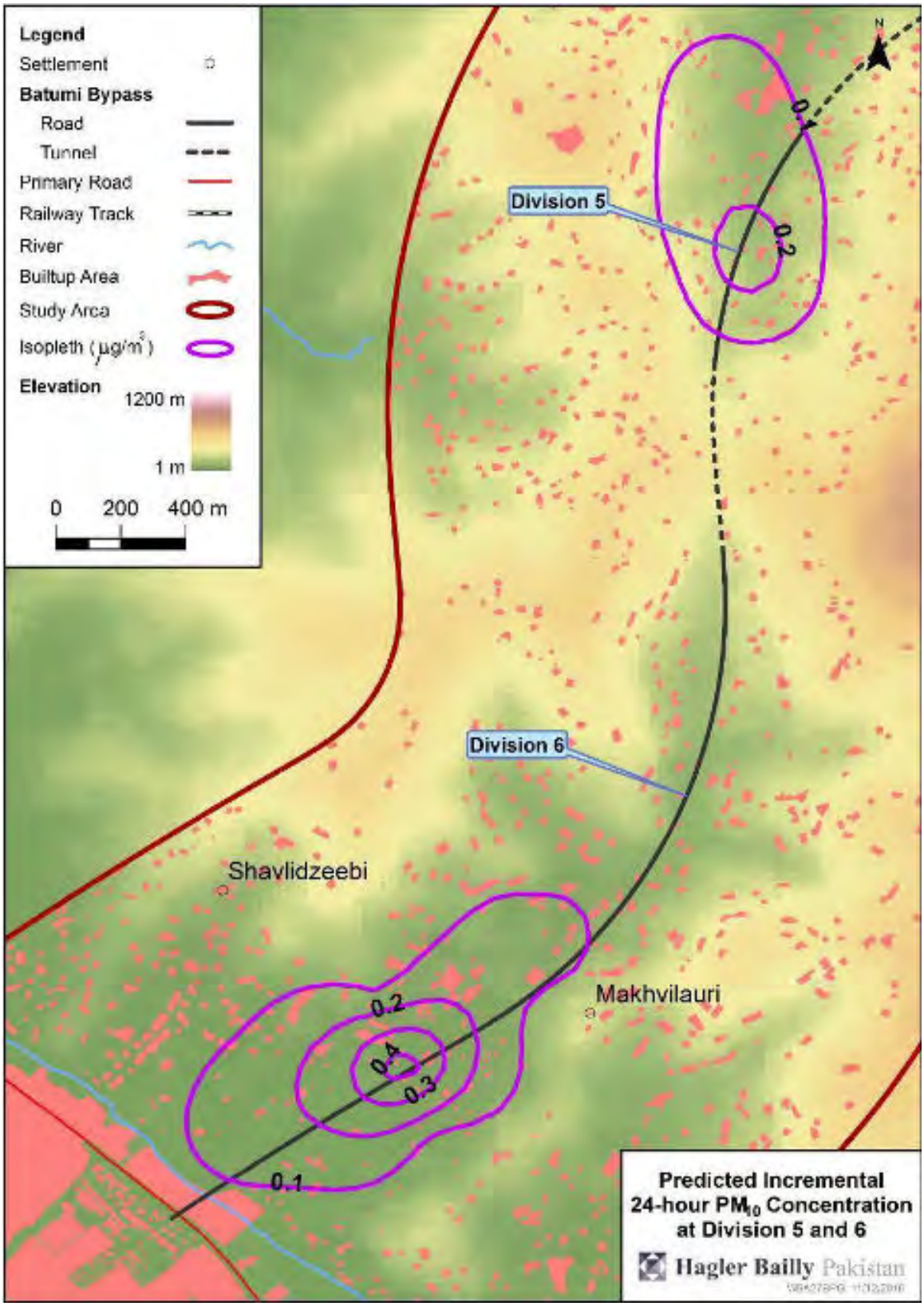


Figure 8-66: Predicted Incremental 24-hour PM_{10} Concentration at Division 5 and 6

8.9 Soil and Water Quality

Phase	ID	Impact
Construction	17	Activities near the water bodies may result in spills leading the contamination of soil and water bodies.
		Construction activities, especially excavation may damage old oil pipelines that can leak and contaminate soils and water.
	18	Bridge construction at the oil terminal (near chainage 4310 m) may unearth contaminated soils which can contaminate the area if not handled properly.

546. The proposed road will cross one river and several streams. Construction work near the stream can pose a risk to these water bodies through accidental spills of oil, fuel, lubricants, and other potentially hazardous chemicals transported by road to the site or stored nearby.

547. There are reports that some old abandoned pipelines are located near the existing oil terminals. However, no map is available describing the precise location of the pipelines. There is a risk that during construction these pipelines may get damaged and result in spillage of residual oil from the pipelines.

548. Bridge construction at the oil terminal (near Chainage 4310 m) may unearth contaminated soils which can contaminate the area if not handled properly.

549. To minimize the risk, the following measures will be taken:

- No construction camp, workshop, or storage facility will be located within 100 m of streams.
- If the stream is within 250 m and downstream of the project facilities or construction site, temporary dykes will be installed to prevent any potential impact from spill and run-off.
- Spill prevention trays will be provided and used at refueling locations
- The run off from maintenance workshops will be collected by impervious channels and be passed through oil water separators (OWS) before final disposal. The sludge and oil collected at the OWS will be disposed off properly.
- Separate impervious pits (with concrete walls and proper shed) will be built at camping sites for temporary handling and storage of contaminated soil and water if encountered during construction such as sludge from OWS.
- All fuel storage tanks and lubricating oil drums will be kept in secondary containment impervious pits with impervious shed walls.
- On-site maintenance of construction vehicles and equipment will be avoided, as far as possible.
- Regular inspections will be carried out to detect leakages in construction vehicles and equipment.
- Spill control kit (shovels, plastic bags and absorbent materials) will be available near fuel and oil storage areas, vehicular parkings and vehicular maintenance areas as well as at construction sites.

- Emergency plan for spill management will be prepared and inducted to the staff for any incident of spill.
- The Construction Contractor will provide the location of the of soak pits and septic tanks;
- The bottom of any soak pit or septic tank will be constructed at least 100 meters away from springs and water bores
- Record of spills and volume of removed contaminated soil will be maintained.
- Record of remedial measures taken will be maintained.
- Silt traps will be used to prevent contamination of river and streams.
- Contaminated soil will be removed from the site and disposed in a manner to ensure protection of water sources using the facilities of the municipal government.
- Besides the removal of the contaminated soil and its disposal according to the norms, the Contractor should be responsible for the remediation of the contaminated soil.
- The disposal site for contaminated soil shall be chosen in accordance with the requirements of the Georgian Legislation.
- Before any excavation work within on kilometer of the existing terminal, a survey for buried metal object will be undertaken metal to locate the pipeline, if present in the area.

8.10 Land Stability

Phase	ID	Impact
Design	-	
Construction	14	Excavation and site clearance will result in decreased slope stability which can result in landslides
Operation	-	

550. The top cover of soil on the slopes around the Project facilities is mainly sand and fine clay. Any excavation work during the construction activities, whether permanent or temporary, would lead to loss of soil. Excavated material collected during boring of the tunnels may be used during construction of the road. Erosion of soil can occur from removal of vegetation cover, runoff from unprotected excavated areas, muck disposal sites and quarry sites. Excavations on slopes would also decrease its stability. Given the topography of the area, unprotected excavations on sloping grounds may lead to landslides, especially during the rainy season. Major landslides will disturb the slopes of the area and may also alter the bed of streams and rivers.

551. The proposed mitigation measures include:

- Vegetation loss will be limited to demarcated construction area.
- Areas such as muck disposal area, batching plant, labor camp and quarry sites after the closure shall be covered with grass and shrubs.

- Slope stabilization measures will be adopted such as adequate vertical and horizontal drains, drainage along roadsides, cross drainage and retaining walls.
- Slope movements will be monitored around excavation work areas.

8.11 Disposal of Spoil from Tunnel Construction

552. The main impacts of tunnel construction will be vibration and generation spoil. Vibration is discussed in **Section 8.7**. Overall construction of tunnel over surface road or bridge may be considered preferable as it reduces land acquisition, is less intrusive on the vista, does not impact flora and fauna and avoids issues such as noise and fragmentation of land.

553. There is a possibility of soil erosion and adverse aesthetic impact if spoils from tunnel excavation are not properly placed and rehabilitated. An estimate of soil and rock to be excavated, and thus disposed of properly, should be completed. It is estimated that 490,500 cubic meter of spoil will be generated. Part of the material may be used for road construction. The remaining material may have to permanently disposed of at a suitable location. Before the final disposal, temporary storage may have to be undertaken.

554. Inadequate management and disposal of waste from the tunnel can lead to deterioration of soil, contamination of water bodies, and habitat destruction with consequent negative impacts on the flora and fauna, and generation of dust.

555. The following mitigation measures are proposed:

- The disposal site for the spoil will be discussed with the local municipality and a mutually agreed location will be identified;
- The permanent disposal site or temporary storage will not be located will within 250 m of a streambed, house, or any other building or site where people assemble.

8.12 Greenhouse Gas Emission and Climate Change

Phase	ID	Impact
Construction	15	Construction activities will generate Greenhouse Gas emissions
Operation	16	Project road will divert vehicles onto smoother road reducing net GHG emissions.

8.12.1 Construction Phase GHG Emission

556. The Greenhouse Gas (GHG) emissions resulting from road construction have been estimated to be between 0.37 and 1.07 ktCO_2/km for a 13m wide road – depending on construction methods. Maintenance over the road lifetime (typically 40 years) can also be significant in terms of costs, energy consumption and GHG emissions. GHG emissions are estimated at between 26% and 67% of the total emissions from the construction phase, depending on materials and conditions of the maintenance regime.[193]

557. Using the conservative value of 1.07 k tCO_2/km the 13.2 km construction of the Project road will emit an approximate total of 14,124 t CO_2.

[193] EA ETSAP - Technology Brief T14 – August 2011

558. As the Project contains many bridges and tunnels which require a large amount of steel, **Table 8-20** presents the GHG emissions due to the steel production required for the Project.

Table 8-20: GHG Emissions for Project Steel Requirements

Material	Required Amount	Emission factor	Total
Steel	11,695 tons	1.8 t CO_2 e / ton [A]	21,051 t CO2 e / ton

[A] http://www.worldsteel.org/publications/position-papers/Steel-s-contribution-to-a-low-carbon-future.html

559. These two values come to an approximate total of 35,000 t CO2 e of GHG emissions during construction of the Project. This does not include emissions due to tunneling and cement required for bridge construction and tunnel lining.

560. The Project also requires clearing a number of trees. As per the EMP these will be replanted therefore there is no net negative impact expected.

8.12.2 Operation Phase GHG Emission

561. GHG emissions are calculated broadly on the methodology described in the *Handbook for Estimating Transportation Greenhouse Gases for Integration into the Planning Process* developed by the Federal Highway Administration, US Department of Transportation.

562. Carbon dioxide (CO_2) is the primary GHG associated with the combustion of transportation fuels, accounting for over 95% of transportation GHG emissions based on global warming potential. CO_2 is emitted in direct proportion to fuel consumption, with different emissions levels associated with different fuel types.

563. Other notable GHGs include methane (CH_4) and nitrous oxide (N_2O), which together account for two percent of transportation GHG emissions, and hydrofluorocarbons (HFCs), which comprise approximately three percent of transportation GHG emissions. N_2O and CH_4 are not directly related to fuel consumption, but instead are dependent on engine operating conditions (i.e., vehicle speeds) and emissions control technologies. In addition, HFCs are emitted from vehicle air conditioners and refrigeration used in some freight shipments; these emissions do not come from the tailpipe, and depend on factors such as the age of the vehicle and how often air conditioners are used.

564. CO_2 emissions from transportation can be calculated based on the amount of fuel - gasoline, diesel, and other fuels - used by motor vehicles and other transportation sources. This simple concept becomes more complex though, when trying to capture the variety of factors that affect fuel consumption, some of which are listed below:

- Vehicle kilometers travelled
- Fuel economy (speeds, stops/starts, idling)
- Vehicle composition
- Fuel type

565. The parameters used to calculate the GHG emissions due to the Project are given in **Table 8-21**. Traffic volume estimates for the Project road for 2023 and 2033 were used as described in **Section 8.5.1**.

