Environmental and Social Compliance Audit Report

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Prepared by DG Consulting Ltd for International Energy Corporation

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ENVIRONMENTAL AND SOCIAL REVIEW REPORT

SEVAN-HRAZDAN CASCADE REHABILITATION PROJECT
REPUBLIC OF ARMENIA

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1 Nature of the Project

1.1 Introduction

The Present Environmental and Social Review Report is prepared by DG Consulting Ltd (‘Consultant’) for the Sevan-Hrazdan HPP Cascade located in Armenia. The report is based on a site visit undertaken in August 2012 to assist in environmental and social due diligence of the cascade and its operator company so that to meet the requirements of the ToR, which implies: ,

- Assessment of IEC’s ability to manage and address all relevant social and environmental risks and impacts of its business and operations through review of corporate policies, management systems, procedures and capacity in relation to environmental, human resources and health and safety management;
- Assessment of IEC’s compliance record with applicable laws and regulations through review and audit, including on-site assessment, of its operations against relevant Armenian and EU legal EHSS requirements, EBRD’s PR’s, ADB’s relevant policies and requirements and review of legal requirements and Armenian EIA/ permitting system in relation to the Project components;
- Outlining of potential environmental and health and safety risks related to the Project and the Project Area of Influence;
- Identification of key stakeholders and develop Stakeholder Engagement Plan to guide the company’s future communications; and
- Based on the findings of the above, development of an Environmental and Social Action Plan/Corrective Action Plan addressing identified gaps and outlining further steps for IEC’s long term programme.

The Sevan-Hrazdan HPP Cascade, comprising of seven hydropower plants of 565 MW total nominal capacities, was built in early 20th century (1930-1965). It is a key part of the Armenian electricity system and urgently needs substantial rehabilitation to ensure safe and stable operation and restore output capacity. The cascade is owned and operated by the International Energy Corporation (IEC) of Armenia.

The IEC and its major shareholder JSC RusHydro intend to invest in rehabilitation of the existing infrastructure in order to improve technical condition of the hydropower facilities included in the cascade, the operation characteristics of power generation plants and improve safety of operations. In order to improve the system, the corporation has prepared the five years development/investment plan and has started implementation of some works based on corporate resources. Additionally company applied for the loan from banks and has asked EBRD and ADB to support the project.

The Project has been categorised as B under the EBRD’s Environmental and Social Policy 2008 and is expected to be classified as category B for environment and both category C for involuntary resettlement and Indigenous Peoples under ADB Safeguard Policy Statement (SPS) 2009. The banks require that the company’s current operations and investment project be in line with the Armenian and EU legal requirements, as well as EBRD’s Performance Requirements and ADB’s relevant

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1The EBRD Environmental and Social Policy and Performance Requirements (PRs) are available on the EBRD website at: [http://www.ebrd.com/downloads/about/sustainability/2008policy.pdf](http://www.ebrd.com/downloads/about/sustainability/2008policy.pdf)
environmental and social policies and requirements\textsuperscript{2}. Under the EBRD’s Performance Requirement 1 (2008) and the ADB SPS (2009) Safeguards Requirements 4, for the projects involving existing activities and facilities, an environmental and social due diligence is necessary to determine the existence of any areas where the Project may cause or is causing environmental and social risks or impacts and design corrective measures to address such instances of non-compliance, risks or adverse impacts. As the Project does not foresee any new major expansion, the audit will constitute the environmental and social compliance assessment for the Project and the existing facilities.

To comply with EBRD and ADB requirements and based on outcomes of the Environmental and Social Review, the Consultant has developed the Environmental and Social review report, the Environmental and Social Action Plan/Corrective Action Plan and the Stakeholder Engagement Plan, which are presented as standalone documents, as well as the Non-Technical Summary representing the major findings.

\textbf{1.2 Description of the Proposed Project}

The IEC intends to invest in rehabilitation of the existing infrastructure of the Sevan-Hrazdan Cascade (SH Cascade) in order to improve technical condition of the hydropower facilities included in the cascade and improve the operation characteristics of power generation plants.

In total there are seven power generation plants included in the cascade (Sevan, Hrazdan, Argel, Arzni, Kanaker, Yerevan-1 and Yerevan-3) comprising diversion channels, tunnels, aqueducts, reservoirs, power houses, sub-stations etc. The plants were built during 1930-1965. No major rehabilitation programs have been implemented at the plants throughout the lifetime. Respectively, despite routine maintenance works and some relatively small scale rehabilitation projects during the last decade, major part of the hydro power scheme is in poor condition including diversion channels, hydraulic units and sub-stations. Due to this the cascade faces big water losses, instable operations and frequent failure of hydraulic and power generation units, and respectively, its output is reduced in comparison to nominal capacity. In particular, the nominal capacity of the cascade is reduced from the designed 560 MW to 490 MW; annual output is reduced from the designed 2300 mln kWh to 500 mln kWh. Reduction of power generation is partly due to poor condition of HPP infrastructure; Second important factor is changes in water management from Sevan Lake. In 1990’s some actions were implemented to restore original water level in Sevan lake, accordingly the usage of water for irrigation and power generation was changed and reduced. The system for strict accounting of water usage was implemented as part of improved management of Sevan Lake.

To improve the situation and ensure continued safe and stable operation of the SH Cascade and to restore capacity the IEC has planned five years development/investment project envisaging the following rehabilitation works:

- reconstruction of Yerevan 1 plant - reconstruction of the weir, replacement of turbines, dredging of the reservoir;
- replacements of much of the electrical equipment in Sevan, Hrazdan, Argel, Arzni and Kanaker HPPs (accumulator battery, generator, excitation equipment, stators)
- rehabilitation of full length of diversion channels for Hrazdan, Argel and Arzni HPPs;
- replacements of hydro units in Argel, Hrazdan and Kanaker HPPs.

\textsuperscript{2} ADB’s relevant policies include the following: ADB’s 2009 Safeguard Policy Statement (SPS), Social Protection Strategy (2001) and Public Communications Policy (2011) which are available from \url{http://www.adb.org/about/other-operational-policies-and-strategies}
The planned rehabilitation works will be carried out within the existing footprint. Expansion of the existing facilities is not planned. The project as it was stated above includes replacement of existing technical equipment inclusive hydro turbines. It is presumed that the installed capacities of the hydropower units will not be changed significantly, however it can not be excluded, as soon the new turbines will be tailored specially for existing situation and auxiliary equipment, accordingly, exactly same capacity of the turbines can not be reached technically. This statement is true for Yerevan 1, part of argel and Kanaker HPP. in Other plants existing hydrounits will be operating without changes, accordingly installed capacity will not be changed.

The rehabilitation process is in progress. Some of the activities have been already implemented using own financial resources, what partly improved the system’s operation parameters. Additionally company applied for the loan to international financial institutions (IFIs), in particular they addressed EBRD and ADB to obtain financial support for the project.
2 The Existing Company/Facility Conditions and Area of Influence

2.1 Overview of IEC organizational structure

International Energy Corporation (IEC) owns and operates the Sevan-Hrazdan Hydropower Cascade (SH Cascade) located in Armenia. The Corporation became owner of the mentioned facilities in 2003; in 2011 the JSC RusHydro became a shareholder of the corporation.

The IEC is one of the largest enterprises in Armenia. It employees total about 450 people in its all facilities. The organization structure of the IEC is well established. Roles, responsibilities and accountabilities of all staff members are clearly defined through job descriptions, which are developed for all positions. Overall management of the company is provided by the General Director, which is assisted by four deputy directors managing and coordinating technical, financial, procurement issues and other issues. There are number of departments in the company, which share responsibilities on technical and engineering issues, construction and maintenance operations, safety of company operations, human resources, logistics, commercial, financial and others. The corporate organisational Chart is provided in Figure 2.1.1.

In addition, each HPP has director and personnel comprising Mechanical Engineer and Operations Engineers. The plants are operated on 2 shift scheme when they operate 24 hours /day. The Plants directors are reporting on technical matters to the Corporation’s Chief Engineer.

