



**MILLENNIUM CHALLENGE ACCOUNT – ARMENIA PROGRAM  
RURAL ROADS REHABILITATION PROJECT**

**ENVIRONMENTAL MANAGEMENT PLAN**

**FOR REHABILITATION OF**

**M1-AGARAK-BYURAKAN-ANTARUT ROAD**

**SECTION**

**KM 0+000 - KM 8+650**

YEREVAN 2007

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### 1 Executive summary

This Environmental Management Plan has been developed for the road M1-Agarak-Byurakan-Antarut, designed under the MCA Armenia RRR project. The road rehabilitation includes mainly pavement rehabilitation and a minor rehabilitation of [bridges, drainage and sidewalks.

Negative environmental impacts might be caused both during implementation of rehabilitation works and further operation and maintenance of the road. The impacts during the implementation period are expected to be mainly caused by cutting of vegetation, earth borrow and quarry pits, spoils and garbage removal, removal of old asphalt on some small sections and the risk for pollution of water. During operation the negative environmental impact will be less apparent, but increased speed might lead to increase in number of traffic accidents and endanger people and animals crossing the road. The positive environmental impacts are e.g. reduced dust and noise pollution.

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The social and economic impact of the road rehabilitation is mostly positive due to better and faster access to markets, jobs, and social infrastructure and to possible increase in property values along the rehabilitated road. Furthermore, no land acquisition will occur while rehabilitating the given road sections.

Required measures to mitigate the negative impacts for various stages of rehabilitation and operation are described below.

- For the design phase:  
Design for M1-Agarak-Byurakan-Antarut, road was carried out by SWECO and Dorproject Institute and was completed in 2007 Design documents includes some clauses reflecting climate conditions, relief, soil types, hydrology, vegetation as well as requirements to obtain necessary permits from the Ministry of Nature Protection. Design Consultant is obliged to follow relevant environmental and social Armenian legislation as well as MCC and WB appropriate guidelines and policies as is stated in the Compact. Design Consultant is also obliged to identify the quarries and appropriate sites for waste disposal and obtain all necessary agreements from relevant state authorities before the construction works are tendered out.
- For the construction phase:  
In general, the Construction Contractor should follow the measures described in the EMP, such as for instance: dust and noise from the Construction site should be minimized especially close to residential areas. The Construction Contractor will also review the sites identified by the Design Consultant and agreed with relevant state and local authorities for the quarries and waste disposal, choose and use the most convenient quarries and waste disposal sites.
- For the operation phase:  
The drainage system should be periodically maintained to ensure proper drainage in order to prevent flooding and damages caused by water in the road structure and frost heave.

A list of measures required by the Environmental Management Plan (EMP), which focus on the Construction and Operation phases is developed and attached as Annex A.

## 2 Introduction

The Government of Armenia has received a grant from the Government of the United States of America through the Millennium Challenge Corporation to support a five-year Program approximating USD 236 million and intends to apply part of the proceeds of this grant to fund a reconstruction and repair up to 943 km of rural road network out of which 321 km are republican and 622 km are local roads including 19 bridges with total cost equal to USD 67.1 million. The mentioned 943 km of rural roads cover more than a third of Armenia's proposed "Lifeline Road Network" (LLN). After completion LLN will ensure that every rural community in the country has access to the main road network, and thus to markets, services, and social infrastructure.

All rehabilitation works envisaged under the Rural Roads Rehabilitation Project will be undertaken on existing alignments and will include pavement rehabilitation, improvement of bridges, drainage facilities and road safety features resulting in stable and safe roads with the minimum service term of 20 years.

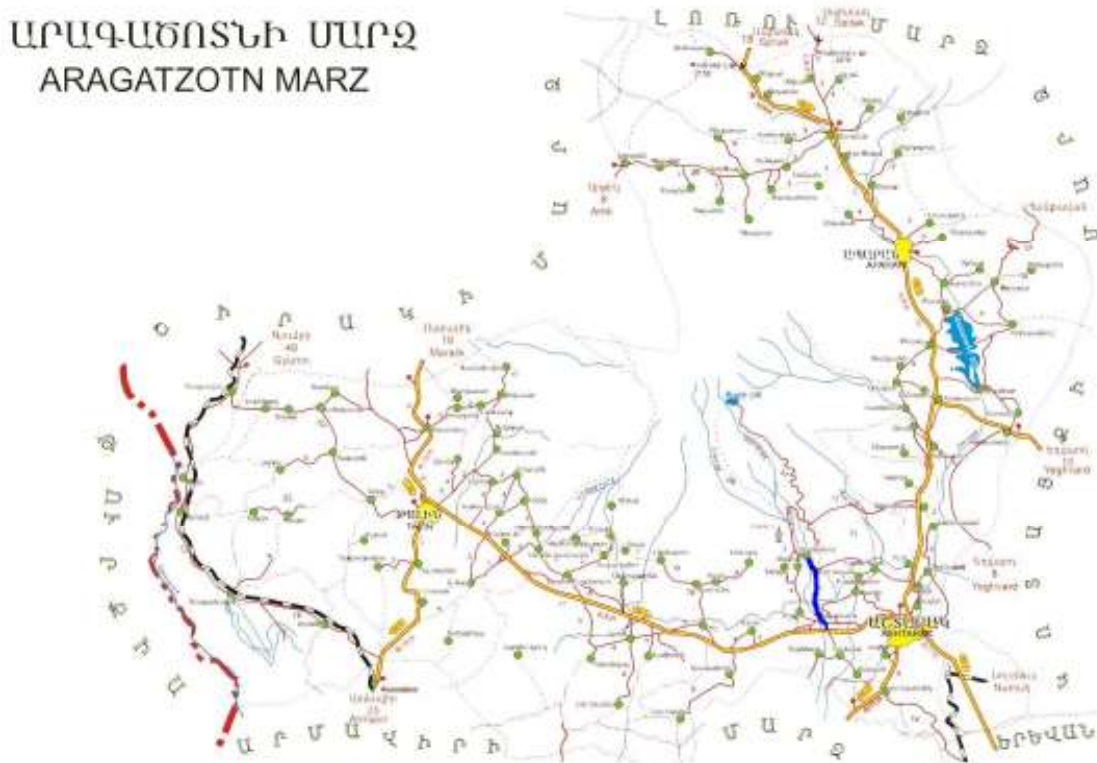
Some roads included in the LLN were recently rehabilitated through the RA budget allocations and Lincy Foundation funds. Besides, for some other sections design works were conducted under the Lincy Foundation funding, but due to further unavailability of the Lincy funding some of the designed road segments were not rehabilitated.