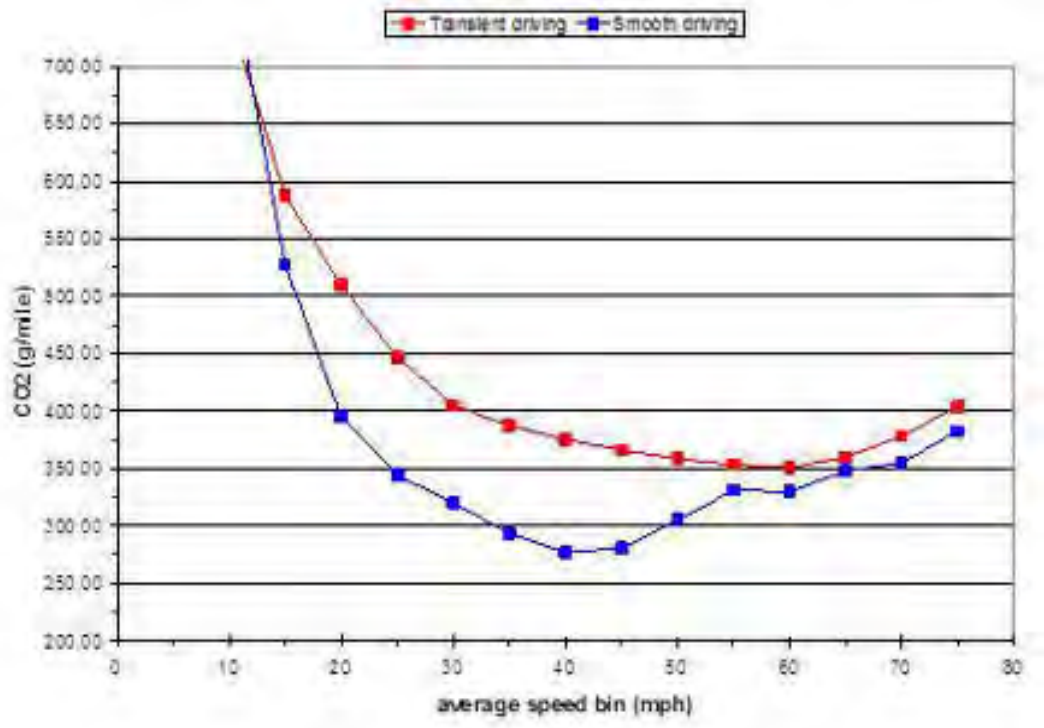
Table 8-21: GHG Calculation Parameters during Operation

Parameter	Existing Road	Project Road
Length	16 km	17 km[A]
Average Speed	60 kph	90 kph
Speed Type	Transient	Smooth

Note:

[A]: Length is of the Project road plus the possible option two of the remaining route as shown in **Figure 4-1**

566. Based on **Figure 8-67** smooth driving at 90 kph has 13% less GHG emissions than transient driving at 60 kph. It should be noted that after 65 kph (40 mph) increasing speeds further increases GHG emissions.



Source: U.S. EPA, analysis using MOVES for all light-duty vehicles for 2010.

Figure 8-67: GHG Emissions, Transient vs Smooth Driving

567. **Table 8-22** presents the results. The columns showing tons of CO_2 e are an average of those emitted in 2023 and 2033. The Project road emissions are reduced by 13% to account for smoother traffic flows compared to the transient traffic flow on the existing road.

568. There is a 4 t CO2 e decrease per day, 1500 t CO2 e decrease per year and a 44,000 t CO2 e decrease over 30 years. This compares favorably to the 35,000 t CO2 e required for construction as evaluated in **Section 8.4.11**.

Table 8-22: GHG Emission Reduction for Proposed Project

	AADT			Classification used	CO_2 e (g/mi)[A]	Tons CO_2 e	
		2023	2033			Existing Road	Project Road
	Cars	3,621	5,107	Passenger Car	395	17.2	15.9
Bus	Small	1,108	1,563	Transit Bus	1,373	18.3	17.0
	Middle	124	175	Transit Bus	1,373	2.1	1.9
	Large	48	68	Intercity Bus	1,864	1.1	1.0
Truck	Small	254	359	Light Comm. Truck	731	2.2	2.1
	Middle	77	109	Single Unit Long-haul Truck	1,104	1.0	1.0
	Large	130	183	Combination Long-haul Truck	2,266	3.6	3.3
	Trailer	284	401	Combination Long-haul Truck	2,266	7.8	7.2
				Total		**53.3**	**49.3**

[A] Sample emission factors from Handbook for Estimating Transportation Greenhouse Gases for Integration into the Planning Process. CO_2e emissions include running, start, and extended idle (as appropriate for each vehicle type) exhaust emissions of CO_2, N_2O, and CH_4, each pollutant normalized according to its Global Warming Potential (GWP).

8.12.3 Climate Change Risk

569. A separate climate risk screening exercise was undertaken for the Project.[194] The exercise concluded that due to possible increase in precipitation in the highlands, there is a risk that climate change will influence the frequency and intensity of floods. The study cautioned that the current engineering designs may not take into account the climate change risk such as flooding. The risk was categorized as medium and therefore recommended that a more detailed climate risk and vulnerability assessment be carried out.

570. The screening report, prepared using Acclimatise Aware™ tools, listed the following topics as high risk, each of which is discussed further in this section based on the:

- Flood
- Snow Loading
- Landslide
- Sea Level Rise

Flood

571. The Project is located in a region which has experienced recurring major flood events in the recent past. Between 1985 and 2010 there have been more than one significant, large-scale flood event in the region. This is based on post-processed data

[194] ADB Internal Communication

from the Dartmouth Flood Observatory at the University of Colorado. The risk and type of flooding is dependent on local geographical factors including:

- Proximity to the coast and inland water courses
- Local topography
- Urban drainage infrastructure

572. **Cause of Concern**. Climate change is projected to influence the frequency and intensity of flood events. Existing engineering designs need to take into consideration the impact of climate change on the risks from flooding.

573. **Relevant Design Parameters.** In the Detailed Design hydraulic calculations were carried out to determine the maximal discharges and highest water levels at bridge crossings. The hydraulic calculations for bridge river crossings were carried out for 100-year return period for the 4 rivers present in the design section.

574. In total 67 culverts are located along the Project roads. In order to adapt the structures to a wider range of discharges and, at the same time, limit the height of the required structures, single or double culverts are used depending on the required discharge capacity and the topography. The following principles are included in the design for drainage infrastructure:

- 50 year return period
- 1.5 m minimum diameter/height for culverts on main road
- 1.0 m minimum diameter/height for culverts on ramps and secondary roads

Snow Loading

575. The Project is located in a region where snow is commonly observed and future precipitation may also increase (2050s). This is based on snow extent data for the northern (1967 – 2005) and southern hemispheres (1987–2002) from the US National Snow and Ice Data Centre (NSIDC) in addition to precipitation projections from 16 global climate models.

576. **Cause of Concern**. The impact of increasing precipitation at higher latitudes could represent an increased risk of snow loading which could impact the structural integrity of bridges and road surfaces. Existing design standards need to take into consideration the impact of climate change on snow loading risk.

Landslide

577. The Project is located in a region which is at risk from precipitation induced landslide events. A high exposure in Aware means that based on slope, lithology, geology, soil moisture, vegetation cover, precipitation and seismic conditions the area is classed as ‘medium’ to ‘very high’ risk from landslides. This is based on post-processed data from UNEP/ GRID-Europe. Risk is locally influenced by other factors, for example local slope and vegetation conditions as well as long term precipitation trends.

578. **Cause of Concern**. Climate change is projected to influence landslide risk in regions where the frequency and intensity of precipitation events is projected to increase. Existing engineering designs may not take into consideration the impact of climate change on the risk of landslides. Previously affected areas may suffer from more frequent and severe events.

579. **Relevant Design Parameters.** The Project road alignment runs through the complicated hilly area requiring a significant amounts of high cuts and fills. More than 2 kilometers road side cuts require support-stabilization. Design walls are located at 179 places respectively with different lengths and heights. Slope stabilization is achieved through the appropriate placement of:

- Terramesh walls
- Reinforced concrete (RC) retaining walls
- Gabion walls

580. The most critical and unfavorable places were selected for the terramesh walls. The Terramesh system is a modular system used for soil reinforcement applications such as mechanically stabilized earth walls and slopes. Terramesh System is fabricated soft tensile, heavily Galfan (Zn-5%Al-MM alloy) and PVC coated double twisted steel wire mesh.

581. Application of the RC retaining walls is quite limited throughout the design section due to the conditions of the foundation soils. RC retaining walls are applied for separation of ramp embankments and also used to retain high embankment at the outlets of some culverts, simultaneously serving as headwalls.

582. One of the purposes of introducing the Gabion walls is to safeguard the edge of the road embankment fills from direct impact of the stream flow where expected.

Sea Level Rise

583. Some recent research suggests that global sea levels could be 0.75 to 1.9m higher by the end of the century. Sea level rise has the potential to accelerate the rate of coastal erosion. Changes in erosion regimes also impact the rate of sedimentation in other areas, particularly in estuarine and other tidal settings. Erosion of the coastline can exacerbate 'coastal squeeze', putting pressure on natural sea defenses, such as salt marshes and mangroves as well as man-made structures. This could provide problems with access to existing ports and jetties.

584. **Cause of Concern**. Sea level rise could result in impacts of inundation from the sea that may not be considered in the current design, operational and maintenance standards.

Relevant Design Parameters

585. **Relevant Design Parameters.** The Project road is more than 500 m away from the Black Sea at its closest point (near Makhinjauri) and runs through mountainous terrain with a minimum elevation of 25 m above sea level. The current road (S2) has a greater risk due to sea level rise as it is within 20 m of the Black Sea near the Batumi Port area and has near sea level elevation.

586. Batumi city is under more threat from sea level rise than the Project which is much further inland. The Batumi coast is already facing coastal erosion which could be accelerated due to climate change. Coastal erosion is not expected to impact the Project road.

8.13 Socioeconomic Impacts

Phase	ID	Impact
Design	17	A cemetery is within the RoW of the alignment and will be displaced resulting in sentimental impacts on the families.
Construction	18	Access to residential and other land, via informal routes, may be hampered due to the Project road causing inconvenience to owners.
Construction	19	Resettlement of households in the LARP may result in negative socioeconomic impacts to their wellbeing during the transition.

587. As described in **Section 5.3**, there are 8 villages in the Study Area. The proposed Project is located in an area which is close to the urban area of Batumi, however, has a semi-urban and rural setting. The residents of the village depend on the city for their essential economic needs. Agricultural farming is the local economic activities.

588. The key socioeconomic impacts on the community relates to resettlement. Other impacts such as noise, dust, and traffic impacts are covered elsewhere in the report.

589. There were some other concerns expressed by the community such as the fear that the construction of the road near their property devalue the property. This may be a concern if the residences experience direct impact from the road such as noise, vibration or visual intrusion. With the implementation of the mitigation measures proposed in the EIA, this is not considered a valid concern. It may be necessary to undertake awareness sessions with the community to allay the fear. Open sharing of information about the project, particularly, the monitoring data will also be essential in this regard.

590. Similarly, fragmentation of the land and possible restriction due to the project was another concern expressed by the community. This is also not likely to happen. The proposed road is divided into nearly 40 sections of bridges, surface, and tunnel. Passage will be available under the bridge and where necessary over the tunnel. The longest section of the surface road is 790 m. The project will ensure that if any existing road is blocked alternate route either under the bridge or from over the tunnel is provided.

8.13.1 Cultural Resources

591. The Adjara is rich with archeological findings and the list of the identified archeological sites located near the Project road is given in **Chapter 4**. Though no known archeological sites are located within the construction corridor of the Project alignment, there is a potential that these works may damage the unidentified underground archaeological remnants. According to the Law of Georgia on Cultural Heritage, a separate study will be carried out to ascertain whether there is any archeological site present in the area. As part of the study Chance find procedure will also be developed.

592. A cemetery is within the RoW of the alignment and will be displaced. The community is in agreement to relocate the cemetery. The Roads department will execute an agreement with the community and facilitate the relocation of the cemetery.

8.13.2 Employment

593. The Project will have impacts on both urban economics and rural poverty in the project area. The road construction will create lot of job opportunities to the local community. It is expected that about 70,000 man months of employment during construction. The construction of the new bypass road constitutes the long-term

improvement of economic conditions in the project area due to better traffic access. The greatest beneficiaries from a monetary standpoint will be the current road users, who will experience greater efficiency, higher safety, time and operational cost reduction, and less wear and damage to their vehicles. From a numerical standpoint, the largest group of beneficiaries will be all kind of people around Batumi city and the periphery by getting rid of traffic congestion and huge traffic flow. Second group will the local people, who will have improved access to markets and cheaper transport costs for their commercial produce.

594. Local residents will also be benefitted from expanded opportunities for seasonal employment elsewhere to earn supplemental incomes. Rural villages will also have improved delivery of health, education, and other social services by virtue of all weather feeders and rural road connections to the bypass interchanges. With the year-round access to new markets provided by the Project, the village level enterprises will also prosper, promoting local economic growth.

8.13.3 Resettlement

595. The most significant socioeconomic impact relates to the land acquisition and resettlement. A Land Acquisition and Resettlement Plan has been prepared separately to manage the resettlement process in accordance with the ADB safeguard policies.

8.13.4 Community Safety

596. Consideration is made in the engineering design to provide paved full-width shoulder for pedestrians and roadside lay-bys for marketing local produce. Where space permits, either a part of the roadway or a separate surface from the edge of the roadbed is considered, especially in the region where road is passing through settlements, schools, and markets. Special provisions are made in bridge and tunnel designs for pedestrian traffic.

597. Crash guardrails and barriers will be constructed along the roads and bridges designed to German standards. These barriers protect both the vehicles and surrounding communities from collisions. Bridges also contain pedestrian guardrails, after the sidewalk.

598. The bypass roads will attract more traffic after their completion. To help reduce the risk of serious accidents, speed control signs and other visual means will be considered at the entrance and through the urban zones of towns and settlements along the road. Reduced speed will help improve safety and reduce noise, particularly in the evening.

8.13.5 Occupational Health and Safety

599. An Occupational health and safety (OHS) management system will be developed to international standards and good practices. Local employees, may only speak Georgian and any relevant training, literature or signs must be sensitive to the language requirements of the employees. The OHS system will take into account risks inherent to the road construction sector and specific classes of hazards in the work areas, including physical, chemical, biological, and radiological hazards. The may include, for example, of the falling hazards during bridge construction, asphyxiation hazard in tunnels. The Road Department will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of

hazardous conditions or substances; (iii) providing appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place.