2.2 EHS Organization and Management

As the organization chart shows, the IEC has a Technical Audit and Safety Engineering Department, which is responsible for safety of the company operations, occupational safety including safety trainings and testing of workforce in the company facilities. Deputy Director – Chief Engineer ensure overall supervision of this department and coordination of its operations with other departments.

The company has neither a unit liable for environmental issues nor environmental policy and ESMS to manage environmental issues respectively. Environmental issues are managed on case by case basis by the technical departments responsible for engineering, maintenance and safety issues.

General labour issues in the company are managed by HR Department, which is responsible for contract management, keeping of personal files on employees, etc. The company has not internal grievance mechanism for the staff. The company has not social policy or department responsible for management of external social issues.
Figure 2.2.1  Corporate organization Chart

General Director
Grigorian Arsen

Financial controller
Kosian Georgi

Department of economic security & regimen
Sarkisian David

HR Department
Mirzoeina Lili

Deputy Director of General Matters
Pakhlevanian Vachagan

Deputy Director of Procurement
not appointed

Deputy Director Economics and Finance
Mkhitarian Arman

Accounting department (chief)
Melkonian Liiliza

Logistic department
Babaian Arman

Tender based procurement department
Barsegian Armen

Transport Department
Koraniya Asatur

Deputy Director
Chief Engineer
Sarkisian Oganes

Industrial engineering department
Arakelian Artur

Technical audit and safety engineering department
Aleksan Ruben

Financial economic department
Masrian Karen

Branch office "Energy Repair"
Ovsian Artur

Construction and maintenance department
Tarakchan Maram

Corporative management & Legal matter department
Arutunian Anna

The treasury office
Vardanian Rimma

Branch office "HPP Operation"
Zakharian Mikhail


2.3 SH Cascade Facilities Description and Planned Rehabilitation

The Sevan–Hrazdan Cascade is a key part of the Armenian electricity system. Its output can satisfy around 10% of the country demand on electric power, but it urgently needs substantial investments to ensure safe and stable operation.

The Sevan-Hrazdan (SH) HPP Cascade comprises seven small to medium scale plants (Sevan, Hrazdan, Argel, Arzni, Kanaker, Yerevan-1 and Yerevan-3), which were built during 1930-1960s. The Cascade spreads over the area from the Sevan Lake to Yerevan City, comprising about 70 km long corridor. The general layout of the cascade is given in Annex 1, Figure 1-1.

The hydropower system is built on the Hrazadan River and its tributaries, major of which are Marmarik, Tsaghkadzor, Aray and Getar; though it gets water from the Sevan Lake as well during irrigation season as its diversion system is multipurpose. In order to maintain and control water level in the Lake Sevan, amount of water supply form the lake is determined by the government each year, based on water availability in the lake and irrigation requirement. Usually 150 mln cubic meters of water is used from Lake Sevan.

As the agriculture is a priority sector in the country and water availability from the Sevan Lake is limited, the operation of the cascade is completely dependent on the country strategy for irrigation. The two first plants of the cascade are operated completely on water released from the Sevan; respectively they work only during irrigation season. The last stage of the Cascade (Yerevan 3) takes water from Artoshan channel, which irrigates vast agricultural lands in Ararat Valley and is also operated only during non-irrigation season. The rest four plants are capable to generate power round the year, as they use water flow of the Hrazdan’s tributaries. The total installed capacity of the SH Cascade is 560 MW and designed mean annual output is around 2300 mln kWh; however, due to poor condition factual nominal capacity and generation of the cascade comprises 490 MW and 500 mln kWh respectively.

2.3.1 Sevan HPP

The Sevan HPP is the first HPP of the Sevan-Hrazdan Cascade. It is located in the vicinity of the Sevan Lake, spreading from the lake to Sevan City along ca 2 km. General layout of the Sevan HPP is shown in Annex 1, Figure 1-2. Water supply of the plant is ensured from the Sevan and due to this a water intake is arranged at the lake. Water taking from the Sevan is permitted only during irrigation season and respectively, the plant is operated only during this period.

The Sevan HPP does not have a dam/weir and artificial reservoir. The plant comprises the following facilities:

- 67 m long, 33 m wide and 6.5 m deep r/concrete water intake, which takes water immediately from the Sevan Lake. The water intake is provided with fish protection facilities built adjacent to the flow regulation gates enabling management and control of water taken from the Lake.
- Diversion system, which is presented by about 1.7 km long open channel and 500 m long pressurized tunnel. Design flow of the diversion system is 70 m3/sec.
- One 160 m long steel penstock, connected to the diversion tunnel.
- Power house - underground type, built at 100m depth from surface. The power house is equipped with two 17 MW installed capacity turbines; total installed capacity of the plant is 34 MW. The access to the power house is provided through a tunnel and elevator. The power house has technical maintenance shaft, emergency staircase and staircase around the
elevator shaft as well. The plant has not tailrace channel, as discharged water is transferred immediately into the diversion tunnel of the next stage Hrazdan HPP.

- Above ground substation with switchyard and transformer area, control building, oil storage infrastructure, repair and maintenance facilities. The substation is separated from other buildings. The special lifting equipment is installed above the maintenance shaft, designed to lift the turbines and generation units above ground.

All territory is fenced in order to restrict unauthorized access. The facility is connected to public roads with a gravel road. There is no populated area in the vicinity of the plant. Neighbouring areas are mostly industrial or undeveloped.

At present nominal capacity of the plant is reduced from designed 34 MW to 24 MW; mean annual power generation for last period comprises 15 mln kWh against 130 mln kWh designed. The rehabilitation project for the plant to restore the capacity envisages:

- Replacement of stators on both generators as soon they are in bad state and cannot ensure stable operation of the hydropower plant.
- Rehabilitation of the 110/35 kV wing of the substation.
- Rehabilitation of the low voltage part (10kV) of the substation - mainly this includes modernization of the distribution panel.
- Replacement of the lead/acid batteries required for HPP operation.
- Full length rehabilitation of 1.7 km long diversion channel.

The existing high voltage oil switches have been recently replaced with modern gas circuit breakers.

### 2.3.2 Hrazdan HPP

Hrazdan HPP is built between the cities of Sevan and Hrazdan. The total length of the diversion system between the Sevan HPP and Hrazdan HPP equals 15km. The HPP does not have a dam and reservoir. Diversion system of the plant starts immediately at the tailwater discharge from the Sevan HPP. The Hrazdan HPP comprises the following facilities:

- Unpressurised diversion system presented by 3 sections of open concrete channels of 7800 m total length and 2 tunnel sections with 6400m total length. Design flow of the diversion system is 65 m3/sec.
- The intake structure, which is presented by small size r/concrete forebay supplying water to main gates equipped with screens and solid waste removal unit.
- Two steel penstocks installed on the mountain slope, inside concrete U-channel. The length of each penstock is 104 meter, design flow 65 m3/sec.
- Emergency spillway, which is provided at the intake structure to release water in emergency situations at the HPP. The spillway is made of reinforced concrete and has pressure reduction shaft. The access to water intake is provided via a gravel paved road parallel to the open channel.
- Powerhouse building - is above ground structure, built in unpopulated area. Two turbines of 86MW total installed capacity are provided there.
- 320 m long tailrace channel, which discharges water into the Akhparin Reservoir, at the confluence of the Marmarik River.
- 220/110 kV sub-station, which is built on the slop next to the power house.

The general layout of the Hrazdan HPP is given in Annex 1, Figure 1-3 shows layout of the penstock, power house, emergency spillway and Akhaprin Reservoir, receiving tailwater (details see in the next section).
The nominal capacity of the Hrazdan HPP is maintained at designed 86 MW. Mean annual power generation is around 40 mln kWh instead of designed 375 mln kWh, which is partly due to water losses from diversion channels and partly due to restricted water release from the Sevan Lake. The rehabilitation project envisages following activities for Hrazdan plant: replacement of switchyard at substation (220/110KV wing); modernization of low voltage part (10KV) of the substation which includes replacement of switchboard; replacement of oil breakers with Insulating gas filled circuit breakers; rehabilitation of the control system for gate operations at water intakes; full length rehabilitation of the diversion channels (7800 m) and security systems of the Hrazdan HPP.