### 3 Project description

#### 3.1 Description of the existing road

The proposed project in total covers a 8.65 kilometre section of road M1-Agarak-Byurakan-Antarut, in Aragatson Marz and Ashtarak district.

The location of M1-Agarak-Byurakan-Antarut road to be rehabilitated as well as communities linked to that road is shown on the map below.



The first 4 km through Agarak and outside the village has a good alignment. Then the road starts to climb up the hillside in serpentine curves towards Byurakan and Antarut. This road is the shortest from Byurakan, Antarut and one resort to the road M 1.

The carriageway width varies between 6 m and 12 m in some curves. The carriageway on the rural sections is mainly 6 to 7 meters with shoulder width about 1 m.

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Average yearly daily traffic intensity is about 370 v/d.

Road pavement is in poor condition. Shoulders and slopes are deteriorated in several places. Side ditches are filled with soil, here and there rain water and snow water flow through the shoulder and pavement. In some sections, shoulders are low and not strengthened or the cross-sectional slope does not meet standard requirements.

Traffic regulation and safety elements are also in very poor condition. Numerous traffic signs and road markings are missing; guardrails are either in insufficient quantities or installed in inappropriate places, or are below the norms and corroded.

There are lot of longitudinal, transverse and alligator cracks, potholes, and edge breaks. The average IRI value for the link is 19.8 which not seem to be relevant for long sections of the road. Though, in the villages the surface is very bad.

The road base is in good condition as very few minor depressions could be detected. These could be sufficient remedied through a levelling course.

Core samples have been taken from 5 sections for study. The table below presents the results of core sample tests:

Borehole N	Location of borehole km+	a/c, cm	crushed stone, cm	gravel, cm	soil, cm	rock, cm	Borehole depth cm	Notes
B-1	0+050	17		25	10		52	10eIV
B-2	2+250	11	15	22	10		58	10eIV
B-3	5+200	11	13	20	15		59	10eIV
B-4	7+900	9	15	16		10	50	10eIV 50% 20U
B-5	8+550	8	17	15	10		50	10eIV

### 3.2 Description of the proposed rehabilitation works

Design works were accomplished by SWECO and Dorproject Institute in compliance with the existing design norms and typical drawings. The road alignment will not be changed as a result of rehabilitation. The main technical parameters applied for design are the followings:

- Subgrade width 8.0 – 15.0m
- Carriageway width, 6.0 – 9.0m in village at km 0 – 1.5
- Carriageway width, 6.0 m and shoulders 0.0 - 0.9 m on each side. at km 1.5 – 5
- Carriageway width, 6.0 – 7.0 m in village at km 5 – 8
- Carriageway width, 6.0 – 6.6 m mostly in village at km 8 – 8.6

The following types of activities will be implemented during the rehabilitation works within the scope of the assignment:

- Road bed rehabilitation (cleaning, filling, cutting, etc.);
- Drainage system rehabilitation (drainage systems rehabilitation or repair, side ditches cleaning);

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- Road pavement rehabilitation (potholes patching, levelling course, one layer asphalt-concrete);
- Shoulders filling and levelling;
- Artificial structures rehabilitation;
- Measures for Road Safety improvement.

The estimated ERR for the project road is 20.6 %. Estimated duration for the road sections rehabilitation is around 12 months during two construction seasons in 2008 and 2009.

The estimated cost for implementing mitigation measures is included in Table presented in the Annex A. The amount proposed by the Construction Contractor for implementing those mitigation measures should be included in the bid and be not less than 1.5% of the total contract amount.