8.14 Residual Impacts

600. After the successful implementation of the mitigation measures described in this chapter the residual impacts of the Project are presented below

Table 8-23: Residual Impacts of the Project

ID	Aspect	Phase	Impact	Receptors	Number of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Threshold (Legal or Other)	Magnitude	Duration of Continuous Aspect	Frequency of Intermittent Aspects	Timeframe	Spatial Scale	Consequence	Probability	Significance
1	Land Use	D	The change in land use due to the proposed Project is potentially incompatible with the existing land use and hence will affect the overall environmental quality in the Study Area	Overall EQ	H	M	M	None	Minor	Major		Medium	Small	L	Possible	L
2	Visual Impact	D	The proposed road will affect the visual and aesthetic quality in the Study Area	Nearby communities	M	M	M	None	Moderate	Moderate		Medium	Small	M	Possible	M
3	Visual Impact	C	Degradation of aesthetic value of the area due to construction activities	Nearby communities	M	M	M	None	Moderate	Minor		Short/ low	Small	L	Possible	L
4	Ecology and Habitat	C	Loss of habitat due to site clearance	Terrestrial flora, herpetofauna	M	M	L	Legal (for Red list species)	Moderate	Minor		Short/ low	Small	L	Definite	L
5	Ecology and Habitat	C	Pollution and waste generation during construction activities may deteriorate the surrounding habitats such as water bodies.	Overall EQ	M	L	L	None	Moderate		Minor	Short/ low	Small	L	Possible	L
6	Ecology and Habitat	C	Lack of regulation may result in poaching of wildlife, especially birds, by staff.	Aviafuana	L	L	M	None	Minor		Minor	Short/ low	Intermediate	L	Possible	L

ID	Aspect	Phase	Impact	Receptors	Number of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Threshold (Legal or Other)	Magnitude	Duration of Continuous Aspect	Frequency of Intermittent Aspects	Timeframe	Spatial Scale	Consequence	Probability	Significance
7	Noise	C	Construction activities will generate noise which may result in annoyance, disturbance, stress.	Nearby communities	L	H	H	High (strict IFC and local regulations)	Moderate	Minor		Short/ low	Small	M	Definite	L
8	Noise	O	Vehicles on the Project road will generate noise which may result in annoyance, disturbance, stress.	Nearby communities	L	H	H	High (strict IFC and local regulations)	Minor	Minor		Medium	Small	M	Definite	L
9	Vibration	C	Construction activities will generate vibration which may result in annoyance, disturbance, stress.	Nearby communities	L	M	H	None	Moderate	Minor		Short/ low	Small	L	Definite	L
10	Vibration	O	Vibration impacts unlikely of Project operation	Nearby communities	L	L	M	None	Minor	Major		Medium	Small	L	Definite	L
11	Air Quality	C	Construction activities will generate pollution which will deteriorate the air quality of the area.	Nearby communities	L	L	H	Moderate (IFC and local regulations)	Minor	Minor		Short/ low	Intermediate	M	Definite	L
12	Air Quality	O	Vehicles on the Project road will generate pollution which will deteriorate the air quality of the area.	Nearby communities	M	L	M	Moderate (IFC and local regulations)	Moderate	Major		Medium	Intermediate	M	Definite	M
13	Water Resources	C	Construction may impact mountain springs including altering hydrology and damaging existing water	Spring water users	L	M	M	None	Moderate		Minor	Short/ low	Small	L	Possible	L

ID	Aspect	Phase	Impact	Receptors	Number of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Threshold (Legal or Other)	Magnitude	Duration of Continuous Aspect	Frequency of Intermittent Aspects	Timeframe	Spatial Scale	Consequence	Probability	Significance
			infrastructure such as pipes and water collection units													
14	Land Stability	C	Excavation and site clearance will result in decreased slope stability which can result in landslides	Nearby communities, water bodies	L	H	H	None	Minor		Minor	Medium	Small	M	Possible	L
15	Greenhouse Gas Emissions	C	Construction activities will generate Greenhouse Gas emissions	Global	H	L	L	None	Minor	Minor		Long/ high	Extensive	M	Definite	M
16	Greenhouse Gas Emissions	O	Project road will divert vehicles onto smoother road reducing net GHG emissions.	Global	H	L	L	None	Minor	Major		Long/ high	Extensive	M	Definite	M
17	Soil and Water Quality	C	Construction activities, especially excavation may damage old oil pipelines that can leak and contaminate soils and water.	Water and soils	L	M	M	None	Minor		Minor	Short/ low	Small	L	Possible	L
18	Soil and Water Quality	C	Bridge construction at the oil terminal (near chainage 4310 m) may unearth contaminated soils which can contaminate the area if not handled properly.	Water and soils	L	M	M	None	Moderate		Minor	Short/ low	Small	L	Possible	L

ID	Aspect	Phase	Impact	Receptors	Number of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Threshold (Legal or Other)	Magnitude	Duration of Continuous Aspect	Frequency of Intermittent Aspects	Timeframe	Spatial Scale	Consequence	Probability	Significance
19	Socioeconomic	D	A cemetery is within the RoW of the alignment and will be displaced resulting in sentimental impacts on the families.	Single family	L	M	M	None	Minor	Moderate		Short/ low	Small	L	Possible	L
20	Socioeconomic	D and C	Access to residential and other land, via informal routes, may be hampered due to the Project road causing inconvenience to owners.	Households along the RoW	L	M	M	None	Minor	Moderate		Medium	Small	M	Possible	L
21	Socioeconomic	C	Resettlement of households in the LARP may result in negative socioeconomic impacts to their wellbeing during the transition.	Households with the LARP	L	M	M	None	Minor	Moderate		Medium	Small	M	Possible	L

	Number of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Threshold (Legal or Other)	Consequence	Significance
H	Large	Highly Sensitive	High	High	High	High
M	Moderate	Sensitive	Medium	Medium	Medium	Medium
L	Small	Not Sensitive	No or insignificant	Low or Not Applicable	Low	Low

9. Cumulative Impact Assessment

601. Cumulative impacts are those that result from the incremental impact of a project when assessed in combination with other existing and reasonably foreseeable future developments in a rationally set geographical and temporal scale. Cumulative impacts of a project are limited to those impacts only which are generally recognized as important on the basis of scientific concerns and concerns of the local communities located around the project area which can be affected by the project development and other developments in their vicinity.

602. Section D of the ADB SPS 2009, in its Subsection 6 requires analysis of impacts in the context of project's area of influence, encompassing "areas and communities potentially affected by cumulative impacts from further planned development of the project, other sources of similar impacts in the geographical area, any existing project or condition, and other project-related developments that are realistically defined at the time the assessment is undertaken"[195].

9.1 Anticipated Development in the Region

603. Other than the continuing growth and expansion of the city of Batumi in the vicinity of the Project there are currently no plans for major additional developments such as industrial zones or housing schemes that are likely to be triggered by the construction of the Project or developed otherwise along the Project alignment. Most development in Batumi is occurring along the coastline. Secondly, there are limited access locations in the Project. Nevertheless, there are several developments expected in the wider region which are described below.

Complete Adjara Bypass Road

604. The complete Adjara bypass alignment consists of the Kobuleti and Batumi bypasses and is discussed in **Chapter 1**. The start and end points of the Project will be connected to the complete Adjara Bypass road.

Adjara Solid Waste Management Project

605. A company has been established by the Autonomous Republic of Ajara to own and operate a new landfill facility. It intends to use the proceeds of a loan from the European Bank for Reconstruction and Development and an investment grant from the Swedish International Development Agency for a project to improve solid waste management services in Adjara through building a new sanitary landfill. The project will be the first regional landfill fully compliant with EU standards and Georgian legislation. It will establish a model structure that could be replicated for the financing of other regional waste management companies in Georgia and create new legal and institutional structures to promote economies of scale, employ new technology and install best practice management techniques. The total area of the site is 27 ha and the area planned for landfilling is 17 ha. The proposed project, which has a total estimated cost of 7 million euros and will include the following[196]:

- Building a new sanitary landfill; and

[195] Asian Development Bank, "ADB Policy Paper; Safeguard Policy Statement" Manila, June 2009.

[196] http://www.ebrd.com/work-with-us/procurement/p-pn-141222a.html

- Closures of existing landfills in Batumi and Kobuleti.

Coastal Erosion Rehabilitation.

606. A section of coastline and roadways in several of Georgia's Black Sea towns will be soon corrected and restored. This investment will help halt coastal erosion and falling rocks in the popular summer seaside resort areas.[197]

607. The ADB has approved a $20 million loan to stem coastal erosion around the popular Black Sea tourist destination of Batumi[198]

Installation of Local Infrastructure

608. During consultations it was ascertained that there are several local infrastructure development Projects ongoing in the Study Area. These include the following:

a. local road construction, repair and maintenance;
b. gasification of homes; and
c. connection of homes to a central water supply system.

9.2 Study Area

609. As described in the paragraph 464 cumulative impacts should be evaluated in the projects area of influence. The area of influence and rationale for selection is discussed in **Chapter 4** and has been referred to as the Study Area in this report.

610. The locations of the projects discussed in **Section 9.1** are shown in **Figure 9-1** along with the Study Area.

[197] http://agenda.ge/news/58703/eng

[198] https://www.adb.org/news/adb-extends-20-million-protect-vulnerable-batumi-coastline

Figure 9-1: Developments in the Project Vicinity

9.3 Valued Environmental Components

611. Valued Environmental Components (VECs) are the biophysical attributes of the environment which are considered to be significant in assessing risk associated with the cumulative impacts of the Project and reasonably foreseeable developments. VECs may include wildlife habitats (such as terrestrial and fresh water ecosystems to support biodiversity); environmental processes (such as hydrological cycle and nutrient cycling); physical features (such as air, noise, water, and soil); flora and fauna (such as resident and migratory birds and medicinal plants); and social conditions (such as public health, livelihood, and access). The VECs are identified on the basis of literature review and scoping consultations.

612. The list of identified VECs along with the perception of communities on them is provided in **Table 9-1**. The baseline of the VECs is established in **Chapter 5**.

Table 9-1: Land Identified VECs and their Current Status

VECs	Key Component	Status
Physical environment	Air	The area adjacent to the Project is mostly rural with very few industrial units other than the southern portion. Currently the air quality in the Study Area is not compromised. Baseline conditions are discussed in **Section 5.1.6**.
	Noise	Noise levels near major existing roads is beyond limits at certain times, but the remaining rural areas are fairly quiet. Baseline noise levels are discussed in **Section 5.1.10**.
	Traffic Congestion	During the tourist season Batumi faces serious traffic jams that extend up till and beyond Makhinjauri which is within the Study Area.
	Coastal Geomorphology	Literature review indicates that coast along northeast Turkey and southwest Georgia is exposed to severe coastal erosion.
Social conditions	Livelihood	Livelihood in the area is associated with agricultural land, fruit trees and tourism. While the Project will make Batumi favorable for tourists the land acquisition will reduce fruit trees and arable land in the area. There are limited markets for selling citrus. Unemployment is quite high. Construction of the Project may increase employment opportunities for the population in the Study Area. The socioeconomic baseline can be found in **Section 5.3**.
	Access	A few respondents reported access issues across the RoW.

9.4 Cumulative Impacts of the Anticipated Developments

613. As is clear in **Figure 9-1** the expected developments are at a distance from the Project and no major cumulative impacts are expected on the area of influence of the current Project.

Social Conditions

614. The complete Adjara bypass results in a large amount of acquisition of land which includes the displacement of fruit and nut trees and agriculturally productive land. **Table 9-2** displays the total estimated agricultural land (including fruit and nut trees) to be acquired for the construction of the Kobuleti and Batumi bypasses as per their associated

LARPs. It can be observed that hazelnut, mandarin, and walnut trees are effected in larger quantities than the other categories.

615. This cumulative impact is not on individual growers but an indirect impact on businesses a step down the supply chain such as on buyers, redistributors, transporters etc a transporters, processors and resellers. These groups may see a decline in the produce available to them locally.

616. It can be observed that hazelnut, mandarin, and walnut trees are effected in larger quantities than the other categories.

Table 9-2: Total Land Acquisition for the Kobuleti and Batumi Bypass

	Kobuleti Bypass		Batumi Bypass		Total
	Section 1	Section 2	Section 1	Section 2	
Number of Productive trees					
Hazelnut	517	5073	5955	7440	**18985**
Mandarin	53	3810	2719	5787	**12369**
Walnut	18	1125	2363	2997	**6503**
Other	53	765	1864	2664	**5346**
Grape	19	246	712	914	**1891**
Plum	2	236	688	919	**1845**
Persimmon	22	269	431	739	**1461**
Lemon	-	59	589	683	**1331**
Medlar	2	84	423	497	**1006**
Pear	29	210	369	325	**933**
Fig	15	66	243	530	**854**
Orange	-	77	437	299	**813**
Apple	24	182	251	332	**789**
Feijoa	3	55	170	130	**358**
Kiwi	0	72	147	113	**332**
Acres of Crops					
Corn	27.7	20.1	0.0	0.8	**48.7**
Hay/Grass	2.7	36.8	-	0.2	**39.7**
Tea	-	9.2	0.8	0.5	**10.5**
Vegetables	0.1	3.0	0.6	1.2	**4.9**
Beans	-	0.7	0.8	0.3	**1.8**

Physical Environment

617. The other developments are at a large distance from the Project to directly impact the noise, air quality, water quality and other physical parameters of the Study Area.