2.3.3 Argel HPP

Argel HPP, the third plant of the SH Cascade spreads from the Hrazdan City to Argel City. This is the first plant of the cascade which is not only the Sevan’s water dependent and can be operated round the year on the discharge of the Hrazdan River. Argel HPP produces about 40% of the total Sevan-Hrazdan Cascade energy.

The HPP comprises the following infrastructure:

- Akhparin Reservoir, which is created behind 15 m high rockfill dam. The crest length of the dam is 117 m and width – 5.5 m. The area of the reservoir is 1.7 km², total water capacity – 5.6 mln m³. The reservoir requires permanent dredging in order to maintain normal depth and capacity. Therefore, a dredger continuously pumps sediments from the reservoir and disposes material to a nearby accumulation area. Figure 1-3 in Annex 1 shows operation area of the dredger and spoil disposal site.
- Diversion system, comprising open channels and tunnels. The total length of the open channels is 6.5 km and total length of the diversion unpressurised tunnels is 11.6 km. Design flow of the diversion system is 70 m³/sec. A major irrigation channel of Kotay is connected to the diversion system little upstream the pressure basin of the plant.
- R/concrete water intake structure
- Forebay, which is created by 10 m high weir. Surface area of the forebay is 42,000 m³, total volume – 300,000 ths m³.
- 1010 m long emergency spillway, which ensures water diversion from the forebay to the reverbed if required
- 900m long steel penstocks (four units), or accumulate water in a daily regulation reservoir with capacity of 300 thousand m³.
- The powerhouse building, which is located outside of Argel town. The powerhouse is an above ground structure equipped with four turbines of 224MW total installed capacity (each 56 MW).
- Tailrace water channel – ca 60 m long, which discharges water into the riverchannel.
- Sub-station, which is located on the

General layout of the Argel HPP is given in Figure 1-4, Annex 1.

The HPP is equipped with modern control systems, hydro-electric devices has automatic start-up system to fit the peak demands. Argel HPP provides direct power supply to Armenian nuclear station, to raise its reliability. The nominal capacity of the HPP is reduced to the 168 MW; annual generation of the plant comprises 200 mln kWh instead of design 870 mln kWh due to reduced water taking from the Sevan Lake and water losses from diversion channels.

Worthy to note is that the emergency spillway was constructed in 1998-1999 after the old spillway was damaged by a landslide triggered by heavy rains failed in 1995. The riverbed was blocked up with slide material and the powerhouse building was flooded during 10-15 minutes entirely due to the
The plant was re-launched after construction of a new emergency spillway and rehabilitation of the powerhouse building, what took 6 months.

The main part of rehabilitation project is directed to the full length rehabilitation of diversion channels (6.5 km) to reduce water loses. Additionally project includes: replacement of electrical equipment 110 kV and 10 kV switchgears in switchyard; reconstruction of #1 turbine’s bearings; modernization of excitation systems for generators #1, 2 and 4; upgrading of the security system; and replacement of lead/acid batteries.

2.3.4 Arzni HPP

The Arzni HPP is built between the villages of Argel and Nor-Hachn. The total length of the hydro power scheme is about 11 km.

Headwork facilities of the Arzni HPP comprise 23 m high concrete dam creating so called Argel Reservoir. The reservoir’s total volume is 1 million m³, the active volume is 300 thousand m³ and it can function as daily regulation basin. The dam is equipped with two control gates. The plant has 8 km long diversion system, of which 3.8 km is open channels and 4.1 km tunnels. Design flow of the diversion system is 70 m³/sec. The diversion system is followed by a head pond which supplies water to the power house through 700 m long intake channel, a surge tank and 3 penstocks. The head pond has 1 km long emergency spillway to bypass water from the power house into the river.

The diversion system, head pond, intake channel and spillway pass through several settlements. A large size irrigation channel of Arzni-Shamiram takes water from the head pond.

The underground power house and switchyard built on 100 m depth from the ground level are located at the river bank, outside residential area between the Nor-Hachn and Arzni settlements. The power house is equipped with 3 turbines of 23.5 MW installed capacity each. The total installed capacity of the Arzni HPP is 70.5 WM. Tailrace water is discharged into the Hrazdan River.

Like Argel HPP, the Arzni plan is operated round the year. Power generation is much lower during non-irrigation period, as soon the Lake Sevan water intake is shut. The plant is equipped with modern control systems, HPP devices have automatic start-up system to fit the peak demands.

At present hydraulic units of the Arzni HPP can operate at their installed capacity of 70.6 MW; however, actual power generation comprises 80 mln kWh instead of design 300 mln kWh partly due to water losses from diversion channels and reduced water supply from Sevan. In the frames of the planned rehabilitation project the sum allocated for the Arzni HPP will be mainly used for rehabilitation of the diversion channel to reduce water losses. The channels will be rehabilitated along the full length, or 3.8 km. Besides, the planned works will include replacement of 110 kV and 10 kV equipment in the switchyard and upgrading of security system.

2.3.5 Kanaker HPP

The Kanaker HPP scheme starts immediately from the tailwater discharge of the upper stage and spreads down to Yerevan City. The corridor of the hydro-power scheme is about 13 km long. Headwork of the Kanaker HPP comprises 10.7 m high reinforced concrete dam, which creates a reservoir having 50,000 m² surface and 150 thousand m³ active volume. The reservoir has daily regulation function. The dam is equipped with gates having bottom outlets. The daily regulation reservoir enables to meet peak demand.
The Kanaker HPP has 12.6 km long diversion system presented by 8.5 km long open channels and 4.1 km long tunnels. Design flow of the diversion system is 60 m³/sec. The diversion system is followed by a head pond, created behind 10 m high concrete faced rockfill dam. It gives origin to four 159 m long penstocks. The head pond has a ca 900 km long spillway channel to discharge water into the river bed if necessary. Nor-Dalmaiski irrigation channel is connected to the diversion system little upstream the head pond.

The power house is installed on the river bank, remote from residential area. The power house is equipped with six hydraulic units, four of which have 12.5 MW capacity and the rest two 25 MW capacity. The total installed capacity of the plant is 102 MW. The Kanaker HPP has a 110 kV substation, which is located on a hill near the power house. Tailwater is discharged in the Yerevan Reservoir.

Some rehabilitation works were implemented on the Kanaker HPP during the past decades and the nominal capacity of the plant is maintained; though, actual power generation comprising 110 mln kWh per year is well below of the designed value (435 mln kWh/year). Despite rehabilitation works of the last period, the plant still faces many technical problems, which should be solved to maintain nominal capacity and ensure smooth operation. Main part of the planned rehabilitation works include replacement of #1, 3 and 4 turbines and generators and replacement of power transformers #3 and #4. Besides, 110 kV equipment will be changed in the switch yard and 10kV connections will be replaced with cable connections. Diversion channels will be rehabilitated at full length (8.5 km). Rehabilitation of the power house access road is also planned to protect it against landslide.

### 2.3.6 Yerevan HPP1

The Yerevan HPP1 scheme is completely comprised within the boundaries of Yerevan City. The plant was built in 1957-1962. Total length of the hydropower scheme is about 3 km. The headwork of the plant is located immediately downstream the Kanaker HPP, where tailwater is discharged. 21m high concrete faced rockfill dam is constructed for the plant to create daily regulation basin. The designed active volume of the basin is 320 thousand m³; however most part of the reservoir is silted at present. The dam is provided with a spillway to discharge water during floods.

Diversion system of the Yerevan 1 is presented by a pressurized tunnel. The tunnel has 4.4 m diameter and is 2.7 km long. Design flow of the tunnel is 62 m³/sec. It is connected to an underground concrete surge tank, which is followed by two 270 m long underground penstocks.