## 4 Description of existing conditions

### ***Climate***

The studied road section belongs to the second climatic zone 1050-1700m in altitude. The summer is warm, and the winter is moderately cold. Annual average air temperature is 7.9°C. Average temperature in the coldest month is – 5.8 ° C (January). Average temperature in the warmest month is 20.7 ° C (August). Passage of temperature through 0° occurs in March and November. The absolute maximum temperature in summer reached 36 ° C, and the minimum one in winter - 26 ° C. Annual prevailing wind directions: south-west and north in summer, north and south-west in winter. Annual average wind speed 1.8m/sec.

The region belongs to dry and humid zone in terms of the quantity of atmospheric precipitates. The annual precipitation is 451mm, more than 60% of which occurs in May-July. The maximum water content in snow is 137mm. The snow blanket is formed in the end of November and starts melting in March. Number of days with snow blanket is 82.

The rated height of snow blanket with 5% provision is 55 cm Number of snow-stormy days is 0-1, freezing – 0. The maximum depth of soil freezing is 106 cm.

### ***Relief and Geomorphology.***

The designed road section begins at M1 in the village of Agarak and ends in the village Antarat.. The whole section is located in Ashtarak region.

The section is located on the southern side of Aragats mountain. The relief is sub mountainous. Absolute altitude varies between 1150-1700m. The relief is volcanic, represented by shield-shaped massifs formed on smoothed base of miscellaneous fold-clastic structures.

### ***Engineering-geological conditions***

There are present sandy clay rocks of sedimentary complex and effusive rocks of magmatic complex (tuff and tuff-lava).

### ***Seismicity***

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According to seismicity map of the territory of Armenia, the region of the studied road section belongs to the III zone with seismicity factor of IX and higher

### ***Hydrology***

The section is located in the landscape-hydrological zone of the Akhurian and Hrazdan rivers. The average water flow is 10 l/sec. per 1 km<sup>2</sup>. No mudflows occur on the designed road section.

There is widespread water in unclassified sediments with artesian aquifers and powerful sub-lava and inter-lava watercourses.

### ***Biodiversity***

There are no forests or bigger trees along this road section. The flora is desert and semi-desert one represented by wormwood semi-desert. Also, cultivated types of trees and bushes are present. No protected areas are located in the rehabilitation area.

### ***Soil and land use***

There are some farmlands along the road, but mostly it is grass steppe covered with a lot of stones. Mountain steppe soil, represented by mountainous carbonate and typical black soil of moderately humid steppes, is dominating on the whole territory of the section. No land taking is envisaged for this project.

Gravel-sand ground to be used for filling should be taken from 10.0 km from the designed road. The extra soil should be transported to a dumping place 3 km from the road in average. Before commencement of the construction, the Contractor must obtain permission from the local authorities and appropriate departments of the Ministry of Nature Protection for exploitation of pits and use of dumping places included in the design documents.

### ***Annual Average Daily Traffic***

Based on traffic counts conducted in November - December 2006 as well as on existing and forecasted GDP growth the future traffic on the road has been calculated.

Calculated AADT for 2026 is about 1 400 v/d.

(Source: Revised Traffic Study Report dated 6<sup>th</sup> of February 2007, SWECO Intl).

## **5 Environmental and social impacts**

There are no new construction works under the project: only rehabilitation works on existing pavements are to be carried out. Due to its rehabilitation nature the project is not likely to cause any major negative environmental and/or social impact on the environment. The road sections are surveyed and the assessment forms 1 and 2 are presented in Annex C.

Possible negative impacts are related to the construction works and hence are expected to be localized and short-term. As a result of timely and proper implementation of this Environmental

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Management Plan with appropriate mitigation measures all these potential negative impacts can be prevented and minimized. Based on the preliminary assessment, these impacts mostly would be limited to:

- **Disposal of excavated materials and construction wastes.** Demolition debris will be generated during the construction works on road sections;
- **Degradation of landscapes and soil erosion.** Soil erosion may occur as a result of the removal of plants and earth cover during the restoration of ditches and slopes along the road as well as in earth borrow sites. The proposed road crosses no stream. The impacts on vegetative cover will be short-term, localized, and associated with rehabilitation works;
- **Pollution by construction run-off.** Negative impacts of fuel and oils to ground and surface water, soil are expected to be temporary and of minor significance;
- **Noise and vibration disturbances during construction and temporary air pollution (dust)** related to the transportation of construction materials and truck traffic. These impacts will occur during the construction and rehabilitation works, but will be only short-term and affect different people at different times. Effects include dust from construction activities, noise during trench excavation, possible effect of vibration caused by operation of heavy machinery, increased traffic in some sections of roads, etc;
- **Air pollution from improper maintenance of equipment.** Dust and the bitumen smoke arising from road construction work will have negative impact on the ambient air quality, and it is necessary to take effective protective measures to minimize the negative impact, especially in settlements. However, no major pollution is expected as long as proper construction/equipment functioning practices are applied;
- **Traffic disruption during construction activities.** These impacts will occur during the rehabilitation works, but will be short-term and related to the transport of different raw/construction materials to work sites;
- **Safety hazards from construction activities and during operation.** The rehabilitated road will result in higher speed when the road is in operation after the rehabilitation. The design includes the repair of damaged guard rails as well as the installation of new guard rails on sections deemed hazardous. No major hazards are expected during the construction of the proposed project elements, as long as proper construction practices and safety procedures are applied.