618. The construction of the Projects will required extraction of quarry materials, such as gravel, which may be extracted from the river beds in the area. The cumulative impact of this extraction can exacerbate the erosion of the coastline.

619. The multiple linked road developments discussed are likely to increase road transport especially freight. Indeed the purpose of these developments is to facilitate in Georgia becoming a transport and logistics hub that will facilitate the development of trade relations on the one hand with Central Asia and the Far East and on the other hand with Turkey and Europe. Due to the increased traffic flow there may be negative impacts on noise and air quality in the Study Area. However, the projected increase in traffic which was used in the impact assessment of the Project is expected to accommodate for most of this increase.

620. The previous landfill was to the south of the city however the new landfill is adjacent to the bypass road. This means that waste material transport is likely to use the bypass route. Maximum waste produced in Batumi is during the tourist season and peaks in August. The EIA for the project estimates that waste generated in Batumi was close to 4000 tons in August, 2007 and an annual 3% increase.[199] Therefore, the waste generated is approximately 8500 tons (or 27 truckloads per day[200]) in August, 2033 most of which is likely to use the Project road. This is not a significant increase over the projected traffic, of over a thousand trucks per day, in 2033.

Batumi City

621. Batumi City, while not directly within the Study Area, sees multiple cumulative benefits of all the expected developments. The Project will divert traffic from the city which will divert traffic during the entire year and especially during the tourist season. This will improve the noise, air quality and traffic of the city.

622. The shifting of the poorly managed landfill will improve environmental conditions, such as odor and air quality in Batumi in areas near the landfill.

9.5 Recommendations for Mitigation Measure

623. The fruit and nut industry in the area should be supported. Possible enhancement measures include:

a. Developing markets for fruit and nut produced in the area. A possible benefit of the bypass includes quick market access. However, in the absence of markets increased connectivity does not benefit the farmers.

b. Replacement seeds and saplings of high quality should be made available to the houses within the Study Area. This is especially true for mandarin as poor quality mandarins demand a very low price and households are not motivated to continue their production.

624. As the landfill is being constructed to EU standards, so should the waste transport be maintained at the highest standards. Any trucks carrying waste from Batumi should be properly covered and maintained accordingly.

[199] EIA Waste amounts disposed at Batumi and Kobuleti 2007.

[200] Assuming a dump truck can carry 10 tons of waste.

10. Environmental Management Plan

10.1 Overview of EMP

625. The main objective of the Environmental Management Plan (EMP) is to identify mechanisms to implement the environmental mitigation measures discussed in **Chapter 8**. It is the fundamental tool that ensures that all mitigation measures are consolidated, their implementation responsibilities identified and the resources required to implement the measures are provided. Further, the EMP includes monitoring measures as a feedback mechanism on implementation and effectiveness of the mitigation measures.

626. Environmental Management Plan (EMP) is prepared for all the identified environmental impacts during design, construction, and operation and management (O&M) stages due to implementation of various Project activities. The methodology followed for preparing the EMP consists of the following steps:

- Deriving mitigation/protection measures for identified impacts,
- Recommend mitigation, compensation and enhancement measures for each identified impacts and risks,
- Developing a mechanism for monitoring the proposed mitigation measures,
- Estimating budget requirements for implementation mitigation and monitoring measures, and
- Identifying responsibilities of various agencies involved in the Project for implementation and monitoring of mitigation measures.

10.2 Environmental Mitigation Plan

627. The Environmental Mitigation Plan for the Project is presented in **Table 10-1** through **Table 10-3**.

Table 10-1: Design Phase Mitigation Plan

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
01	The change in land use due to the proposed Project is potentially incompatible with the existing land use and hence will affect the overall environmental quality in the Study Area	• Removal of vegetation under the bridges will be minimized • As part of the restoration following the completion of the construction, all areas which are not required for the project will be planted with trees.	During detailed design	Construction Contractor	Measures included in design documents
03	The proposed road will affect the visual and aesthetic quality in the Study Area	• Consider environmentally pleasing design for structures particularly noise walls.	During detailed design	Construction Contractor	Measures included in design documents
08	Relocation of Houses for noise mitigation	• Undertake negotiations with the owners of the house to determine the course of action. • Refined mitigation options will be considered. These may include higher walls (up to 6 m); wall and berm on the hill to provide better shielding; and plantation of 200 m wide avenue of trees to shield the houses. • If by any of these measures noise levels for the houses cannot be mitigated, the owners of the houses will be given the option to relocate after selling their houses. Their names will be included in the LARP. • An alternate, is that they despite the high noise want to stay in their houses. In that case, a legally binding agreement will be executed between the Roads Department and the receiver. • Conduct community consultations to establish social feasibility of the above mitigation options.	Before Construction Phase	Roads Department	Part of LARP

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
09	Vibration Impacts of construction	**Overall Approach** • The tunneling will start from a tunnel with sparse population in the surrounding (for example, Tunnel 3). In the initial stages, the blasting induced vibration shall be measured as a function of maximum instantaneous charge and distance from the blasting site. This data shall be then used to refine the damage risk zones on the basis of the adopted criteria. • Early during the construction phase, the construction contractor shall develop a detailed tunnel blasting plan as part of the overall construction schedule. The plan shall specify, to a reasonable level of accuracy, the schedule for boring of each tunnel.	Before Construction Phase	Construction Contractor and Supervision Consultant	Vibration Data Tunnel Blasting Plan
		• Using, the refined damage risk map and the tunnel boring schedule, the Supervision Consultant in consultation with the Roads Department and the Construction Contractor, shall identify the houses that will be affected and the impact duration and schedule. • For the houses that will fall in the Structural Damage Risk Zone, a temporary relocation plan will be developed. An amendment to the Land Acquisition and Resettlement Plan (LARP) will be commissioned for this purpose. Before start of blasting, all residents of houses in the Structural Damage Risk Zone will be relocated as per the LARP.	Early During Construction	Supervision Consultant RD for Updated LARP	List of Houses to be Relocated Updated Impact Zone Updated LARP
		• A survey will be undertaken in both zones, to determine the pre-blasting conditions of the buildings. The survey will be commissioned by the Supervision Consultant and will identify and record any existing damage to the structures. The survey will cover the following aspects: o Overall condition of the structures, both exterior and interior. o Documentation of defects observed in the structure using digital imagery along with notes, measurements and sketches.			Log of consultations Survey report

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
		○ Documentation of pre-existing cracks using digital imagery along with notes, measurements and sketches. • The survey will be accompanied with consultations with the affected household to explain the extent and reason for the survey, and the process for reporting any grievances regarding vibration impacts. The households should be provided with materials that summarize the grievance redress process. • Following completion of the blasting, the survey will be repeated in the Structural Damage Risk Zone to determine the condition of the buildings and verify that they are safe for re-occupation. If the buildings are safe, the residents will be allowed to return to their houses following any necessary damage repairs. If the buildings are damaged beyond repair, compensation will be paid to the owners as per the LARP. • If there are any claims or reports of damage in the Cosmetic Damage Risk Zone, the affected house will be surveyed against the pre-Project survey and repairs will be undertaken as appropriate.			
12/24	Deterioration of community safety and air quality due to construction traffic.	• Include appropriate traffic control measures at traffic hotspots. These may include traffic signal, traffic warden posts, speed breakers (on the side roads) and roundabouts. • Install appropriate traffic signs on all roads • Consult Traffic Police for implementation of the above measures	During detailed design	Construction Contractor	See above
20	Damage to the graveyard.	• An agreement will be reached between the community and the Roads Department to relocate the graveyard	During detailed design	Construction Contractor	Measures included in design documents

Table 10-2: Construction Phase Mitigation Plan

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
-	Construction Impacts	• The site specific environmental management plan (SSEMP) for each site will outline areas to be cleared, vegetated areas to be protected or fenced, slopes to be stabilized and solid waste disposal locations. • Submit all SSEMP to Roads Department and ADB for approval.	At start of construction	Site Managers of EPC	SSEMPs prepared before initiation of construction
04	Loss of habitat due to site clearance	• Implement measures listed in **Table 10-4**. • A supporting plan to manage these mitigation measures should be developed.	During Construction	Construction Contractor	Measures included in design documents SSEMPs prepared before initiation of construction. Visual confirmation of replantation The re-planted vegetation should be monitored and supported until it is established. This should be verified by a botanist.
05	Pollution and waste generation during construction activities may deteriorate the surrounding habitats such as water bodies.				
06	Lack of regulation may result in poaching of wildlife, especially birds, by staff.				
07	Construction activities will generate noise which may result in annoyance, disturbance and stress.	• Equipment emitting excessive noise in comparison with other similar equipment will not be allowed to operate. • Equipment under use will be regularly maintained, tuned, and provided with mufflers to minimize noise levels. • Equipment in poor state of maintenance, particularly without effective noise control will be checked to determine if it can be improved, and replaced with less noisy equipment as soon as practicable.	During construction	Construction Contractor	Maintenance record of equipment Records of community meetings regarding noise.

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
		• Blowing of horn will be prohibited within the construction zones except under emergency conditions. • Close liaison with the community and regular monitoring of the noise levels in the community are key to successfully implementation of the above mitigation measures. Specifically, the communities will be informed of all major construction activities at least three days in advance. Noise control measures will be discussed with the community through informal and formal meetings. • A complaint registering, tracking and redressal mechanism will be implemented.			Noise level monitoring in nearby communities
09	Construction activities will generate vibration which may result in disturbance to humans, and damage to buildings.	• Blasting will be scheduled during the day only. • Local communities will be informed of blasting timetable in advance and will be provided adequate notice of when blasts are required outside of the planned schedule. • A meaningful community engagement plan will be developed. The plan will cover identify the affected community; the key contact persons; frequency of engagement; the information to be shared; the responsibilities to manage the plan; and the notice period to be giving to the community for various blasting related generating activities. • The Grievance Redress Mechanism will be used to record, investigate, and respond to any complaints. Investigation of the complaints will be undertaken by the Supervision Consultant.	During construction	Construction Contractor/Supervision Consultant	Log of vibration monitor and crack gauge readings
11	Construction activities will generate pollution which will deteriorate the air quality of the area.	• Minimize disturbance to, or movement of, soil and vegetation. • Prevent soil damage and erosion. • Retain as much natural vegetation as possible. • Sprinkle water on all exposed surfaces, particularly those close and up-wind of the settlements.	Before and during Construction	Construction Contractor	SEMP documents prepared before initiation of construction

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
		• Site specific environmental management plan will be made for each construction site and must outline areas to be cleared, vegetated areas to be protected or fenced, solid waste disposal locations, and sprinkling locations. • Indicate the limits of a clearing with highly visible markers. • Erect silt fences around perimeter of works area and/or rock check dams, sedimentation ponds, and silt traps. • Give stockpiles protective covering, e.g., revegetation, geotextiles. • For fugitive dust control, sprinkling of water on the all unsealed roads used by the project vehicles that are within 200 m of any community will be done • Earthwork operation to be suspended when the wind speed exceeds 20 km/hr in areas within 500 m of any community • All stockpiles shall be adequately wetted, or covered with plastic, or provided with wind shield to reduce dust emission. • Speed limits and defensive driving policies will be strictly implemented • Road damage caused by project activities will be promptly attended to with proper road repair and maintenance work • Install and maintain all vehicles and machinery with appropriate emission control equipment. • Smoke from internal combustion engines should not be visible for more than ten seconds. • To the extent possible, new and low emission equipment and vehicles shall be used • Batching plants and associated machinery installed for project activities will be installed with suitable pollution control arrangements			Vehicle and equipment maintenance logs

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
		• Best quality fuel and lubes shall be purchased where possible lead free oil and lubes should be used • Batching plant shall be set up considering the wind direction so that the nearby communities are not affected by the emissions from batching plant • Regular maintenance of vehicles and equipment will be conducted to keep emissions in check • Filters will be installed wherever available in equipment. The minimum acceptable performance is obtained using a fabric filter dust collector. Whichever technology is employed, it needs to be maintained properly, in accordance with the manufacturer's instructions, to ensure adequate performance.[201] Filters will minimize dust emissions from operations. • All stacks will be vertical and at least 3 m above ground			
13	Activities near the water bodies may result in spills leading the contamination of soil and water bodies.	• No construction camp, workshop, or storage facility will be located within 100 m of streams. • The Construction Contractor will provide the location of the of soak pits and septic tanks in the layout accompanying the SSEMP; • If the stream is within 250 m and downstream of the project facilities or construction site, temporary dykes will be installed to prevent any potential impact from spill and run-off. • Spill prevention trays will be provided and used at refueling locations • The run off from maintenance workshops will be collected by impervious channels and be passed through oil water separators (OWS) before final disposal. The sludge and oil collected at the OWS will be disposed of properly.			Emergency Spill Management Plan document Visual implementation of mitigation measures Log of spills and remedial actions taken

[201] Environmental Guidelines for the Concrete Batching Industry, EPA Victoria, June 1998

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
		• Separate impervious pits (with concrete walls and proper shed) will be built at camping sites for temporary handling and storage of contaminated soil and water if encountered during construction such as sludge from OWS. • The contractor shall make arrangements for safe disposal, according to Georgina Law, of the contaminated soil or its remediation. • The disposal site for contaminated soil shall be chosen in accordance with the requirements of the Georgian Legislation; • All fuel storage tanks and lubricating oil drums will be kept in secondary containment impervious pits with impervious shed walls. • On-site maintenance of construction vehicles and equipment will be avoided, as far as possible. • Regular inspections will be carried out to detect leakages in construction vehicles and equipment. • Spill control kit (shovels, plastic bags and absorbent materials) will be available near fuel and oil storage areas, vehicular parkings and vehicular maintenance areas as well as at construction sites. • Emergency plan for spill management will be prepared and inducted to the staff for any incident of spill. • The bottom of any soak pit or septic tank will be constructed at least 100 meters away from springs and water bores • Record of spills and volume of removed contaminated soil will be maintained. • Record of remedial measures taken will be maintained. • Silt traps will be used to prevent contamination of river and streams.			