The Yerevan 1 has surface level power house and switchyard, which are built on the river bank and remote from residential area. The power house is equipped with two hydraulic units of 22 MW capacity each. The total design capacity of the plant is 44 MW.

The plant’s mean annual output is about 50 mln kWh instead of designed 210 mln kWh due poor condition of turbines and generators, water losses from diversion channels and silting of the reservoir; though, power generation rate is also reduced due to lower water release from the Sevan Lake.

The first goal of the planned rehabilitation project regarding the Yerevan 1 plant is replacement of turbines, generators and associated systems. Besides, dredging of the reservoir is planned within the planned investment program to restore its active capacity. According to the rough estimate amount of sediment (spoil) removed from the reservoir will be over 80,000 m³, which should be specified before starting dredging operations.
### 2.3.7 Yerevan HPP3

The Yerevan HPP3 is the last stage of the Sevan-Hrazdan cascade and the smallest plant. The plant is built on the Artashan Irrigation Channel with the aim to utilize water not used for the irrigation. Respectively it is mostly operated during non-irrigation season.

The Yerevan 3 is built at the south-west boundary of Yerevan City, within non-residential area. The plant does not have dam, reservoir or diversion system. The plant’s single penstock is connected immediately to the Artashan irrigation channel and when the penstock inlet is closed, the water flows into the irrigation scheme. The plant has surface level power house, with one hydraulic unit of 5.0MW installed capacity. Mean annual power generation by the plant is 5 mln kWh, which is half of the designed value. Generated electricity is transmitted via cable to the nearest switchyard. Figure 1-5 shows layout of the Yerevan 3.

The rehabilitation program for the Yerevan 3 includes upgrading of 10 kV switch gears and ongoing maintenance of power generation unit.

### 2.3.8 Diversion System of Seven-Hrazdan HPP Cascade

The Seven-Hrazdan HPP Cascade comprises a set of open diversion channels and tunnels system which transports water from the Sevan Lake to the HPPs. The diversion system is a property of IEC; though, it is also used for throughput of irrigation water. The channels are presented with reinforce-concrete structures of different shape. Most of the channels are built in the middle of the last century; nowadays they are significantly deteriorated. The summary data of the water diversion installations based on technical passports provided by IEC management are presented in Table 2.2.1. Some other details of water diversion structures are presented in the chapters above.

<table>
<thead>
<tr>
<th>Description</th>
<th>Sevan HPP</th>
<th>Razdan HPP</th>
<th>Argel HPP</th>
<th>Arzni HPP</th>
<th>Kanaker HPP</th>
<th>Erevan 1 HPP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flow</td>
<td>70 m³/sec</td>
<td>65.0 m³/sec</td>
<td>70 m³/sec</td>
<td>70 m³/sec</td>
<td>60 m³/sec</td>
<td>60 m³/sec</td>
</tr>
<tr>
<td>Total length</td>
<td>2283.5 m</td>
<td>15,037.48 m</td>
<td>18824.6 m</td>
<td>8,014 m</td>
<td>12,661 m</td>
<td>2746 m</td>
</tr>
<tr>
<td>Open channel</td>
<td>1930 m, trapezoid</td>
<td>7774.5 m trapezoid and box r/concrete</td>
<td>7266.6 m, trapezoid and box r/concrete</td>
<td>3877, trapezoid</td>
<td>8,527 trapezoid</td>
<td>-</td>
</tr>
<tr>
<td>Tunnel</td>
<td>283.5 m, concrete facing, circle</td>
<td>6372 m</td>
<td>11557.6 m</td>
<td>4137 m, horseshoe</td>
<td>4,134 m, oval</td>
<td>2746 m</td>
</tr>
</tbody>
</table>

The diversion system is multipurpose used both for power generation and irrigation. The first priority is to supply the water for irrigation purposes and after then power generation. To protect the Sevan Lake, water extraction from the Sevan Lake is regulated by Armenian legislation and any changes should be approved by the Parliament of Armenia. Water from the Sevan is released only during irrigation time. Respectively, the first two HPPs (Sevan and Hrazdan) operate only during the irrigation season. Other HPPs are operable during all seasons, depending on water availability in the
Hrazdan River and its tributaries. The IEC is responsible to ensure water availability for irrigation. Based on the agreement with Armenian authorities the IEC should maintain the existing channels and keep them in good condition. However, because of oldness and technical damages the channels are in poor condition and require major rehabilitation.

Every year when channels are empty the company implements the repair/patching works which helps to keep channels in comparatively good condition only temporarily. The patching includes recovering of the damaged concrete throughout the channels, filling the cracks, polishing of the surface etc, when channels are empty. Once a year the company conducts general thorough cleaning of the diversion system to remove accumulated waste.

One of the issues related to the diversion channels is water losses due to existing improper connections by local population to extract water for irrigation. It is not possible to quantify the water losses due to improper connections or faults in the channels. As it was mentioned before, the main purpose of channels is to supply water for irrigation, accordingly it is not possible for the International Energy corporation to quantify how much water is dedicated for irrigation and how much is lost. The evidences of water leakages are practically in most part of channels passing through the populated areas. In non populated areas and inside the tunnels losses are very small. The overall losses of water in accordance to estimations carried of by the corporation engineers is up to 7 % at maximum flow, however we believe, that this is rough figure and can not be used as reference of baseline value.

During the design works and assessment of the technical conditions of channels, the EIC engineers have tried to estimate losses due to the technical issues, however the technical design documentation does not provide quantified information. The company management also confirmed that only rough estimations were done, however, the water belongs to irrigation system and IEC does not have rights to manage the water; the IEC should just use the water flowing through channels for energy generation. It is presumed, that rehabilitation of channels will have significant impact on water losses, and will improve overall situation on channels.

Due to many damages on the channels and high volume of water losses the IEC have planned to conduct major rehabilitation of the channels system, which means to surface the existing ones with new concrete layer. It is expected that rehabilitation activities will be conducted from inside of channels to minimize the adverse impact to the nearby territories, as some part of the channels are located in populated area. As mentioned above, the rehabilitation of the channels are included in the frame of the proposed program. Besides, as discussed below, installation of railings is recommended along the populated areas in the frames of the rehabilitation to reduce community safety risk.

Different from the open channels, the condition of the existing diversion tunnels is well and they need only some routine cleaning. It is expected that the tunnels will be cleaned during the channels rehabilitation and corresponding actions will take place whenever damages are detected.

Another important issue related to the diversion channels is that they miss railings or other guarding installations to prevent entry of community members; The design of channels does not allow to use the infrastructure for household and recreational needs, the access to channels by local population should be restricted for safety reasons.

It should be mentioned that the time for rehabilitation activities is very limited, as no works should be conducted during the irrigation season.
2.3.9 Power evacuation and auxiliary infrastructure

All hydropower plants are connected to the National power grid of Armenia; All HHP’s have the power substations with high voltage and low voltage grid. The mentioned substations are used to evacuate generated power and deliver it to the local consumers of electric power. The technical equipment provided on substations are installed in accordance to the local and GOST (Former soviet Union Standard for substations). The high voltage wing depending on voltage (220, 110 KV) are equipped with oil transformers. Typically transformers are using up to 20-30t of transformer oil in each unit. Practically all transformers are very old, except than two units of transformers which were replaced some 10 years ago as part of the rehabilitation works. Exception are also transformers at Arzni substation, which is located inside the mountain, the transformers are equipped with automatic fire fighting system and gas circuit breakers. The mentioned transformers have been rehabilitated.

The switchyard includes several circuit breakers, typically represented as oil containing units with up to 3 ton of oil in each unit. The oil containing circuit breakers are step by step replaced by modern type CF6 containing breakers; the existing ones are demounted and disposed.

The low voltage grid is dedicated to the distribution to local network located in vicinity of substations. The local network feeders are supplying power to local medium-low voltage distribution systems. This was developed historically as soon the most part of hydropower plants are located in vicinity of populated areas and of course substations were used to supply power to local distribution system.