In contrast to the given potential negative impacts, the project can potentially lead to positive social outcomes. There are three communities located on the road segment to be rehabilitated. Total number of permanent residents in the villages is 6200 including 3150 women will benefit directly or indirectly from the rehabilitation of the above-mentioned road segment. The proposed road rehabilitations will promote the local areas' sustainable economic development.

The rehabilitated road will also result in lower Vehicle Operating Costs (VOC), which also will have a positive effect on the private economy of car owners. No land acquisition for detours during construction time and for re-alignment is foreseen and no resettlement will be necessary.

In sum, the proposed road rehabilitation will reduce transportation costs and improve the accessibility of social and economic services for more than 6200 people residing in the 3 communities. Moreover, visitors to the resort will also benefit from the rehabilitation.

## 6 Mitigation measures

- Obtain permits from the Ministry of Nature Protection and as needed from other state/regional authorities for the opening and/or use of quarries;
- When opening new quarries or borrow pits, remove and store the topsoil for use in the restoration of the quarry or borrow pit sites after completion of the construction.
- Obtain permits from the relevant local/regional authorities for disposal of excavated materials and construction wastes;
- Provide for zones of preliminary accumulation of wastes that will cause no damage to the vegetation cover and other components of the environment;
- Strengthen steep slopes with vegetation, grass and plants or gabions. In streams special silt fences should be used to prevent eroded material to spread downstream.
- Transport and disposal of construction concrete rubbles, debris and spoils in approved paths and landfills/dump sites;
- The traffic management plan should be developed and approved to ensure smooth traffic flow and safety both for workers and the passing traffic;
- Use closed/covered trucks for transportation of raw/construction materials and debris;
- Clean the surrounding area from dust by water sprinkling, removal of excess materials and cleaning of sites upon completion of activities;
- Noise from the work site should be minimized especially close to residential areas, near schools, etc through establishment of work time schedule (e.g. works could be conducted at daylight, working in peak hour could be avoided etc.). The vehicles should be regularly checked and equipped with effective exhaust mufflers
- Workers on the road should have and use safety equipment. In some cases appropriate guidance could be given to the workers in charge for handling oil, chemicals, etc.
- Arrange necessary measures for passer-by safety, all means of transportation safety (establish protection zones, by-pass these areas during transportation and other). Relevant safety elements such as metal guardrails, road signs and delineators, pavement markings, barricades and beams, warning lights should be installed. In some cases a flagman or traffic control supervisor should be engaged.
- Restoration to quasi-original conditions of landscape after completion of construction and rehabilitation works;
- Cease the works as soon as historical and/or cultural monuments are unexpectedly found during earthworks and provide relevant information to the State Agency for Historical and Cultural Monuments Protection;
- Conduct on-going public consultations in coordination with ARD, MCA-Armenia, and the ESAOC on the road rehabilitation activities.
- During the operation phase the drainage system should be periodically maintained to ensure proper drainage in order to prevent flooding and damages caused by water in the road structure and frost heave;

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- The design includes the repair of damaged guard rails as well as installation of new guard rails on sections deemed hazardous. During the road operation stage the police should conduct inspections and unannounced speed checks.

## 7 Environmental management

### 7.1 Institutional Responsibilities

Institutional responsibility for implementation of the proposed mitigation measures will be shared among the following agencies:

- **Executing agencies** responsible for executing the measure. For this specific assignment the executing agency during the design phase (Consortium of SWECO International and Dorproject institute) shall ensure that all necessary agreements and permits (e.g. EIA conclusion, permits for water use and discharge and for the disposal of excavated materials, wastes, and demolition debris) are obtained from relevant state and local authorities before the construction works are tendered out. Executing agencies during construction phase (Construction contractors) shall take the responsibility for physical implementation of mitigation measures provided under the EMP, as well as for obtaining all construction activities related permits and agreements (e.g. agreement with Historic and Cultural Monuments Protection Agency if any new historical/ cultural/ archaeological monument or artefacts are unexpectedly found during civil works) in accordance with the MCC Environmental Guidelines and Armenian relevant environmental and social legislation.
- **Supervising agencies** responsible for supervising the executing agencies to ensure that they execute the mitigation measures as planned. The Armenian Roads Directorate SNCO (ARD) will be responsible for supervising the timely, proper and reliable implementation of works and measures in as provided by the EMP. ARD will also ensure that all necessary agreements and permits are obtained by appropriate contractors from relevant state and local authorities before the construction works are tendered out. The MCA-Armenia may request to check if such permits are issued and are valid (e.g., not expired) as well as if the EMP mitigation and monitoring aspects are implemented on the ground during the construction phases according to the MCC Environmental Guidelines and Armenian relevant environmental and social legislation.
- **Monitoring agencies** in charge of monitoring the extent of implementation and the effectiveness of the mitigation measures and of adjusting the program if needed. Monitoring agencies will be responsible for covering all measures requiring some sort of monitoring by ARD, MCA-Armenia and its key partners for this project, in particular the Ministry of Nature Protection and its affiliated agencies (State Environmental Inspectorate etc.), Ministry of Health (State Hygienic Anti-Epidemiologic Inspectorate), and if relevant the Ministry of Culture (Historic and Cultural Monuments Protection Agency). During operation, traffic police should monitor speeds on the roads, in accordance with their normal duties and responsibilities.