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
14	Construction activities, especially excavation may damage old oil pipelines that can leak and contaminate soils and water.	• Before any excavation work within one kilometer of the existing terminal, a survey for buried metal object will be undertaken metal to locate the pipeline, if present in the area.	Before Construction	Construction Contractor	Survey records
15	Bridge construction at the oil terminal (near chainage 4310 m) may unearth contaminated soils which can contaminate the area if not handled properly.	• Contaminated soil will be removed from the site and disposed in a manner to ensure protection of water sources using the facilities of the municipal government.	During Construction	Construction Contractor	
16	Excavation and site clearance will result in decreased slope stability which can result in landslides	• Limit vegetation loss to demarcated construction area. • Areas such as muck disposal area, batching plant, labor camp and quarry sites after the closure shall be covered with grass and shrubs. • Adopt slope stabilization measures such as adequate vertical and horizontal drains, drainage along roadsides, cross drainage and retaining walls. • Monitor slope movements around excavation work areas.	During construction	Construction Contractor	
17	Improper spoil disposal can lead to soil erosion and ruin aesthetics of the disposal site.	• The disposal site for the spoil will be discussed with the local municipality and a mutually agreed location will be identified; • The permanent disposal site or temporary storage will not be located will within 250 m of a streambed, house, or any other building or site where people assemble. • Adopt slope stabilization measures such as adequate vertical and horizontal drains, drainage along roadsides, cross drainage and retaining walls.	During construction	Construction Contractor	Spoil Management Plan document

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
		• Prepare a Spoil Management Plan			
18	GHG emissions during Construction	• Ensure vehicles are maintained • Regularly inspect vehicle exhaust emissions to meet required standard for exhaust emissions	During construction	Construction Contractor	Vehicle inspection log and results
17	Construction activities may be cause alterations to the groundwater flow patterns.	• Record location of the springs especially those in areas proximal to where the tunnels will be closer to the ground level. • Monitor flow for located springs and maintain records • Support the community in development of alternate water supply schemes • Ensure the availability of water to the communities and the access of the communities to the water resources being used by them is not adversely affected.	During construction	Construction Contractor	Flow records of identified springs
21	Direct, indirect and induced employment at the local levels, resulting in increased prosperity and wellbeing due to higher and stable incomes of people.	• Include an assessment of the contractor's demonstrated commitment to domestic and local procurement and local hiring in the tender evaluation process. • Coordinate recruitment efforts related to non-skilled labor, including for non-skilled labor positions required by contractors. • Determine what is considered to be 'fair and transparent' in recruitment and in distribution of jobs between different community groups, in consultation with local communities and their leaders.	During construction	Construction Contractor	Contractual documents Number and ratio of local employees

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
22	Resettlement of households in the LARP may result in negative socioeconomic impacts to their wellbeing during the transition.	• These are quantified and addressed in the corresponding LARP of the Project.	Before and During Construction	RD	As given in the corresponding LARP
23	Construction workers will be exposed to occupational health and safety hazards	• An Occupational health and safety (OHS) management system will be developed to international standards and good practices. • Local employees, may only speak Georgian and any relevant training, literature or signs must be sensitive to the language requirements of the employees. • The following additional measures will also be taken to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by o identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; o providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; o providing appropriate equipment to minimize risks and requiring and enforcing its use; o training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; o documenting and reporting occupational accidents, diseases, and incidents; and o having emergency prevention, preparedness, and response arrangements in place.	During Construction	Construction Contractor/RD	Occupational health and safety (OHS) management system documentation Reports on occupational accidents, diseases, and incidents

Table 10-3: Operation Phase Mitigation Plan

ID	Impact	Mitigation Measure	When	Responsibility	Monitoring Indicators
08	Vehicles on the Project road will generate noise which may result in annoyance, disturbance, and stress.	The following measures should be implemented to control noise • Maintenance of the noise wall • Enforce speed limits through the use of speed cameras and patrolling • Consult Traffic Police for implementation of the above measures	During Operation	Road Department	
24	Community Safety	• Install appropriate traffic signs on all roads • Consult Traffic Police for implementation of the above measure	During Operation	Road Department	

Table 10-4: Mitigation Measures for Ecological Impacts

Receptors	Management and Mitigation Measures
Plants	• Planting of native species • Use of measures to prevent the spread of invasive species including environmentally friendly pesticides • Monitoring surveys to identify growth of invasive species in the disturbed area • Replacement of top soil to restore conditions for biological activity • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife
Colchic Boxwood *Buxus colchica*	• Re-planting of the species
Common Walnut *Juglans regia*	• Re-planting of species. This is a key measure for this species as tree cutting is major threat and the species is rare in Adjara
Colchis Water-Chestnut *Trapa colchica*	• Use of sites designated for dumping to avoid polluting aquatic habitat • Mitigating impacts against this species will result in benefits to bird and fish fauna as well
Lazetian Forget-me-not *Myosotis lazica*	• Re-planting of the species
Mammals	• Re-plantation will result in some habitat restoration. Wildlife that will re-locate may return once planted vegetation is established • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain • Noise pollution should be minimized to reduce the disturbance to animals as far as possible • Dust pollution should be minimized to reduce disturbance to animals as far as possible • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project
Mehely's Horseshoe Bat *Rhinolophus mehelyi*	• The species is legally protected in Georgia, therefore, if any specimens are found in the Project area or any roosting sites are identified, a specialist should be consulted on re-location of the bats • If bats are found within the Project area, pollution including noise, dust and contamination of nearby habitat should be prevented • Re-plantation is needed to for the re-establishment of feeding sites

Receptors	Management and Mitigation Measures
Mediterranean Horseshoe Bat *Rhinolophus Euryale*	• The species is legally protected in Georgia, therefore, if any specimens are found in the Project area or any roosting sites are identified, a specialist should be consulted on re-location of the bats • If bats are found within the Project area, pollution including noise, dust and contamination of nearby habitat should be prevented • Re-plantation is needed to for the re-establishment of feeding sites
Western Barbastelle *Barbastella barbastellus*	• Clearance of mature woodland should be minimized as far as possible to preserve the species' habitat • Re-plantation and support to trees until they are established will increase chances of habitat restoration for the species
Schreiber's Bent-winged Bat *Miniopterus schreibersii*	• Habitat loss should be minimized to avoid depletion of its food supply • Disturbances to caves should be minimized as that is present threat
Giant Noctule *Nyctalus lasiopterus*	• Clearance of mature woodland should be minimized as far as possible to preserve the species' habitat • Re-plantation and support to trees until they are established will increase chances of habitat restoration for the species
Common Otter *Lutra lutra*	• Although this species is reported to be present in the Project area, its distribution within Georgia does not overlap with the Study Area • If the species is observed in the Project area, a biodiversity specialist should be notified the specimens re-located
Birds	• Re-plantation will result in some habitat restoration. Wildlife that will re-locate may return once planted vegetation is established • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain, especially of water bodies which are very important for bird fauna in and around the Study Area • Noise pollution should be minimized to reduce the disturbance to birds as far as possible • Dust pollution should be minimized to reduce disturbance to birds as far as possible • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project
Dalmatian Pelican *Pelecanus crispus*	• If vegetation around aquatic habitat is disturbed it should be re-planted at similar sites to facilitate the development of habitat to replace that lost • Contamination of aquatic areas should be prevented to minimize risk of contamination of its food source • Staff should not engage in hunting as this species is often targeted

Receptors	Management and Mitigation Measures
White-winged Scoter *Melanitta fusca*	• Improper waste disposal should be avoided to minimize the risk of contamination of aquatic habitat which, as pollution is one of the threats to this species
Imperial Eagle *Aquila heliacal*	• Re-plantation should be done to restore habitat as far as possible to prevent decline in the species' prey base • Staff should not engage in hunting as this species can be targeted and is legally protected in Georgia
Greater Spotted Eagle *Aquila clanga*	• Re-plantation to restore habitat is important to minimize impacts on this species, both direct and indirect
Egyptian Vulture *Neophron percnopterus*	• Re-plantation to restore habitat is important. In particular this species forages around human settlements, therefore, the likelihood of loss of habitat for it is higher than for other bird species • Staff should not engage in shooting of wildlife as this species is sometimes targeted
Black Vulture *Aegypius monachus*	• Re-plantation to restore habitat is important as one of the threats to this species reduced food availability • Staff should not engage in shooting of wildlife as this species is sometimes targeted
Saker Falcon *Falco cherrug*	• Re-plantation to restore habitat is important
Red-footed Falcon *Falco vespertinus*	• Re-plantation is important to restore habitat so that the species can have alternative nesting sites to replace those destroyed by the Project
Migratory species	• Staff should not engage in hunting as migratory bird species are targeted by hunters in Batumi
Herpetofauna	• Re-plantation will result in some habitat restoration. Reptile and amphibian species that will re-locate may return once planted vegetation is established • Any herpetofauna species observed during construction activities should be re-located with assistance from a biodiversity expert to ensure proper handling • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain • Noise pollution should be minimized to reduce the disturbance to herpetofauna species as far as possible • Dust pollution should be minimized to reduce disturbance to herpetofauna species as far as possible • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project

Receptors	Management and Mitigation Measures
Caucasian Viper *Vipera kaznakovi*	• Re-plantation to restore habitat is important • Care should be taken when carrying out Project-related activities even in areas that are already disturbed • If the species is spotted, the specimens should be re-located with the help of a biodiversity specialist to ensure proper handling
Caucasian Salamander *Mertensiella caucasica*	• Re-plantation to restore habitat is important • If the species is spotted, the specimens should be re-located with the help of a biodiversity specialist to ensure proper handling
Caucasian Parsley Frog *Pelodytes caucasicus*	• Disturbance to pools and small pond habitats should be minimized to preserve the species' habitat • Re-plantation to restore habitat is important • If the species is spotted, the specimens should be re-located with the help of a biodiversity specialist to ensure proper handling
Derjugin's Lizard *Darevskia derjugini*	• Re-plantation to restore habitat is important • If the species is spotted, the specimens should be re-located with the help of a biodiversity specialist to ensure proper handling
Large-headed Water Snake *Natrix megalocephala*	• Disturbance of undergrowth in Colchis type forests should be minimized as far as possible to preserve the species' habitat • Re-plantation to restore habitat is important • If the species is spotted, the specimens should be re-located with the help of a biodiversity specialist to ensure proper handling
Invertebrates	• Re-plantation will result in some habitat restoration. Wildlife that will re-locate may return once planted vegetation is established • Use of sites designated for dumping to avoid polluting ecologically important areas such as habitat for wildlife • Use of sites designated for dumping will also result in prevention of contamination of the food chain, especially of water bodies which are very important for invertebrates • Noise pollution should be minimized to reduce the disturbance as far as possible • Dust pollution should be minimized to reduce disturbance as far as possible
Fen Raft Spider *Dolomedes Plantarius*	• During re-plantation, some habitat that is restored should be ponds and small bodies of water so that the species can re-colonize

Receptors	Management and Mitigation Measures
Fish	• Use of sites designated for dumping to avoid polluting ecologically important aquatic habitat • Use of sites designated for dumping will also prevent contamination of the aquatic food chain • Hunting and poaching should be prevented to protect species of conservation importance and minimize loss of wildlife, which will already be undergoing habitat loss due to the Project
Sturgeon Species	• Dumping of waste should not be carried out in the riverine habitat or any aquatic habitat that connects to the river system • Hunting and poaching should be prevented to protect species especially the Sturgeon species for whom this is already a threat
European Eel *Anguilla anguilla*	• Dumping of waste should not be carried out in the riverine habitat or any aquatic habitat that connects to the river system • It is indicated that adults may be at risk from accumulation of lipophilic chemical pollutant, therefore, preventing contamination of aquatic habitats is very important for this species
Periphyton	• Use of sites designated for dumping to avoid polluting aquatic habitat • Impacts on periphyton should be minimized to avoid impacts on other organisms in the food chain

10.3 Environmental Monitoring Plan

628. Monitoring of environmental components and mitigation measures during implementation and operation stages is a key component of the EMP to safeguard the protection of environment. The objectives of the monitoring are to:

- manage environmental issues arising from construction works through closely monitoring evidence for implementation of the mitigation measures and environmental compliance; and
- monitor changes in the environment during various stages of the Project life cycle with respect to baseline conditions.

629. A monitoring mechanism is developed for identified impact and includes:

- location of the monitoring (near the Project activity, sensitive receptors or within the Project influence area);
- means of monitoring, i.e. parameters of monitoring and methods of monitoring (visual inspection, consultations, interviews, surveys, field measurements, or sampling and analysis); and
- frequency of monitoring (daily, weekly, monthly, seasonally, annually or during implementation of a particular activity).

630. Monitoring program will include regular monitoring of construction and commissioning activities for their compliance with the environmental requirements as per relevant standards, specifications and EMP. The purpose of such monitoring is to assess the performance of the undertaken mitigation measures and to immediately formulate additional mitigation measures and/or modify the existing ones aimed at meeting the environmental compliance as appropriate during construction.