All substations in accordance to the standards have been properly demarcated. In some cases the substations are inside the hydropower plant fence, in some cases they are installed as alone standing units in vicinity of plants. All of the alone standing substations are properly demarcated to prevent unauthorised access to the substation territory and avoid possible incidents. The substations are provided with guards patrolling the site 24 hours a day.

On each substation, in accordance to the local standards, the facilities for transformer oil storage were provided. The vertical oil tanks installed on the concrete basement are built. they were dedicated to store emergency reserve of transformer oils and provide accommodation to used oils, however the oil storage facilities have lost their function during the last few years and are not used any more.

2.3.10 Summary of Planned Rehabilitation Works

The table below summarises planned rehabilitation works by the plants of the Sevan-Hrazdan Cascade.

<table>
<thead>
<tr>
<th>Hydro Power Plant</th>
<th>Planned Rehabilitation Works</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sevan HPP</td>
<td>- Replacement of generator’s stator</td>
</tr>
<tr>
<td></td>
<td>- Replacement of electrical equipment switch yard 110/35 kV</td>
</tr>
<tr>
<td></td>
<td>- Modernization of security system</td>
</tr>
<tr>
<td></td>
<td>- Replacement of accumulator batteries</td>
</tr>
<tr>
<td></td>
<td>- Modernization of 10 kV distribution board</td>
</tr>
<tr>
<td>Hrazdan HPP</td>
<td>- Replacement of electrical equipment switch yard 220/110 kV</td>
</tr>
<tr>
<td>Hydro Power Plant</td>
<td>Planned Rehabilitation Works</td>
</tr>
<tr>
<td>------------------</td>
<td>-----------------------------</td>
</tr>
<tr>
<td></td>
<td>- Modernization of security system</td>
</tr>
<tr>
<td></td>
<td>- Rehabilitation of diversion channel (7.8 km)</td>
</tr>
<tr>
<td></td>
<td>- Replacement of accumulator batteries</td>
</tr>
<tr>
<td></td>
<td>- Modernization of control system of intake gates of #1 and #2 turbines</td>
</tr>
<tr>
<td></td>
<td>- Modernization of 10 kV equipment</td>
</tr>
<tr>
<td>Argel HPP</td>
<td>- Replacement of electrical equipment 110 kV in switch yard and switch gears 10 kV</td>
</tr>
<tr>
<td></td>
<td>- Modernization of security system</td>
</tr>
<tr>
<td></td>
<td>- Rehabilitation of diversion channel (6.5 km)</td>
</tr>
<tr>
<td></td>
<td>- Replacement of accumulator batteries</td>
</tr>
<tr>
<td></td>
<td>- Reconstruction of turbine’s bearings on turbines #1 and #2</td>
</tr>
<tr>
<td></td>
<td>- Modernization of excitation systems for generators #1, 2 and 4</td>
</tr>
<tr>
<td>Arzni HPP</td>
<td>- Replacement of electrical equipment in switch yard 110 kV</td>
</tr>
<tr>
<td></td>
<td>- Modernization of security system</td>
</tr>
<tr>
<td></td>
<td>- Rehabilitation of diversion channel (3.8 km)</td>
</tr>
<tr>
<td></td>
<td>- Replacement of 10 kV equipment</td>
</tr>
<tr>
<td>Kanaker HPP</td>
<td>- Replacement of #1, 3 and 4 hydro turbine and generators</td>
</tr>
<tr>
<td></td>
<td>- Replacement of power transformers #3 and #4</td>
</tr>
<tr>
<td></td>
<td>- Replacement of electrical equipment in 110 kV switch yard</td>
</tr>
<tr>
<td></td>
<td>- Modernization of security system</td>
</tr>
<tr>
<td></td>
<td>- Replacement of 10 kV connection unit by cable connection</td>
</tr>
<tr>
<td></td>
<td>- Rehabilitation of diversion channel (8.5 km)</td>
</tr>
<tr>
<td></td>
<td>- Renovation of access road (construction of protection wall against landslide) (nearby the plant)</td>
</tr>
<tr>
<td>Yerevan HPP1</td>
<td>- Reconstruction of power house including replacement of electro-mechanical equipment (turbines, generators and associated systems)</td>
</tr>
<tr>
<td></td>
<td>- Civil works at reservoir including dredging (rough estimated volume of dredging 100,000 m³ spoil)</td>
</tr>
<tr>
<td>Yerevan HPP3</td>
<td>- Modernization of 10 kV switch gears at sub-station</td>
</tr>
</tbody>
</table>

### 2.4 Project Area of Influence

The SH Cascade is built on the Hrazdan River and spreads from the Sevan Lake to Yerevan City, over 70 km distance. The corridor of the SH hydro power scheme belongs to the Regions of Kotayk and Gegharkunik and the Municipality of Yerevan. General layout of the hydro power scheme is shown in Annex 1.

The most part of the SH Cascade corridor passes through agricultural lands and settlements; some industrial sites and urban areas are also found there. Among settlement in the SH Cascade corridor should be mentioned those which lie along open channels, close to the power house and reservoirs, as their residential areas, property or agricultural lads could be affected by the planned project or routine operations of the cascade. These include Kanaker-Zeytun District of Yerevan City, Geghamavan in the Gegharkunik Region and Getamej, Solak, Nor Geghi, Nor Hachn, Charentsavan and Hrazdan in the Kotayk Region. Other settlements and their agricultural lands are along diversion tunnels and respectively, are not likely to be impacted during works. Over 95% of population in the project corridor is ethnic Armenian. Minorities are presented by Russian, Assirian, Greek, etc, which are mainly concentrated in Yerevan. No ingenious people are found in the project corridor.
As mentioned, the Cascade is built on the Hrazdan River, which flowed out of the Sevan Lake in the past. However, the natural outflow of the river was lost after construction of the multipurpose diversion system of the Sevan-Hrazdan. At the beginning and until the 1980s, water abstraction from the Sevan Lake for various uses including agriculture, hydropower, and industry was very intensive and led to the lake being severely degraded as a result. Water level dropped by 20 m in the lake and fish population drastically reduced. Impact on Sevan fish also occurred due to the absence of fish protection installations at the water intake, intensive fish harvesting, and introduction of non-native species. In 1978, the Sevan Lake and its surroundings were converted into the National Park. The state government started implementation of a program for restoration of water level and fish population in the lake. Since the 1980s, water abstraction from the lake is strictly planned and monitored, enabling restoration of water level by some meters. Besides, fish protection facilities were built on the water intake, and an increase in fish population is also reported. The mean annual water abstraction from the lake comprises 150 mln m³, what is released during irrigation season only as the agriculture is a priority economic sector in Armenia. Depending on water availability and water requirement for irrigation, water abstraction may be increased upon decision of the Parliament of Armenia.

Another water body affected by the SH Cascade is the Hrazdan River, which is notably fragmented by the cascade and factually half of the river length is left on sanitary flow; the natural flow in the river is maintained only downstream Yerevan City.

At the confluence with its main branch, the Marmarik River is established the Akhporinsko Reservoir. All SH Cascade facilities are built downstream the Marmarki and respectively, the river does not fall within the cascade’s influence area. However, the river is still affected by a dam which has been installed to regulate water for irrigation.