Besides the mentioned agencies the Environmental and Social Assessment and Oversight Consultant (ESAOC) hired by MCA-Armenia will oversee the environmental and social aspects of all activities implemented under RRRP in order to ensure that environmental and social analysis,

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EIAs, EMPs, other relevant surveys and assessments are implemented properly by the responsible consultants and other implementers in accordance with their respective terms of reference for the duration of the Compact.

A specific EMP for the rehabilitation of these sections including potential negative impacts, proposed mitigation measures, responsible institutions and timing is presented in the table in Annex A.

## 7.2 Reporting Format and Schedule

The construction contractor will be responsible for reporting to ARD on the implementation of the mitigation measures included in Annex A. A sample scheduling and reporting form has been included in Annex F for the contractors use in planning and documenting the implementation of the mitigation and monitoring plans on a quarterly basis.

## 7.3 Budget

The budget for civil works contracts includes costs allocated for implementation of environmental and social mitigation measures, since appropriate mitigation measures to be fulfilled by the construction contractor is include in the Table presented in Annex A. The MCA-Armenia will hire supervisor responsible for daily supervision over the implementation of civil works. Besides, ARD appropriate engineer and environmental specialist will conduct periodical visits to construction sites to ensure proper implementation of works and relevant mitigation measures.

# 8 Environmentally sound clauses for civil works contracts

Most construction phase impacts will be possible to mitigate by including appropriate clauses into the civil works contracts. These clauses should cover at least the following issues:

- Compliance with general national environmental guidelines;
- Compliance with MCC's Environmental Guidelines and Gender Policy<sup>1</sup>; as well as with the World Bank Operational Policy on Involuntary Resettlement<sup>2</sup> (WB OP 4.12), if relevant.
- Adequate disposal of construction and excavation wastes;
- Location of construction camps;
- Restoration of the quasi-original conditions of landscape in construction sites after works completion, including the removal and storage of top soil before using materials from quarries and borrow pits for use in the restoration;
- Occupational safety and health (Consultants and contractors working on the program will be required to adhere to all applicable laws and regulations controlling workplace health and safety), etc.

Sample clauses applicable to identified impacts and mitigation measures to be included in the civil works contracts are presented in the Annex D.

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<sup>1</sup> MCC's Environmental Guidelines and Gender Policy: <http://www.mcc.gov>

<sup>2</sup> World Bank Operational Policy on Involuntary Resettlement OP 4.12:

<http://web.worldbank.org/WBSITE/EXTERNAL/PROJECTS/EXTPOLICIES/EXTOPMANUAL/0,,contentMDK:20064610~pagePK:64141683~piPK:64141620~theSitePK:502184,00.html>

## Annex A. Mitigation Measures

POTENTIAL NEGATIVE IMPACT	ENVIRONMENTAL AND SOCIAL MITIGATION OR MONITORING MEASURES	EXECUTING AGENCY	SUPERVISING AGENCY	COST ESTIMATES	TIMING
Possible production of construction debris/spoils.	Obtain agreement/permit from the MNP and other relevant state authorities for opening and/or use of quarries.	Design Institute	ARD	Minimal	During design phase, before starting the bidding for construction
	Obtain agreement/permit from the relevant Regional Authorities for construction and disposal operations.			Minimal	
Pollution of water and soil as a result of improper disposal of excavated materials and construction wastes, or poor location of work camps	Storm-water facilities should be designed so as to avoid pollution of sensitive groundwater aquifers and surface waters	Design Institute	ARD	N/A	During design works
	Provide for zones of preliminary accumulation of wastes that will cause no damage to the vegetation cover and other components of the environment. Consult with local authorities.	Construction Contractor	Supervisor	Minimal, included in the 1.5%	After obtaining of agreement/ permit, during construction works
	Removed old asphalt should be tested for aromatic and toxic poly-aromatic hydrocarbons before reuse or stored. Alternatively it should be treated as hazardous waste	Construction Contractor	Supervisor	Depends on frequency of analysis and the list of parameters to be determined. In general, the cost for analysing one sample of soil/asphalt on oil, aromatic and poly-aromatic compounds is approximately 250 USD.	During construction works