631. The monitoring program will be coupled with a series of supporting procedures, yet to be developed, covering:

- sample or data collection;
- sample handling, sample storage and preservation;
- sample or data documentation;
- quality control;
- data reliability (calibration of instruments, test equipment, and software and hardware sampling);
- data storage and backup, and data protection;
- interpretation and reporting of results; and
- verification of monitoring information by qualified and experienced external experts.

10.4 Specific Monitoring Plan

632. Environmental monitoring and reporting plan for the construction and operation phases are provided in **Table 10-6.**

Table 10-5: Environmental Monitoring Program for Construction and Operation

Aspect	Type of monitoring	Frequency of Monitoring	Location/s	Reporting Frequency	Monitoring and implementation Responsibility	Report Preparation Responsibility	Report Receiving Authority
Construction Phase							
Soil Quality	Visual inspection for any oil and lubricant spills and leakages in the construction area and presence of oil in the drains at the construction site	Daily	Construction area and drains at the construction site	Monthly report during construction	Construction Contractor, SC, RD	Construction Contractor	RD, SC and ADB
Soil Erosion	Visual inspection of soil erosion and land sliding, especially in the wet season	Once a month in dry season. Once a week in wet season.	Construction sites, rehabilitated areas and water release points	Monthly report during construction	Construction Contractor, SC, RD	Construction Contractor	RD,SC and ADB
Waste Disposal	Inspection of waste disposal areas and channels	Weekly	Waste disposal sites,	Quarterly report during construction	Construction Contractor, SC, RD	Construction Contractor	RD, SC and ADB
Water Resource Depletion	Record of water used and source of water supply for construction, sprinkling and camp	Daily	Construction sites, truck filling points and water tanks at camp.	Quarterly report during construction	Construction Contractor, SC, RD	Construction Contractor	RD and ADB
Community Water Supplies	Monitor flow for springs identified as at risk from tailrace construction.	Monthly	Identified springs in communities.	Quarterly report during construction	Construction Contractor, SC, RD	Construction Contractor	RD and ADB
Fugitive Dust Emissions	Air quality sampling (PM_{10} and $PM_{2.5}$) at social receptors in case any complaints regarding excessive particulate matter in ambient air are received.	As required, in case complaints are received	Social receptors	Report as required, in case complaints are received	Construction Contractor, SC, RD	Construction Contractor	RD and ADB

Aspect	Type of monitoring	Frequency of Monitoring	Location/s	Reporting Frequency	Monitoring and implementation Responsibility	Report Preparation Responsibility	Report Receiving Authority
Vehicular and Machinery Exhaust Emissions	Visual checks of exhaust emissions from vehicles and batching plant machinery to ensure excess pollutants are not being released	Monthly	Construction sites and batching plant location	Quarterly	Construction Contractor, SC, RD	Construction Contractor	RD and ADB
Noise Nuisance	Monitoring of the noise levels (24 hour measurements for hourly Leq in dB A) in the nearest communities against the baseline noise conditions	Once a month and when a complaint is received	Nearest settlements or area for which complaint is received	Quarterly	Construction Contractor, SC, RD	Construction Contractor	RD and ADB
Traffic	Random speed checks and inspections and investigations in case of complaints by community	Once a month and in case complaints are received	Different location and different time	Quarterly	Construction Contractor, SC, RD	Construction Contractor	RD and ADB
Vibration	Vibration sensors for PPV monitoring.	Continuous during blasting in the vicinity	One sensor for each cluster of house within the risk zones. At least 5 sensors within 100 m and 5 beyond.	Quarterly	Construction Contractor, SC, RD	Construction Contractor	RD and ADB
Operation Phase							
Noise Level	Monitoring of the noise levels (24 hour measurements for hourly Leq in dB A).	Continuous				RD	ADB

10.5 Documentation and Reporting

633. Monitoring elements of the EMP will be documented and controlled in accordance with a document control system by the Supervision Consultant (SC) and communicated to RD. Records demonstrating compliance with legal requirements and conformance with the EMP will also be maintained. RD through SC will supervise, establish, implement and maintain procedures.

634. Documentation and record keeping controls will include:

- measures to enable relevant documents and records to be readily available and identifiable (labeled, dated and properly filed), legible and protected from damage;
- review, revision and approval of documents for adequacy by authorized personnel at least once a year;
- establishment of the electronic document control version as the 'authorized version';
- making current versions of relevant documents available at locations where operations essential to the effective functioning;
- suitably identifying obsolete documents retained for legal and knowledge preservation purposes; and
- identification and segregation of confidential and privileged information.

635. Monitoring data will be documented and analyzed to determine temporal and spatial trends and confirm compliance with relevant thresholds. Monitoring reports will be produced to meet internal and external reporting requirements. If monitoring results indicate non-conformance with stipulated thresholds or if a significant deteriorating trend is observed, it will be recorded as a non-conformance and handled by the non-conformance and incident procedure.

636. The following reports will be prepared

- The construction contractor will prepare reports based on the parameters detailed in **Table 10-5** based on inputs from the SC, RD and their own monitoring.
- The SC will prepare quarterly reports to be reviewed by the RD.
- The RD will prepare bi-annual reports to be shared and reviewed by the ABD.

10.6 Site-Specific Environmental Management Plan

637. EPC's Contractor's managers during the construction phase will operationalize their responsibilities described in **Section 10.2** by developing Site Specific Environmental Management Plans (SSEMP). These will applied to the actual site where construction activities will occur. Ideally, the preparation of the SSEMP must occur before the contractor is given access to the project site. However, it can be prepared after the access is given but certainly before the initiation of site clearance and any major site construction or erection work.

638. All contract documents must include the requirement that SSEMPs be prepared by the contractor and reviewed by RD and OE and approved by ADB prior to commencement of construction activities.

639. This section explains the following steps that should be followed while developing an SSEMP:

- Definition of boundaries
- Identification of environmental values and sensitive receptors of the site and its surrounds
- Definition of construction activities
- Assignment of environmental management measures
- Preparation of site plans
- Preparation of environment work plans

Definition of Boundaries

640. For megaprojects with multiple construction sites, there will be a number of SSEMPs. Generally, areas falling under the jurisdiction of a construction manager should have a separate SEMP. At a minimum the following sites should have an SSEMP prepared:

- Each tunnel
- Each bridge
- Asphalt and batching plants
- Construction camps
- Quarry areas
- Waste dump areas

641. Some of these sites, such as the longer bridges or tunnels may require multiple SSEMPs to cover the entire spatial extent of the development.

Identification of Sensitive Receptors

642. Once the boundaries of a site to be covered by a SSEMP have been defined, the sensitive receptors surrounding the site and the environmental values of the area need to be confirmed.

643. Areas that can be considered sensitive receptors include

- Forested area
- Water bodies
- Communities (including schools, hospitals, homes)
- Agricultural areas

644. The physical, ecological and socioeconomic baselines in **Chapter 4** provide the necessary details. The information is best presented as an overlay on the detailed engineering drawings or maps for the project.

Construction and Associated Mitigation Activities

645. A schedule of works for the project will have been prepared during the detailed design phase. It is important to understand what the various phases of work are for each site, as different phases will include different activities and thus different environmental management requirements. In this simplified example, the construction of a bridge across a river could have the following schedule of works:

- Site surveying, vegetation clearance
- Site establishment
- Soil stripping and earth movement
- Bridge construction
- Grading approaches
- Surfacing
- Painting and finishing structures
- Landscaping and signage

646. The planning of the environmental management requirements for the bridge must ensure that the necessary environmental management activities take place at the right time. For example, the site survey should markup areas of vegetation to be removed, trees that must be saved, and the locations of any species of importance. Soil stripping will need to be accompanied by the introduction of erosion-control measures to prevent sediment from entering the river. The concrete pouring and filling of the bridge abutments will require a large number of vehicle movements, so it may be necessary to develop a traffic management plan to ensure that the vehicles don't disrupt traffic on existing roads. If there are sensitive receptors nearby, there may be a requirement to limit working hours that will require a change in the work schedule. These measures are easy to plan for, but very hard to introduce once the project has started. This, again, emphasizes the need for effective planning of the environmental management measures.

647. **Section 10.2** provides a list of required mitigation measures that must be incorporated into the relevant SSEMPs.

Site Plan

648. A site plan must cover the extent of the construction activity and should contain:

- Location and nature of planned work;
- Locations of sensitive receptors; and
- Locations of required mitigation activities.

649. Other important features may include:

- Indication of North, and scale;
- Existing and planned supporting infrastructure (e.g., access roads, water supplies, electricity supplies, etc.);
- Contours; and
- Drainage systems.

Work Plan

650. The completed SSEMP provides details of all the environmental management requirements for all stages of the construction process. For individual work teams responsible for only a small part of the overall construction work, it can be hard to understand what is required for their particular work components. For example, the work team responsible for stripping soil for the construction areas are not going to be interested in the requirements for pouring concrete for footings and foundations. However, it is essential that the soil stripping team know exactly what to clear, what to leave, and where to put stockpiles of soil for later use.

651. When different work activities are required at different times or at different locations, environmental work plans can be prepared. These are similar to the work method statements often produced for major construction projects.

10.7 Guidelines for Supporting Plans

652. Specific management plans, for areas of concern, will be developed by RD or contractors as specified. The framework, outline and requirements for each plan is discussed in this section.

10.7.1 Emergency Response Plans

653. The Construction Contractor will prepare an emergency response plan for natural and human made emergencies.

Spill Prevention and Mitigation Plan

654. Liquid waste spills that are not appropriately managed have the potential to harm the environment. By taking certain actions, the likelihood of spills can be reduced and their effect minimized.

655. To avoid spills and to help the cleanup process of any spills, the EPC contractors and the management and staff of RD should be aware of spill procedures. By formalizing these procedures in writing, staff members can refer to them when required thus avoiding undertaking incorrect spill procedures

656. A detailed spill management plan will be prepared for the construction phase. A plan will also be developed for specific areas during plant operation. These plans will contain the following:

- Identification of potential sources of spill and the characterization of spill material and associated hazards.
- Risk assessment (likely magnitude and consequences)
- Steps to be undertaken taken when a spill occurs (stop, contain, report, clean up and record).
- A map showing the locations of spill kits or other cleaning equipment. This should also be included in the SSEMP

Landslide Prevention and Mitigation Plan

657. Due to the geology and climate of the construction sites it is susceptible to landslides during and after construction. Areas highly prone to land sliding have been identified in the detailed design and supporting structures (such as terramesh, RC

retaining walls and Gabion walls) are planned for those areas. However, it is possible that despite these measures or during implementation landslides may occur. Landslides can be a hazard to surrounding communities. Therefore, a landslide prevention and mitigation plan will be developed by the Construction Contractor. The plan should cover the following aspects:

- Steps to be followed during imminent danger of landslides
- Steps to be followed during landslide emergencies.
- Operational issues
  - Zoning (marking areas prone to landslides and should be included in the SSEMP)
  - Evacuation signals in case of emergency
  - Prioritizing strategy for evacuation and clearing works

658. Staff of the CC, SC and RD should be aware of the response procedures

Other Emergencies

659. Response plans for other emergencies, including but not limited to the following, will also be developed:

- Heavy downpour and consequent flooding
- Vehicle accident
- Earthquake
- Electrical hazards
- Equipment Failure

10.7.2 Spoil Management Plan

660. The Spoil Management Plan will be prepared to manage spoil during construction of the Project. A large amount of spoil will be generated during tunnel excavation and other earthwork along the alignment. The plan should cover the following:

- Spoil storage/disposal units in terms of site preparation (e.g., compaction, overburden removal),
- Under- and side-drainage control (e.g., return interval to be handled), unit configuration (e.g., thickness of lifts, amount of benching, side slope shape and angle),
- Possible methods of compaction (e.g., with truck routing), and
- Closure (e.g., if to be compacted and lined, topsoil and vegetation placement, monitoring and maintenance).

661. These will be critical measures to ensure spoil units are stable for decades and centuries.

662. The construction contractor should coordinate with the following during development of the Spoil Management Plan

- Batumi Landfill, for possible use of spoil for closure of the landfill

- Surrounding communities, for possible use of spoil for reclamation of unusable land.

10.7.3 Waste Management Plan

663. The purpose of this plan is to minimize the amount of waste produced due to activities resultant of the Project as described in this document, for the benefit of the environment and to maximize cost savings. The plan should detailed guidelines to meet the following objectives:

- Waste Minimization: To minimize the waste load discharged to the environment. The following suggested measures can be adopted:
  - Carry out a waste minimization assessment which examines opportunities for waste avoidance reduction, reuse and recycling.
  - Reduce wastes by selecting, in order of preference, avoidance, reduction, reuse and recycling.
  - Incorporate waste minimization targets and measures into the environmental management plan.
- Ensure that all contaminated material uncovered on a construction site are excavated and disposed of in an environmentally responsible manner. The following suggested measures can be adopted:
  - Assay material uncovered on-site prior to disposal. If the wastes include putrescible wastes, then also analyze leachate and landfill gases.
  - Excavate material in a manner which avoids off-site environmental problems.
  - Seal remaining contaminated material or wastes, where only part of the tip has been excavated, to ensure that there is no off-site effect now or in the future.
  - Transport odorous wastes in covered vehicles.
  - Dispose of contaminated material in a landfill licensed to take the type of contaminated material or wastes uncovered.

10.8 Change Mangement

664. During the implementation of the project, often need arises to change the project design, site, construction technology, or implementation method. The change may constitute a departure from the project described in the EIA and may necessitate reevaluation of the environmental impact. In case of any change in the project as described in the Feasibility Study and the EIA, the Supervision Consultant, will make an initial assessment of its likely environmental consequence.