The SH Cascade’s diversion system is used for transportation of water for irrigation of vast agricultural lands in the Kotayk Region and Yerevan Municipality. Therefore, several large channels are connected to the diversion system, including the channels of Kotayk, Arzni-Shamiram, Nor-Dalmaiski, Artashan and Lower Hrazdan. Besides, local communities connected some small scale water intakes to diversion channels to take water for irrigation of their agricultural plots and watering of cattle.
3 Regulatory requirements

3.1 National Regulatory requirements

The following laws of the Republic of Armenia (RA) are related to the environmental protection:

<table>
<thead>
<tr>
<th>Name of Law</th>
<th>Year of Adoption</th>
</tr>
</thead>
<tbody>
<tr>
<td>Law “On Specially Protected Areas”</td>
<td>1991</td>
</tr>
<tr>
<td>Law on Atmospheric Air Protection</td>
<td>1994</td>
</tr>
<tr>
<td>Law on Environmental Impact Assessment</td>
<td>1995</td>
</tr>
<tr>
<td>Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment</td>
<td>1998</td>
</tr>
<tr>
<td>Law on Environmental Fees and Nature Use Charges</td>
<td>1998</td>
</tr>
<tr>
<td>Law on Flora</td>
<td>1999</td>
</tr>
<tr>
<td>Law on Fauna</td>
<td>2000</td>
</tr>
<tr>
<td>Land Code</td>
<td>2001</td>
</tr>
<tr>
<td>Law on Lake Sevan</td>
<td>2001</td>
</tr>
<tr>
<td>Law on Complex Program for the Lake Sevan Ecosystem Restoration, Conservation, Reproduction and Use</td>
<td>2001</td>
</tr>
<tr>
<td>Code on Underground Resources</td>
<td>2002</td>
</tr>
<tr>
<td>Water Code</td>
<td>2002</td>
</tr>
<tr>
<td>Law on Wastes</td>
<td>2004</td>
</tr>
<tr>
<td>Law on Environmental Oversight</td>
<td>2005</td>
</tr>
<tr>
<td>Forest Code</td>
<td>2005</td>
</tr>
<tr>
<td>Law on Fundamental Provisions of the National Water Policy</td>
<td>2005</td>
</tr>
<tr>
<td>Law on the National Water Program</td>
<td>2006</td>
</tr>
<tr>
<td>Law on Inspection of Use and Protection of Land</td>
<td>2008</td>
</tr>
</tbody>
</table>

The laws directly related/applicable to the Project are briefly described below:

- *The Law on the Principles of Environmental Protection* outlines the environmental protection policy of the Republic of Armenia. It provides a legal basis for the development of environmental legislation regulating the protection and use of forest, water, flora and fauna, and the atmosphere. This law also grants every citizen the right to obtain reliable information on environmental conditions.

- *The Law on Environmental Impact Assessment* contains the standard steps of the EIA process for various projects and activities in Armenia. In Articles 2-5 it establishes the general legal, economic, and organizational principles for conducting the mandatory state EIA of various projects and “concepts” of sectoral development.

According to the law, EIA studies should be ensured for construction, reconstruction, expansion, modernization or liquidation of hydropower stations. The planned SH Cascade rehabilitation program does not include construction of new facilities or expansion of existing one; nor significant change in the design parameters are expected. Respectively, it is deemed that according to the national requirements, the SH Cascade rehabilitation project should not require the state environmental expertise. The national law does not require public consultations for projects exempt from EIA. However, worthy to note is that the Law does not give clear definition for the terms ‘reconstruction’ and ‘modernization’, and it is recommended to verify legal requirements prior the planned rehabilitation is commenced.
In addition, dredging of the Yerevan 1 reservoir should be considered separately, as according to Article 4 of the EIA law, **removal, recycling or disposal of harmful and other wastes require EIA study** and the state ecological examination. Respectively, EIA and respective public consultations should be conducted before starting dredging operations.

The Law forbids any economic unit to operate or any concept, program, plan or master plan to be implemented without a positive conclusion of an EIA. In addition, an EIA may also be initiated for projects that exceed “threshold” value requirements set by Governmental Decree N: 193 issued on March 30, 1999. The EIA Law specifies notification, documentation, public consultations, and appeal procedures and requirements (Articles 6-11).

- **The Law on Lake Sevan** defines the legal and economic basis of state policy on natural development and restoration of the ecosystem of strategic significance, reproduction, preservation and use of natural resources of Lake Sevan which is considered an environmental, economic, social, scientific, historical-cultural, aesthetic, health, climatic, recreational and cultural entity of the Republic of Armenia. Lake Sevan has a strategic significance as a source of drinking and irrigation water in the RA. It defines ecological zoning, state policy on restoration, preservation, reproduction, natural development and use of the lake ecosystem, jurisdictions of state and local authorities regarding the use of natural resources, the lake preservation system, as well as normalizing and control over the impacts on the lake ecosystem.

- **The Law on the Protection and Use of Fixed Cultural and Historic Monuments and Historic Environment** provides the legal and policy basis for the protection and use of such monuments in Armenia and regulates the relations among protection and use activities. Article 15 of the Law describes procedures for the discovery and state registration of monuments, the assessment of protection zones around them and the creation of historic-cultural reserves.

- **The Law on Atmospheric Air Protection** regulates the emission licenses and provides maximum allowed loads/concentrations for atmospheric air pollution, etc. There is secondary legislation that establishes sanitary norms for noise in workplaces, residential and public buildings, residential development areas as well as construction sites.

- **The Land Code** defines the main directives for use of the lands allocated for energy production, water economy (water supply, water discharge, pumping stations, reservoirs, etc.), and other purposes. The Code defines the lands under the specially protected areas as well as forested, watered and reserved lands. It also establishes the measures aimed at protection of the lands as well as the rights of state bodies, local authorities and citizens towards the land.

- **The Water Code** provides legal basis for the protection of the country’s water resources, the satisfaction of water needs of citizens and economic sectors through effective management of water resources and safeguarding the protection of water resources for future generations. The Water Code addresses the following key issues: responsibilities of state/local authorities and public, development of the national water policy and national water program, water cadastre and monitoring system, public access to the relevant information, water use and water system use permitting systems, water quality standards, hydraulic structures operation safety issues, protection of water resources and state supervision. Adoption of the Water Code in 2002 generated the need for development of a number of Governmental regulations and procedures, including permitting procedures, environmental flows, drainage water use, water use for fishery purposes, registration of documents in state water cadastre, public awareness and publicity of the documents, etc.
- The Law on Water Users’ Associations (WUA) and Federations of the WUAs. The WUAs and federations of WUAs are established to effectively operate and maintain the irrigation infrastructure and provide for reliable irrigation water supply to members of the WUA, collect water payments and present the rights of member water users. Within the objectives of the Association and Federation (Article 4) the following important issues from an environmental perspective could be mentioned: operation and maintenance of irrigation system; implementation of construction works and restoration of watercourses and irrigation systems; water supply management and pollution prevention; implementation of activities necessary to improve the quality of land, supporting the drainage system; providing ecological safety through preventing land erosion, prevention from salinization, over-watering and promoting the protection of irrigation system.

- The Law on Wastes provides the legal and economic basis for collection, transportation, disposal, treatment, re-use of wastes as well as prevention of negative impacts of waste on natural resources, human life and health. The law defines the roles and responsibilities of the state authorized bodies in the waste sector.

- The Law on Fundamental Provisions of the National Water Policy defines a long-term development concept for protection, strategic management and use of water resources and water systems of Armenia. It spells out the key principles for integrated management and planning of Armenia’s water sector by defining priorities and approaches to be addressed.

- The Law on National Water Program provides short-term (until 2010), medium-term (2010-2015) and long-term (2015-2021) measures for achieving the goals and objectives defined by the Water Code, National Water Policy and Program. The National Water Program Law is a “living” document to be updated regularly. Among other key issues, the law defines volumes of ecological/minimum flow and maximum permissible quantities of water withdrawn for consumption; determination of specially protected basin areas and zones of ecological emergencies and ecological disasters; prevention of negative impact on water eco-systems; improvement of water resources monitoring and pollution prevention; etc.

According to Armenian legislation, the SH Cascade rehabilitation program does not require to undergo the EIA process, as all works are planned within existing footprint, do not lead to increase of original capacity and all facilities have been operational prior to 1995, except of Yerevan-1 reconstruction where reservoir dredging is considered). IEC has carried out the EIA study for reconstruction of the Yerevan 1 in 2010; however, dredging of the reservoir is factually not discussed in the document. In particular, the EIA report does not include qualitative and quantitative assessment of sediments to be dredged, discussion of adverse impacts related to dredging operations and transportation and disposal of spoil, requirements to spoil dumping site, etc.