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POTENTIAL NEGATIVE IMPACT	ENVIRONMENTAL AND SOCIAL MITIGATION OR MONITORING MEASURES	EXECUTING AGENCY	SUPERVISING AGENCY	COST ESTIMATES	TIMING
	Arrange transport and disposal of wastes according to the established procedure and in the approved dump sites designated for the specific purpose.	Construction Contractor	Supervisor	Minimal extra cost outside normal contract	After obtaining of permit, during construction works
	Identify suitable sites for work camps to minimize impacts on soil or water pollution. Specify appropriate operating rules for the camps, including safe handling of petroleum based products including bitumen, control of access, adequate drainage, and rehabilitation after construction. Consult with local authorities.	Construction Contractor	Supervisor	Minimal extra cost outside normal contract	During construction works
Temporary air pollution (dust) related to the transportation of construction materials and truck traffic	Develop the traffic management plan to ensure smooth traffic flow and safety both for workers and the passing traffic	Design Institute	ARD	Part of the regular contract with the Contractor	During design works
	Use closed/covered trucks for transportation of construction materials and wastes. Wash truck tires as appropriate to control tracking mud and dust onto paved roads.	Construction Contractor	Supervisor	Minimal, included in the 1.5%	During construction works
	Clean the surrounding area from dust by water sprinkling, removal of excess materials and cleaning of sites upon completion of activities	Construction Contractor	Supervisor	Minimal, included in the 1.5%	During construction works
	Workers dealing with hazardous materials or exposed to dust should be provided with necessary protection gear, and should follow applicable regulations and procedures as established by Government authorities.	Construction Contractor	Supervisor	Minimal, included in the 1.5%	During construction works

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Noise and vibration disturbances	Terminate the works at the established time (e.g. work in daylight time), and avoid increase of noise and number of peak hours. Consult with local authorities	Construction Contractor	Supervisor	Minimal	During construction works
	Regular checking of vehicles conditions	Construction Contractor	Supervisor	Minimal	During construction works
	Workers in the vicinity of sources of high noise should wear necessary protection gear,	Construction Contractor	Supervisor	Part of the regular contract with Contractor	During construction works
Impacts on safety	Workers on the road should have and use safety equipment. In some cases appropriate guidance could be given to the workers in charge for handling oil, chemicals, etc.	Construction Contractor	Supervisor	Part of the regular contract with Contractor	During construction works
	Arrange necessary preservation measures for passer-by safety, all means of transportation safety (establish protection zones, by-pass these areas during transportation and other).	Construction Contractor	Supervisor	See Traffic management plan	During construction works
	Relevant safety elements such as metal guardrails, road signs and delineators, pavement markings, barricades and beams, warning lights should be installed. In some cases a flagman or traffic control supervisor should be engaged	Construction Contractor	Supervisor	Part of the regular contract with Contractor	During construction works
Impacts on historic-cultural monuments or artefacts	Cease the works as soon as historical and cultural monuments or artefacts are	Construction Contractor	Supervisor, ARD	Could be very expensive if the work	During construction

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	encountered and immediately provide relevant information to the State Agency for Historical and Cultural Monuments Protection			has to be stopped	works
Landscape degradation and soil erosion	Arable land should not be used as earth borrowing. If unavoidable the topsoil (ca 30 cm) should be removed, kept and refilled after construction is over	Construction Contractor	Supervisor	Minimal. As a normal part of a contract is included in the 1.5%	During and after construction works
	Develop measures to strengthen the steep slopes with vegetation, grass and plants or gabions	Design Institute	ARD	Minimal, included in the design costs	During design works
	Develop efficient methods for disposal or backfilling of extracted soils	Design Institute	ARD	Part of the specifications to be followed by the Contractor	During design works
	Dump excavated soils and substances only within the areas designated for that purpose. Consult with local authorities.	Construction Contractor	Supervisor	Minimal. Normal part of a contract	During construction works
	Restoration to quasi-original conditions of landscape after completion of rehabilitation works and after use of quarries; restore the vegetation cover	Construction Contractor	Supervisor	Included in the 1.5%	During and after construction works
	Consider and use plant species characteristic for the landscape in the course of restoration of the vegetation cover	Construction	Supervisor	Included in the 1.5%	During and after construction works

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POTENTIAL NEGATIVE IMPACT	ENVIRONMENTAL AND SOCIAL MITIGATION OR MONITORING MEASURES	EXECUTING AGENCY	SUPERVISING AGENCY	COST ESTIMATES	TIMING
Insufficient maintenance of the drainage system	Contracts to assign responsibility for drainage maintenance after road commissioning	Maintenance Contractor	ARD	Included in routine maintenance budget	Periodic maintenance schedule during operation
Damage to or theft of road safety furniture	Checks on road safety provisions	Maintenance Contractor	ARD	Included in routine maintenance budget	Periodic maintenance schedule during operation

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## Annex B. Monitoring Plan

Phase	What parameter is to be monitored?	Where is the parameter to be monitored?	How is the parameter to be monitored?/ type of monitoring equipment	When is the parameter to be monitored? (frequency of measurement or continuous)	Cost	Monitoring Agency
<b>Design</b>	Traffic safety	At the design consultant	Design and traffic parameters	During the design	Minimal additional design cost	ARD
	Accessibility	At the design consultant	Design and traffic parameters	During the design	Minimal additional design cost	ARD
	Material borrows and dumps	At the design consultant	Permits from responsible authorities	During the design	Minimal additional design cost	ARD
<b>Construction</b>	Soil erosion	In new cutting areas and slopes	Inspections at site and soils mechanical information	During and after construction work	Minimal additional construction cost	Ministry of Nature Protection
	Water pollution	In water bodies mainly at bridge rehabilitation sites	Inspection and analyze of water samples	Before the construction starts and during construction	~200\$/sample	Ministry of Nature Protection
	Ground water pollution (water and soil quality (suspended solids, oils, pH value,))	In wells close to working site.	Laboratory analysis	Before the construction starts and during construction and during operation	~200\$/sample	Ministry of Nature Protection
	Air pollution/dust	At working site	Inspection	During earth and asphalt work. Every 2 months;	Minimal additional construction	Ministry of Nature Protection