665. If the change is minor departure from the EIA but necessitates a change in the EMP, the SC and the Construction Contractor will propose the change in the EMP and submit to the RD and ADB for approval.

666. If the change is assessed to be significant departure from the EIA (for example the use of explosives for tunnel boring), the SC will recommend an independent environmental assessment of the change which will be commissioned by the RD. The assessment, and recommended changes to the EMP will be submitted to the ADB and MoE for approval.

10.9 Institutional Framework for Implementation

667. Institutions responsible for executing and monitoring the environmental aspects of this Project are:

- MRDI is responsible for planning, constructing, operating and maintaining regional, national and provincial infrastructures in Georgia and RD is responsible for overall management of roads.
- Environmental Division of the RD will undertake routine and random monitoring of the specific environmental management plans (EMP) addressed in this EIA.
- The supervision consultants under RD are responsible for environmental monitoring and management of project implementation and to help ensure the implementation of environmental management practices at each stage of the construction.
- MOEPNR will be consulted if complicated issues arise during construction and operation stages.
- External Monitor will be responsible for independent monitoring and implementation of EMP, and external monitoring and evaluation

668. Contractor is responsible for implementation of EMP during construction works and Construction Supervision Consultant (CSC) is primarily responsible for supervision of monitoring of the implementation of the EMMP. RD will hire 'external monitoring consultant' to monitor implementation and supervision of EMMP.

669. Each Contractor procured under this Project will be recommended to be a compliant of ISO 14001, 2004 Environmental Management System (EMS) certification. Further conditions of compliancy for OHSAS 18000 (2007) related Occupational Health and Safety (OHS) could also be imposed on the Contractors. Each contractor will be recommended to have one Environmental Specialist and one Occupational, Health and Safety (OH) Specialist, who will be working in close coordination with the environmental staff of CSC and RD.

670. CSC will be responsible to monitor all activities of all contractors procured under the Project. As several contractors will be working simultaneously for timely and speedy implementation of the project, it is important that CSC has an environmental unit to effectively supervise and monitor the environmental activities being implemented in the field. The CSC is also responsible to update or make necessary changes to the EMMP if required based on the revised designs and locations.

10.10 Institutional Strengthening and Training

671. The RD will play a key role during the implementation of the Project. Based on the assessment of the present capacity of the RD and the sensitivity of the project, the RD will require additional resources and training. At present the Batumi office the RD does not have a dedicated environmental expert. The environmental resource person is located in the capital Tbilisi, about 400 km from the proposed Project site. Given the sensitive nature of the Project, it is essential that the environmental and social capacity of RD at Batumi shall be strengthened. It is therefore recommended that before the initiation of land acquisition work and the construction work, a safeguard specialist shall be appointed in Batumi with the following key responsibilities:

- Monitor the environmental and social impacts (excluding that of LARP) of the proposed project during construction;
- Keep a liaison with the community on environmental matters; and
- Organize awareness sessions for the community.

10.11 Implementation Budget

672. The implementation budget for EMP is presented in **Table 10-6**.

Table 10-6: EMP Implementation Budget for Construction Phase

Head	Item	Quantity	Unit Rate (US$)	Total Cost (US$)
Equipment	Noise meters	3	400	1,200
	Ambient air quality (Low vol sampler)	1	5000	5,000
	Vibration meters	10	800	8,000
Sampling and Analysis	Water	36	200	7,200
	Soil	36	200	7,200
Noise wall		58,000 m^2	275	15,950,000
Staff		36 months	2,500	90,000
Vehicle and Fuel		36 months	500	18,000
Total				**16,086,600**

11. Grievance Redress Mechanism

11.1 Introduction

673. Grievance redress mechanisms (GRMs) are institutions, instruments, methods, and processes by which a resolution to a grievance is sought and provided. GRM is seen by ADB as a pre-litigation mechanism for conciliation of disagreements and addressing concerns of APs at early stages of dispute. GRM is aimed on smooth and creative resolution of disputes, minimizing time and resources waste and reputational risk to the project. The experience gained in ADB and other donor funded projects demonstrates that the efficient GRM enables to avoid time-consuming and complex legal procedures in majority cases of claims.

674. The grievance redress mechanism (GRM) is an integral part of the ADB Accountability Mechanism (AM) that complements the problem solving (OSPF) and compliance review (CRP) functions of the ADB AM Policy 2012.

675. The GRM should be established and operated in compliance with the Georgian Regulations and ADB Policy requirements.

676. According to the ADB requirements, the GRM should be arranged to address the resettlement related issues (SPS 2009 – Safeguard Requirements 2: Involuntary Resettlement, Requirement 7. Grievance Redress Mechanism) and the environmental concerns of the affected communities and other stakeholders (SPS 2009 - Safeguard Requirements 1: Environment, Requirement 5. Grievance Redress Mechanism).

677. Requirement on establishing GRM is stipulated in LARFs/LARPs and EARFs/IEE/EIA. Legitimization of the GRM is ensured through approval of these documents by the Georgian Government. LARFs/LARPs and EARFs/IEEs/EIAs contain description of general principles of operation and structure of the GRM. The present guideline provides more detailed description of GR process and recommendations.

678. The grievance redress mechanism, as defined in LARFs, shall deal with the issues of land and other assets acquisition (e.g. amount of compensation, suitability of residual land plots, loss of acess roads, etc) as well as the losses and damages caused by the construction works, e.g. temporray or permanenet occupation of land by the contractor. Therefore the grievance redress mechanism shall be in place by the time of LARP preparation and intense communication with the APs and shall function until the completion of the construction.

679. The grievance redress mechanism, as defined in EARFs, shall deal with the environmental concerns raised by the affected communities and stakeholder at the stage of IEE/EIA preparation and furher during the construction stage. At the IEE/EIA stage the grievances comprise complains of more general character (complains against triggering geohazard risks, affecting flora and fauna and valuable landscapes and ecosystems, climate change or pollution, impacts on cultural heritage etc.), with more community-focused complains, like risks of damage of property, nuiscance or losses of community property etc. At the construction stage the environmental claims raised by the local communities usually prevail. However, in case of gross violation resulting in significant impacts, the claims could be raised by NGOs or other stakeholders.

680. The environmental and/or the resettlement related grievances from affected population and stakeholders could be submitted throughout the project preparation and

implementation stage. The core group of people involved in grievance resolution (IA staff, local authorities, Construction and Supervising companies, representatives of population and NGOs, etc.) are the same for both processes. There is no substantial reason to consider as a feasible scheme development of two separate GRM for LAR implementation and managing environmental issues. It is considered that the one GRM could be established as an efficient tool for addressing both – environmental and resettlement problems related to ADB financed projects. The proposed structure of GRM, process and procedures for grieavnce resoultion is described in chapters 1.4 and 1.5 of this guideline.

11.2 Georgian Regulations

681. Administrative Code of Geeorgia is the legal document defining the rules and procedures for the grievance review and resolution.

682. According to the law, the Administrative body receiving officially lodged claims is oblidged to review the claims and engage the claimant in the grievance review and resolution process, and issue final decision in that regard.

683. Clause 181. defines the content and the grievance submission forms. In particular, the grievance package should include: a) Name of the administrative body to whom the complaints are addressed; b) Name, address and contact details of the claimant; c) Name of the administrative body, who's decisions or administrative acts are the subject of complain; d) Name of the administrative act or decision, which is subject of complain; e) Content of the claim; f) The context and facts, based on which the complaint is substantiated; g) list of attachments;

684. Clauses 194 and 198 define the rules and procedures ensuring participation of the claimants in the grievance review process.

685. According to the clause 202, the decision issued by the Administrative Body in relation with the reviewed claim has a status of individual administrative legal act.

686. The standard period given for the issuance of the decision in relation with the grievance is 1 month.

11.3 ADB Policy (SPS 2009) requirements in relation with the Grievance Redress

687. The borrower/client will establish a mechanism to receive and facilitate the resolution of affected persons' concerns and grievances about physical and economic displacement and other project impacts, paying particular attention to the impacts on vulnerable groups.

688. The grievance redress mechanism should be scaled to the risks and adverse impacts of the project.

689. It should address affected persons' concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to the affected persons at no costs and without retribution.

690. The mechanism should not impede access to the country's judicial or administrative remedies. The borrower/client will inform affected persons about the mechanism.

11.4 Grievance Redress Process

691. At the LARP/EIA preparation stage, during the consultation meetings and negotiations the APs shall be fully informed of the grievance redress mechanism, its functions, procedures, contact persons and rules of making complaints. This will be ensured through oral information and booklets distributed during the information campaign.

692. Grievance resolution is viewed as a two-stage process, first involving local resources (site-and project specific structures/units) for the grievance resolution and only in case of failure engaging top management and entire capacity of the central offices of IA/PIUs.

693. Grievance redress procedures of Stage 1 represent an informal tool of dispute resolution allowing the APs and the project implementation team to resolve the disagreement without any formal procedures, procrastination and impediments. The international experience of LAR/Environmental Mnagement shows that such informal grievance redress mechanism helps to solve most of the complaints without formal procedures (i.e. without using the procedures specified in the Administrative Code or litigation). This mechanism enables unimpeded implementation of the Project and timely satisfaction of complaints.

694. Care will always be taken to prevent grievances rather than going through official procedures of Stage 2. The achivement of this goal can be ensured through careful planning and preparation of IEE/EIA and LARP, active participation of APs, effective consultations, proper communication and coordination among local communities, IAs and local authorities.

695. In case of failure of the grievance resolution attempts at the stage 1, the process of grievance review and resolution enters Stage 2. Stage 2 is a process formalized in accordance with the Administrative Code of Georgia. The claimant submits official claim in a written form to the IA and the IA as an administrative body is conducting the grievance review and response process following requirements of the law, regarding time frames, involvement of claimant, etc. The stage 2 process may require involvement of different departments and specialists of the IA, its consultants, local authorities and other stakeholders.

696. If the grievance is not resolved at the stage 2 GR process, the claimant has right and possibility to apply to court and the GRM helps the claimant to prepare application package.

11.5 Grievance Redress Mechanism

697. The present chapter specifies the procedures of establishing Grievance Reddress Mechanism (GRM) and its structure and composition. The Safeguard Units of the IA has important role for establishing the GRM.

698. The GRM consists of temporary, project-specific units established at the municipal level in project affected municipality and regular system established at IA. ***Grievance Reddress Committee (GRCE)*** established at municipal level as a project-specific instrument, which is functional only for the period of the project implementation. ***Grievance Redress Commission (GRCN)*** is formed as permanently functional informal structure within the IA to ensure grievance review, resolution and record.

11.6 Grievance Redress Commission in IAs

699. Grievance Redress Commission (GRCN) is formed by the order of the Head of IA as a permanently functional informal structure, engaging personnel of IA from all departments having regard to the environmental and LAR issues and complaint resolution. This includes top management, Environmental and Social Safeguards Units, Legal Departments, PR department and other relevant departments (depending on specific structure of the IA). The GRCN is involved at the Stage 2 of grievance resolution process. The Order shall also state that if necessary representative of local authorities, NGOs, auditors, representatives of APs and any other persons or entities can be engaged in a work of GRCN. For the GRCN the following composition is proposed (**Table 11-1**):

Table 11-1: GRCN Composition

i.	Top management of IA/PIU	Member
ii.	Head of Environmental and Social Safeguards Units	Member
iii.	Legal Departments of IA/PIU	Member
iv.	PR department of IA/PIU	Member
v.	Other relevant departments (depending on specific structure of the IA).	Member

700. A Grievance Redress Committee (GRCE) is an informal, project-specific grievance redress mechanism, established to administer the grievances at Stage 1. This informal body will be established at community level in both the affected Municipality. The representative of Rayon Gamgebeli in the Muncipality will be a Chairman of the GRCE. The IA/PIU representative(s) of Environmental and Resettlement Unit in GRCE (Convener, Contact Person(s)) shall coordinate the GRCE formation. The Contact Person will then be responsible for the coordination of GRC activities and organizing meetings. In addition, GRCE shall comprise representative of Sakrebulo (Secretary), representatives of APs, women APs (if any), and appropriate local NGOs to allow voices of the affected communities to be heard and ensure a participatory decision-making process.

701. GRCEs will be established at the community level (office of the official Representative of the Gamgebeli in the Municipality and the Head of the Municipal Sakrebulo[202]). Establishment of GRCE will be formalized by the protocol of the first meeting with the reference on LARFs/EARFs, as a part of binding agreement of the Government and ADB. For the GRCE following composition is proposed (**Table 11-2**):

[202] Sakrebulo is a elected local authority (local parliament) and the Representative of the Gamgebeli in the Municipality is an executive authority.

Table 11-2: GRCE composition

i.	Representative(s) of Environmmental and Resettlement Safeguards Unit of IA/PIU	Convener; Contact Person(s)
ii.	Representative of Sakrebulo	Member
iii.	Representative of Rayon Gamgebeli in the concerned Muncipality (village/municipality level)	Chairman
iv.	Representative of APs	Member
v.	Representative of NGO	Member
vi.	Representative of Civil Works Contractor	Member
vii.	Environmental and Resettlement/Social Specialists of Supervision Consultant	Member

702. Representative(s) of the Environmental and Resettlement Unit of IA/PIU (Conviner/Contact Person) is coordinating the work of the Commettee and at the same time he is nominated as a contact person for collecting the grievances and handling grievance log. The local authorities at the municipal level, civil works Contractor, Supervising Company (Engineer), as well as IPs (through informal meetings) are informed about the contact person and his contact details are available in offices of all mentioned stakeholders. The ToR for the members of GRCE is given in **Appendix 9.**

703. The APs should be informed about the available GRM. This could be achieved through implementing information campaigns, distributing brochures (e.g. Communication Plan), and forms for the grievance for APs (see **Appendix 9**). Keeping all focal points up-to-date & maintaining regular communication with them, allowing multiple entry points for complaints, Introducing forms for ease of reporting complaints.