Regarding the Environmental impact assessment of reservoir dredging operation, the screening of possible environmental impacts is required and in accordance to local regulations the decision of EIA requirement will be made It is assumed, that EIA study will be required in order to fulfil requirements of local regulations.

The occupational health and safety, as well as labour employment and working conditions issues in Armenia are regulated by the Labour Code, the Law on Employment of the Population and, for particular sector, the Law on Safe Use of Nuclear Energy for Peaceful Purposes, as well as other legal acts and sector specific standards which do not fully comply with relevant EU, EBRD and ADB requirements. Based on review results it should be noted that there are no clear and specified mechanisms in the Armenian legislation retaining health and safety requirements at work and their regulation is only carried out by collective contracts or legal acts drafted by the employer. The field
of safety, hygiene and health at work is mainly regulated by the legal rules of the Labour Code, which are of general nature and do not ensure a detailed regulation of legal relations arising in the field.

### 3.2 Applicable EBRD and ADB requirements and standards

**EBRD Performance Requirements**

As it is stated in the EBRD 2008 Environmental and Social Policy, the EBRD financed projects are expected to meet good international practice related to sustainable development. To help clients and/or their projects achieve this, the Bank has defined specific PRs for key areas of environmental and social issues and impacts. PRs relevant to the project are listed below:

- **PR 1**: Environmental and Social Appraisal and Management
- **PR 2**: Labour and Working Conditions
- **PR 3**: Pollution Prevention and Abatement
- **PR 4**: Community Health, Safety and Security
- **PR 5**: Land Acquisition, Involuntary Resettlement and Economic Displacement
- **PR 6**: Biodiversity Conservation and Sustainable Natural Resource Management
- **PR 8**: Cultural Heritage
- **PR 10**: Information Disclosure and Stakeholder Engagement.

Each PR defines, in its objectives, the desired outcomes, followed by specific requirements for clients to help them achieve these outcomes. Compliance with relevant national laws is an integral part of all PRs. The EBRD will require clients to structure projects so that they meet all applicable PRs. Central to this is a consistent approach to seek to avoid adverse impacts on workers, communities, and the environment, or if avoidance is not possible, to reduce, mitigate, or compensate for the impacts, as appropriate. The PRs also provide a solid base from which clients may improve the sustainability of their business operations.

If a proposed business activity to be financed by the EBRD relates to existing facilities that do not meet the PRs at the time of Board approval, the client will be required to adopt and implement an Environmental and Social Action Plan (ESAP), satisfactory to the EBRD, that is technically and financially feasible and cost-effective to achieve compliance of these facilities with EBRD’s requirements within a time frame acceptable to the EBRD. If the Bank operation is to provide general corporate finance, working capital or equity financing for a multi-site company, the client will be required to develop and implement an ESAP at the corporate level (as opposed to the site-specific level).

**ADB Safeguard Requirements**

As it is stated in ADB 2009 Safeguard Policy Statement, to help borrowers/clients and their projects achieve the desired outcomes, ADB adopts a set of specific safeguard requirements that borrowers/clients are required to meet in addressing environmental and social impacts and risks. ADB staff, through their due diligence, review, and supervision, will ensure that borrowers/clients comply with these requirements during project preparation and implementation. The environmental and social safeguard requirements are as follows:

(i) Safeguard Requirements 1: Environment,
(ii) Safeguard Requirements 2: Involuntary Resettlement,
(iii) Safeguard Requirements 3: Indigenous Peoples

The objectives of ADB’s safeguards are to:
(i) avoid adverse impacts of projects on the environment and affected people, where possible;  
(ii) minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and  
(iii) help borrowers/clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

When the project involves existing activities or facilities, relevant external experts will perform environmental audits to determine the existence of any areas where the project may cause or is causing environmental risks or impacts. If the project does not foresee any new major expansion, the audit constitutes the environmental assessment for the project. A typical environmental audit report includes the following major elements: (i) executive summary; (ii) facilities description, including both past and current activities; (iii) summary of national, local, and any other applicable environmental laws, regulations, and standards; (iv) audit and site investigation procedure; (v) findings and areas of concern; and (vi) corrective action plan that provides the appropriate corrective actions for each area of concern, including costs and schedule.
4 The Company’s Environmental Performance

4.1 Corporate environmental policies and management

Corporate environmental policies and management of the International Energy Corporation (IEC) operating the SH Cascade have been reviewed in respect of the relevant EBRD’s Performance Requirement PR1 Environmental and Social Appraisal and Management and the ADB Safeguards Policy Statement (SPS) 2009 Safeguards Requirements (SR) 1 on Environment. This was accomplished by the review of information provided by the IEC, and a visit to the facilities and offices of the IEC’s. The visit took place in August 2012. The Site visits to each plant included: walk through audit, interviews with management representatives and employees, verification of documentation on site, review of environmental, health and safety issues in terms of compliance to the local regulations, banks standards and best practise.

As a result of site visits and review of documentation it became clear, that EHS issues are not recognized as a high priority on the Company Management agenda; however, some issues are properly addressed because of experience and qualification of staff involved in operation. At corporate level there is no organizational unit responsible specifically for the environmental issues, and they are managed by technical division. In fact, the EHS issue are managed by the Deputy Director - Chief Engineer Oganes Sarkisyan, who ensures direct supervision of the technical division. The corporate organisation Chart is provided in Figure 2.1.1.

Each HPP of the company has the director and personnel comprising a Mechanical engineer and Operations Engineers. The plants are operating on 2 shift scheme, when they operate 24 hours /day. The Plant directors directly report on technical matters and EHS to the Chief engineer.

The corporation does not have a public relations unit, which would be responsible for information disclosure, public relations, community claims collection and processing. Public information and consultation was not priority in the past, so HR department was responsible for mentioned actions.

The important is that security is ensured by a subcontractor – State Security agency, which on contractual basis and in accordance with Armenian legislation secures plants against unauthorized entry and ensures perimeter security for each site. The most sites are equipped with video recording systems (CCTV Cameras); however, the responsibility for their monitoring falls under the main operator of a HPP. According to the IEC information, incidents of breaking or robbery have not had place in the company facilities; facts that security personnel used guns is never recorded and there are not public complaints in relation to their misbehaviour.

In terms of EHS management, the formal structure in the company is a very weak and needs development. The environmental documentation including environmental management plans, method statements and other relevant documents are not available neither at corporate nor at facility level.

In general, the company implements main environmental activities required during operation and maintenance processes; however, this has ad hoc character and seems that environmental performance is based mostly on the experience of staff involved in the operation. Specific activities performed are described in the subchapters below.

As the company does not have an environmental policy statement and formal EMS system in place, all issues are managed in accordance with the requirements of old GOSTs (former Soviet Union
standards) and guidelines prepared for operation of HPPs and power substations, high voltage equipment, labour health and safety, etc. as well as requirements of Armenian legislation.

**Recommendations**

The Company needs to develop the environmental management system (EMS) at corporate level based on main principles established by ISO 14001, including management, monitoring and auditing plans. Formalized ESM system inclusive all pertinent documentation and specific plans comply to EBRD and ADB requirements.

The system should cover whole operation process from the corporate level down to facilities. The system should address specific issues related to rehabilitation and construction activities.

The company should clearly define roles and responsibilities of departments and personnel involved in EHSS management and implementation of EMS. A clear organization structure in this regard should be established on the corporate level. Trainings on new ESM should be personnel involved in EHSS management and implementation so that to ensure that they properly understand principles and requirements of EMS and are capable to implement them.

**4.2 Compliance to National Regulatory Requirements**

Armenian Legislation does not require presence of formalized ESMS. However, the country has certain requirements for technical safety, environmental permitting, monitoring and reporting. In particular, requirements of the national law regulations to the company operations are as follows:

- The company should have a license for production and selling of electric power to the national grid.

  The company has the license, which is issued for 15 years on 01.09.2003, license N 0108. No separate licenses is required for each plant.

- The company should have for each plant water use for each plant permit, water user’s certificate, water use and discharge norms and norms for discharge of waste water and water born pollutants.