### MCA-Armenia Program

#### Environmental Management Plan:

Rehabilitation of M1-Agarak-Byurakan-Antarut,

Phase	What parameter is to be monitored?	Where is the parameter to be monitored?	How is the parameter to be monitored?/ type of monitoring equipment	When is the parameter to be monitored? (frequency of measurement or continuous)	Cost	Monitoring Agency
				unannounced	cost	
	Noise	At working site	Inspection noise levels (dB); equipment	During earth, blast and asphalt work. On complaint	Minimal additional construction cost	Ministry of Nature Protection
	Conservation of Eco resources	At working site	Inspection	When cutting and restoring used areas.	Minimal additional construction cost	ARD
	Communication and transportation	At working site	Inspection	During construction work	Minimal additional construction cost	ARD
	Accidents with hazardous goods	On site	Accident reports	When accident occur	Can cause high remedy costs	Ministry of Nature Protection
	Vehicle and pedestrian safety	At and near work site	Inspection on visibility and appropriateness	once per month in the evening	Minimal	Contractor; Supervisor engineer

**MCA-Armenia Program**

**Environmental Management Plan:**

Rehabilitation of M1-Agarak-Byurakan-Antarut,

Phase	What parameter is to be monitored?	Where is the parameter to be monitored?	How is the parameter to be monitored?/ type of monitoring equipment	When is the parameter to be monitored? (frequency of measurement or continuous)	Cost	Monitoring Agency
	Staff safety (protective equipment; organization of bypassing traffic)	At work site	Inspection	unannounced inspections during work	Minimal additional construction cost	Supervision Engineer, Regional Inspectorate of Environment and water
	Overall workers' camp site conditions	On the camp site during construction activities	Inspection	According to the existing regulations	Minimal additional construction cost	Supervision Engineer, Regional Inspectorate of Environment and water
• Operation	Accidents with hazardous goods	On site	Accident report	Immediately after accident	Can cause high remedy costs	ARD/ Ministry of Nature protection
	Maintenance of drainage system	On site	Inspection	When needed	Routine maintenance	ARD

**Note: The ESAOC will provide additional monitoring support during the construction period in support of MCA-Armenia. This may include environmental audits of specific conditions as requested by MCA-Armenia so as to be in compliance with MCC environmental requirements.**

#### **MCA-Armenia Program**

#### **Environmental Management Plan:**

Rehabilitation of M1-Agarak-Byurakan-Antarut,

# Annex C. Assessment forms 1 and 2 for the total section

Form 1

LOT I, Link 5, section1

## RURAL ROADS ENVIRONMENTAL CHECKLIST

Project Name/Location: M 1 – Agarak – Byurakan - Antarut Date: 12/12 06

For each environmental issue/effect place a cross (X) in one of the columns		Positive Impact		No Impact likely	Negative Impact		More information needed	Comments
		Very likely/ Major	Possible/ Minor		Very likely/ Major	Possible/ Minor		
Issue/Effect		A	B	C	D	E	F	
Ecological	1.1 Protected areas			X				Rehabilitation of road surface and ditches
	1.2 Fisheries, aquatic ecology			X				- “ -
	1.3 Wetlands			X				- “ -
	1.4 Forests			X				- “ -
	1.5 Rare, endangered species			X				- “ -
	1.6 Animal migration			X				- “ -
	1.7 Natural Industry			X				- “ -
Physical	2.1 Erosion and/or siltation		(X)			X		Better drainage
	2.2 Local flooding		(X)			X		New culvert
	2.3 Stream channel regime changes			X				
	2.4 Landslides		(X)			X		Better drainage
	2.5 Dust/pollution		(X)					Mainly rural areas, but better in the settlements
	2.6 Noise		(X)					- “ -
Socio-economic	3.1 Population change		(X)			X		Better communication
	3.2 Income & amenities		(X)			X		- “ -
	3.3 Taking of lands / trees / crops			X				No realignment
	3.4 Resettlement or relocation			X				- “ -
	3.5 Gender		(X)			X		Better social contacts
	3.6 Vulnerable groups		(X)			X		Better sidewalks in settlements
	3.7 Regional effects		(X)			X		Better communication
	3.8 Cultural Resources			X				
	3.9 Urbanizing Problems			X				
	3.10 Health		(X)			X		Better access to healthcare
	3.11 Recreation			X				No recreation area
Other								
<b>Cumulative Effects</b>			(X)					
<i>Number of crosses:</i>			12	13		9		

Name/Position of Assessor: Krister Åhsberg /Project manager (x) impacts after mitigation