11.7 Grievance Redress Procedures

Stage 1 – informal review of the AP's complaint (whether written or oral)

704. **Grievance Collection and registration.** The representative(s) of Environmental and Resettlement Unit of IA/PIU (Contact Person) is a person responsible for collecting the grievances received from different entry points and for recording them. Through the information campaign conducted at the early stages of the project development, the APs will be informed that grievances should be addressed directly to the Contact Person. However, despite any efficient information campaigns, it is expected that some portion of grievances will be addressed to the local authorities at the Municipal or Regional level, to the Construction Contractor and Supervising Company (Engineer). All these stakeholders will arrange entry points and recording systems for grievances and will readdress the grievances to the Contact Person. Further, the Contact Person will register the grievances and will coordinate the grievance resolution process, engaging the required members of GRCE.

Step 1: Informal negotiations

705. Representative of IA (Contact Person) will review the grievance, and based on that will:

- define the list of members of the GRCE and specialists required to address the grievance

- agree with the claimant the date and site for the informal meeting
- conduct meetings, site visits and negotiations with the AP with participation of relevant members of the GRCE
- will document all site-visits, meetings and discussions with the involved parties (minnutes of meetings, photos, etc.)

706. In case of amicable resolution of the dispute, a Protocol of Agreement (Protocol 1: Action Plan) is prepared by the Contact Person describing agreed actions, dates, other conditions (See **Appendix 9**). The protocol is signed by the claimant and Contact Person. The Action Plan should define:

- clear timeline for each action,
- parties responsible for undertaking and completing each action, budget

707. After implementation of the agreed action another protocol is prepared by the Contact Person (Protocol of Grievance Closure), which confirms the fact that the parties have finally resolved the dispute (**Appendix 9**). The protocol will be signed by Contact Person as a representative of GRCE and by the claimant.

Step 2.: Formal Review of the Grievance by GRCE:

708. In case if informal negotiations conducted as step 1 of the stage 1 process fails to resolve the issue, the official procedure of the grievance review by the GRCE is triggered.

709. The Contact Person (Representative(s) of Environmmental and Resettlement Safeguards Unit of IA/PIU) assists the claimant to prepare the official written claim addressed to the GRCE and supplements this by his information notes.

710. The written claim will contain the following information:

- Name and contact details of the claimant
- Date of submitting claim
- The brief description of the essence of claim
- Documents prepared (photos, maps, other documents) confirming the information presented in a claim

711. The Contact Person will notify IA/PIU and all members of the GRCE regarding the need of execution of the formal GRCE procedure. The Contact Person will agree the date of formal meeting with the chairman and Secretary of the GRCE and inform the claimant and all members of the GRCE regarding the meeting site and date. The meeting should be held not later than 2 weeks after the notification issued by the Contact Person. The Contact Person will distribute the claim supplementary documents among the GRCE members.

712. The GRCE will engage all required specialist in reviewing the claim and, in case of need, will invite them on a planned meeting. During 1 week after the meeting the GRCE will issue its Conclusion and the Contact Person will inform the caimant about the decision.

713. In case of amicable resolution of the dispute, a Protocol of Agreement is prepared by the Contact Person describing agreed actions, dates, other conditions. The protocol is signed by the claimant and Chairman of the GRCE.

714. After implementation of the agreed action the Protocol of Grievance Closure is prepared by the Contact Person. The protocol will be signed by the Chairman of GRCE and by the claimant.

715. In case if informal negotiations conducted as stage 1 process fails to resolve the issue, the grievance resolution by GRCE at the local level is considered as not sufficient and the claim resolution process by GRCN at the central level is triggered.

716. The Contact Person (Representative of IA) assists the claimant to prepare the official written claim addressed to the GRCE and supplements this by his information notes.

717. The written claim will contain following information:

- Name and contact details of the claimant
- Date of submitting claim
- The brief description of the essence of claim
- Documents prepared (photos, maps, other documents) confirming the information presented in a claim

Stage 2 – Official Review of the Grievances by GRCN

718. Stage 2 process is triggered by notice from the Contact Person sent to the GRCN with the attached claim and the supplementary package of documents prepared with the assistance of the Contact Person.

719. The notice send by the Contact Person contains brief description of the grievance review and resolution attempts made at the stage 1, including explanation of the reasons of diesagreement and attachements (minnutes of meetings, protocols, photos etc.).

720. Upon receiving the grievance and supplementary documents, the secretary of the GRCN will register the claim in a grievance log and initiate the formal grievance review and resolution process in accordance with the requirements of the Administrative Code. The GRCN members will discuss the issue and engage relevant departments and specialist of the IA, in order to find solutions for the grievance resolution. In case of need the specialists from other governmental institutions or expert groups could be also engaged.

721. Not later than 2 weeks from receiving the claim, the GRCN will conduct a formal hearing participation of the claimant at a date fixed by the GRCN member secretary. On the date of hearing, the aggrieved AP will appear before the GRCN at the IA office for consideration of grievance. The member secretary will note down the statements of the complainant and document all details of the claim, proposed solutions and final agreement.

722. In case of amicable resolution of the dispute, a Protocol of Agreement (protocol 1) is prepared by the Secretary of GRCN, describing agreed actions, deadlines and other conditions. The protocol is signed by the claimant and Chairman of the GRCN.

723. After implementation of the agreed action the Protocol of Grievance Closure is prepared by the Secretary of GRCN. The protocol will be signed by the Chairman of GRCE and by the claimant.

724. If the IA/PIU decision fails to satisfy the aggrieved APs, they can pursue further action by submitting their case to the appropriate court of law (Rayon Court). GRCN

(secretary) will help the claimant to prepare the documents for submission to the Rayon (municipal) court.

725. Brief description of all stages of Grievance Resolution Process are given in the **Table 11-3** below.

Table 11-3: Grievance Resolution Process

Steps	Action level	Process
Stage 1 (GRCE Level)	Step 1: Informal negotiations with Aps	The complaint is informally reviewed by the GRCE Contact Person – Representative of Environmental and Resettlement Unit of IA/PIU, which takes all necessary measures to resolve the dispute amicably. At this stage, Contact Person engages in discussions with AP only those members of the GRCE, who have direct relation to the issue.
	Step 2: Formal negotiations with APs GRCE level resolution of grievance	If the oral grievance is not solved during the negotiations, the GRCE will assist the aggrieved APs to formally lodge the grievances to the GRCE. The aggrieved APs shall submit their complaints to the GRCE within 1 week after completion of the negotiations at the village level or later, as he wishes. The aggrieved AP shall produce documents supporting his/her claim. The GRCE Contact Person will review the complaint and prepare a Case File for GRCE hearing and resolution. A formal hearing will be held with the GRCE at a date fixed by the GRCE Contact Person. On the date of hearing, the aggrieved AP will appear before the GRCE at the Municipality office for consideration of grievance. The member secretary will note down the statements of the complainant and document all details of the claim. The decisions from majority of the members will be considered final from the GRCE at Stage 1 and will be issued by the Contact Person/Convener and signed by other members of the GRCE. The case record will be updated and the decision will be communicated to the complainant AP. After implementation of the agreed action the Protocol of Grievance Closure is prepared by the Contact Person. The protocol will be signed by the Chairman of GRCE and by the claimant.
Stage 2	Step 3 Decision from central IA/PIU GRCN	If any aggrieved AP is unsatisfied with the GRCE decision, the next option will be to lodge grievances to the IA/PIU at the national level. GRCE should assist the plaintiff in lodging an official complaint to GRCN (the plaintiff should be informed of his/her rights and obligations, rules and procedures of making a complaint, format of complaint, terms of complaint submission, etc.). The aggrieved AP shall produce documents supporting his/her claim, in accordance with the legal requirements (Administrative Code of Georgia). The GRCN of the IA shall review the complaint in compliance with the procedures specified in the Administrative Code of Georgia. If needed, a formal hearing will be held with the GRCN at a date fixed by the GRCN member secretary. On the date of hearing, the aggrieved AP will appear before the GRCN at the IA office for consideration of grievance. The Contact person will note down the statements of the complainant and document all details of the claim. The plaintiff shall be informed of the decision.

Steps	Action level	Process
Stage 3	Step 4 Court decision	If the IA/PIU decision fails to satisfy the aggrieved APs, they can pursue further action by submitting their case to the appropriate court of law (Rayon Court). The aggrieved AP can take a legal action not only about the amount of compensation but also any other issues, e.g. occupation of their land by the contractor without their consent, damage or loss of their property, restrictions on the use of land/assets, etc.

11.8 Grievance Log

726. The Grievance Logs will be developed at both – GRCE and GRCN levels.

11.8.1 Grievance Log in GRCE

727. The GRCE is a project specific structure established at the municipal level and functional for the period of project life. Accordingly, the GRCE Grievance Logs will be developed and maintained at the Municipal level (See **Appendix 9**).

728. The Grievance Logs will be developed and managed by the IA/PIU representative at site (Convenor of the GRCE/Contact Person) and will be kept at site (in the IA/PIU office or Engineer's office).

729. The records in Grievance logs include the following information:

- Name and contact details of the claimant
- Date of receiving claim
- Form of claim – (oral or written)
- To whom the claim has been addressed initially (entry point)
- The brief description of the essence of claim
- the stages, dates and participants of negotiations with the AP with GRCE (stage 1)
- Minutes of meetings
- Final decision of the GRCE (in case of the dispute is resolved, the decision is about closure of the issue. In case if the dispute remains unresolved, the decision is about passing to the stage 2 of the grievance redress process)
- Date of decision of GRCE
- Documents prepared by AP with the help of GRCE for passing to GRCN

730. The copies of the records/documents may be also kept in the municipal office.

11.8.2 Grievance Log in GRCN

731. Grievance Redress Commission (GRCN) is formed by the order of the Head of IA/PIU as a permanently functional informal structure within the IA/PIU, to handle the stage 2 process of the grievance resolution. The GRCN is linked with the GRCE through the IA/PIU representatives, who are nominated as Contact Persons and at the same time as coordinators/conveners at the GRCE level.

732. The Convener and Secretary of the GRCE will ensure that properly prepared grievance package is lodget by the complainant to the GRCN. Related records are made in a Complaint Log of GRCE, as described in paragraph 1.6.1.

733. The registration of the complaints passing stage 2 process, will be executed by GRCN. The entire package of complaints will be kept in archaives and appropriate records will be made in a Complaints Log, providing chronologically structured information regarding the grievance resolution.

734. The records in Grievance Logs include the following information:

- Name and contact details of the claimant
- Date of receiving claim
- Form of claim – (oral or written)
- To Whom the claim has been delivered to GRCN (directly or from GRCE, after failure of the stage 1 GR process)
- The brief description of the essence of claim
- The stages, dates and participants of negotiations with the AP with GRCN (stage 2)
- Minutes of meetings
- Final decision of the GRCN (in case of the dispute is resolved, the decision is about closure of the issue. In case if the dispute remains unresolved, the decision is about passing to the stage 2 of the grievance redress process)
- Date of decision of GRCN
- Documents prepared by AP with the help of GRCN to sent to court.

1.7 Afterword

735. The guidelines presented above should not be perceived as a very strict and obligatory scheme and certain variations are accepted. However, there are several basic principles, which should be regarded and ensured through the developed GRM.

736. Efficient Grievance Redress Mechanism should be:

- Hierarchically organized
  - The lower level component of GRM should be project –specific and organized at the local level in those municipalities, where the project is being implemented (municipalities; local branches or offices of IA/PIU, etc.)
  - The higher level component of GRM should be arranged at the level of central office of IA/PIU and should be permanently functional.
- Scaled to risks & adverse impacts and spatial coverage of the project
  - Allowing for multiple entry points for high risk projects and/or projects to be implemented at different locations. The multiple entry points comprise different entities, as: municipal authorities, IAs/PIUs, Construction Contractor, Supervising Company (Engineer), etc.
  - Assigning focal persons at each entry point
  - Documenting complaints, queries, requests, etc (e.g. complaint log)

  - Delivering training for GRM & focal points, developing advisory notes or ToR for GRCE/GRCN members
  - Leveraging technical expertise to make balanced and fair decisions regarding complaints
- Readily accessible to APs
  - accessible to APs with no costs & without retribution
  - efficient and understandable to the affected parties
  - transparent & impartial
  - culturally appropriate, sensitive to gender & vulnerable groups
  - Engaging CSOs, Office of Ombudsman, special facilitators etc
  - Including representative of APs (complainant) to the Grievance Review Group
  - Documenting grievance review & resolution process

12. Conclusions

737. The proposed Project, the Batumi Bypass Road Construction, was evaluated in this report. The proposed design and construction activities were assessed against the laws of Georgia, and ADB's safeguard policies. Mitigation and management measures were recommended and made part of the project design.

738. Environmentally, the most important aspect of the project is the noise to be generated during project operation. Noise modeling was undertaken to predict the impact, and identify mitigation measures. Socially, the most important aspect is resettlement. A resettlement action plan has been prepared separately to undertake the resettlement in a fair and open manner and to minimize social or economic impacts.