### MCA-Armenia Program

#### Environmental Management Plan:

Rehabilitation of M1-Agarak-Byurakan-Antarut,

Project name: Feasibility Study and Design for the roads of the Rural Road Rehabilitation Project

Marz: Aragatsotn District: Ashtarak LOT No: I Link No: 5, M 1 – Agarak – Byurakan - Antarat

Km	Location/Land use	Potential direct project encroachment/impact						Observations			Remarks
		Protected area	Fisheries /streams	Trees	Cultural resources	Wetlands	Houses/ Cultivation	Erosion Siltation landslides	Nearby houses shops	Natural industry	
0+000 – 0+500	Village Agarak								X		Village road
0+500 - 1+200	- ” -								X		- ” -
1+200- 3+000	Open farmland			X							No environmental problems Some bushes/trees in and beside the ditches
3+000 – 5+000	Grass and small bushes on hillside										- ” -
5+000- 7+000	Village Byurakan								X		Village road
7+000- 8+000	Rural landscape, somewhat hilly							X			Very bad maintained road sides and surroundings. Some minor erosion problems.
8+000	Village Antarat starts								X		Village road

Name/designation of Surveyor: **Krister Åhsberg**

Date: 12/12 - 06

**Remark:** The only environmental impact from road rehabilitation will be cleaned ditches and a possible widening in a curv.

In the village Lchashen no taking of land is necessary.

**MCA-Armenia Program**

**Environmental Management Plan:**

Rehabilitation of M1-Agarak-Byurakan-Antarat,

## **Annex D. Sample environmentally and socially sound clauses for civil works contracts**

### **Clause 1. Installation of work site**

- The Construction Contractor shall submit the work site for inspection and shall define the facilities to be created
- The Construction Contractor shall limit disturbances to the environment for the site selected and for residents in the immediate vicinity, both in surface (clearing of vegetation, water flow, and waste storage and in depth (rupture or pollution of ground water).
- The Construction Contractor shall execute, upon work completion, all work necessary to restore the quasi-original conditions of the site. The supervising engineer/ ARD environmental specialist inspector shall write up a reference/report outlining the site reclamation prior to official delivery.

### **Clause 2. Preparation of supply quarry material**

- The Construction Contractor shall preserve trees and other vegetation (as appropriate) during materials stockpiling.
- The Contractor shall remove and stockpile top soils from quarry sites for later use during the restoration of the sites.
- The Construction Contractor shall level stripped materials to facilitate water percolation and make natural grass planting possible.
- The Construction Contractor shall restore the natural water flow to its previous state.
- The Construction Contractor shall eliminate the damaged areas of the site by distributing and hiding massive blocks of rock.
- The Construction Contractor shall create runoff recovery ditches and conserve access ramps, if the quarry is declared fit for use as a watering point for livestock or residents.
- The Construction Contractor shall, upon work completion and at his own expense, restore the environment around the site. The supervising engineer/ ARD environmental specialist shall write up a reference certifying that such site restoration work has been completed.

### **Clause 3. Tree Planting**

- The Construction Contractor shall plant trees (if envisaged by design) at locations defined by the supervising engineer/ ARD environmental specialist, provided the relevant protection (clay brick wall, fencing, etc.), supply the required water and if necessary replace dead trees.

## Annex E. Accident Report Form

### REHABILITATION OF M1-AGARAK-BYURAKAN-ANTARUT ROAD SECTION KM 0+000 - KM 8+650

1	Date:	
2	Road/Link:	
3	Location:	
4	Construction Contractor/ Road manager:	
5	Marz (Region):	
6	Incident Type:	
7	Severity:	<input type="checkbox"/> High <input type="checkbox"/> Medium <input type="checkbox"/> Low
8	Reported By:	
9	Description of Incident Root Cause:	
10	Corrective Action Taken:	
11	Corrective Action to be Taken:	
12	Action Taken to Prevent Recurrence:	
13	Corrective Action Carried Out By:	
14	Close Out By:	
15	Close Out Date:	
16	Person Involved:	
17	Machine Involved:	
18	Contractor/Sub Contractor Involved:	
19	Third Party Involvement:	
20	Photo Reference – Attached:	<i>The photos with appropriate descriptions should be presented as an Attachment to the Accident Report</i>

***For ARD/MCA-Armenia use only***

<i>Date</i>	
<i>Received by:</i>	
<i>Decision/Action made:</i>	

**MCA-Armenia Program**

**Environmental Management Plan:**

Rehabilitation of M1-Agarak-Byurakan-Antarut,

## Annex F. Scheduling And Reporting Form

The sample Scheduling and Reporting Form in table format is presented below. Based on the format provided Construction Contractors shall develop a more detailed form covering their responsibilities for mitigation and monitoring and submit to MCA-Armenia for approval. Further the approved form should filled on quarterly basis and submitted to MCA-Armenia.

	Year 1				Year 2			
Activity	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
<i>Mitigation Measures</i>	-----	-----	-----	-----	-----	-----	-----	-----
a. Sediment control								
b. -----								
c. etc.								
<i>Monitoring</i>								
a. -----								
b. -----								
c. etc								