  All these documents are in place for all plants. Water use permits are in place for all plants. They are issued on 31.07.2012 and valid till 31.07.2015; number of permit for Sevan - #2093, Hrazdan - #2094, Argel - #2095, Arzni - #2096, Kanaker - #2097, Yerevan 1 - #2098 and Yerevan 3 - #2099.

  Water user’s certificates for all plants are issued on 04.07.12 and valied till 31.07.15; number of documents ##00058-00062.

  Water use and discharge norms for all planned are approved on 27.03.12 and valid till 31.07.15; ref. number of documents - ## 38 – 44.

  Norms for discharge of waste water and water born pollutants for all plants approved on 27.03.12 and valid till 31.07.15; ref. number of documents - ## 38 – 44.
- The company should prepare quarterly and annual reports on natural resources consumed and waste generated.

The company has respective reporting describing consumption of water, natural gas and waste.

- The company should submit monthly reports on water abstraction from the Sevan Lake and water allocated to the irrigation systems operated on the diversion system. The company ensures the requested reporting.

The company periodically undergoes the state ecological inspection, which includes checking of sanitary flow left in the river, visual verification of water pollution with oil, waste management, etc. As a result of these inspections the company have been fined several time due to violation of environmental law; however, violations were considered insignificant and fines were in the range 200-300 USD equivalent. In particular, requirement of the ecological inspection were the following:

- In 2008 - establishment of continuous control of water use to meet requirements of Water Use Permit
- In 2009 – implementation of measures to reduce water losses and effective water use.

All the HPPs are provided with water flow control gates, which enable measurement of used water. Reduction of water losses and effective water use will be ensured through rehabilitation of diversion channels, as well as improved efficiency of power generating units.

In accordance with Armenian legislation, rehabilitation of hydro power facilities does not require EIA study; however, EIA is required for reconstruction or modernization HPPs. The company classifies the proposed investment program as rehabilitation as main parameters of HPP facilities will not be changed significantly. However, Armenian law does not give clear definition of terms and difference between the terms “rehabilitation” and “reconstruction” and “modernization”. Due to this fact we do want to recommend, that prior to commencing the works, the legal and technical departments of the corporation evaluate in detail the local legal aspects and consult with state entities responsible for environmental permitting for planned rehabilitations.

In the planned rehabilitation works separately should be discussed dredging of the Yerevan 1 reservoir, as according to Armenian law, removal, recycling or disposal of harmful and other wastes require EIA study and the state ecological examination. Here should be noted that the EIA study was prepared and approved for the rehabilitation of Yerevan 1 HPP in 2010; however, the study is mostly focussed on rehabilitation works other than dredging and spoil disposal.

In regards to dredging, the above mentioned study indicates only small amount of material to be removed from reservoir, what is not consistent with the present plan. Besides, the study does not include information regarding spoil disposal sites or respective environmental requirements, including pollution level of sediments to be dredged. Respectively, it is not likely that the existing EIA study could be considered as EIA study for reservoir’s dredging and spoil disposal. Respectively, disposal site should be identified and proper ESIA study for the reservoir’s cleaning should be fulfilled; at least, the company should consult with the authorized bodies regarding national requirements of EIA for dredging and spoil disposal operations.

We do believe that in accordance with Bank’s requirements the EIA study is not required, as the project is assigned Category B;
Other project elements (such as channel reconstruction) require State Expertise regarding technical aspects (not environmental). Import and replacement of hydro units and other equipment also requires approval from the State Expertise (Gosexpertise).

**Recommendations**

It is recommended if the company will consult with the Ministry of Nature Protection and its National Environmental Inspectorate to clarify whether EIA is required for the planned rehabilitation program as a whole and for its reservoir’s dredging component.

### 4.3 Pollution prevention and abatement

Pollution Prevention & Abatement measures performed by IEC have been reviewed in respect of the relevant EBRD’s Performance Requirement PR3 - Pollution Prevention & Abatement. Main pollution risks associated with the company operations can be defined as following:

- Reservoir Management
- Management of oils and lubricants for turbines, transformers and support infrastructure;
- Management of lead/acid batteries
- Material /waste management

#### 4.3.1 Reservoir Management

Main environmental pollution issues during reservoir management can be related to disposal of dredged sediments and increased water turbidity during dredging operations.

Sediment dredging at present has place only from Akhparin Reservoir, which is in immediate downstream of Hrazdan HPP. Sediments to the reservoir is delivered by Marmarik River, which silt the reservoir and increase eutrophication. A floating dredging system is constantly operated in the reservoir to maintain required active volume and avoid blocking of the mouth of the Marmarik River. The dredger sends spoil via pulp pipes to the field in vicinity of the reservoir, where special disposal area is established. Drained water flows back to the reservoir. In the past, the facility operated inertial materials sorting plant converting spoil into construction materials: sand, crashed stone, gravel. However, the construction of an irrigation dam upstream on the Marmarik River has significantly reduced sediment transport to the reservoir and processing of dredged material became unfeasible. So the sorting plant’s operation was stopped. It is anticipated that the sedimentation of the reservoir significantly reduces as well due to the new upstream dam.

The dredger will definitely cause certain localized increase of water turbidity in the reservoir. Availability of main receptor of this impact that is fish is not assessed there. Dredging mainly has place at the river inflow point and turbid water is not likely to be released in the river channel, which is remote from the dredging area and water turbidity should not be an issue for river.

Sedimentation issue is of low importance for a daily regulation reservoir of Kanaker HPP and even less important for Argel HPP reservoir. The cleaning of mentioned daily regulation reservoirs is not included in the scope of the proposed project; however, it might be required in long term perspective. In such case the quantitative and qualitative assessment of sediments will be required as well as assessment of disposal methods and place.
Sedimentation is a significant issue for Yerevan 1 water reservoir (See Photo review, #43-45), as soon the reservoir factually has lost its active volume. Dredging of this reservoir is one of the challenging items of the proposed rehabilitation. The quality and exact quantity of sediments is not known; however, it is estimated that over 80 000 cubic meters of deposits could be removed. The impact assessment document prepared by the IEC in 2010 for rehabilitation of Yerevan 1 did not cover issues related with reservoir dredging and spoil disposal (as it was discussed in above sections), as the rehabilitation of the HPP infrastructure was deemed without dredging. As discussed in sections 3.1 and 4.2, the detailed environmental study for reservoir cleaning will be required in to fulfil local regulatory requirements.

**Recommendations**

Impacts due to maintenance dredging of reservoirs should be considered during development of EMS and related management plans so that to ensure appropriate management and mitigation of associated environmental and social effects. In particular, procedures incorporating assessment of sediments, management of spoil disposal, management of runoffs from disposal site, etc should be considered.

The study for sediment quality (pollution) and quantity should be conducted for dredging of Yerevan 1 reservoir to enable selection of appropriate disposal site and identify requirements for drainage/leachate measures. Sediment assessment can be fulfilled either as a separate project to assure, that future environmental studies is based on accurate data, or be incorporated in the possible environmental assessment process. It is very important to use qualified consulting company for sediment pollution and environmental study.

Important issue is selection of a disposal site. In accordance with Armenian legislation, relevant governmental body should be consulted regarding disposal and selection of dump site. It is very important to ask government to provide several (at least three) alternatives locations for disposal of extracted material. The study should include complex assessment of all these alternatives in terms of feasibility and environmental acceptance, and propose a preferable option respectively.

Important issue is pollution prevention during dredging, transportation and disposal of voluminous dredged material. Sediment control measure should be required to prevent spread of potentially polluted sediments and increased turbidity downstream reservoir. Special measures should be taken to avoid pollution with potentially polluted material and drainage water leakage from trucks during transportation. It is may be necessary to organise preliminary drainage of the dredged material on site in order to avoid leakages on public roads.

### 4.3.2 Management of oils and lubricants

**Turbine Oils**

Armenian legislation does not require monitoring of river water pollution with turbine oils. Accordingly, the IEC has no program regarding turbine oil monitoring and assessment of losses and formal procedures for accounting on oils and oil losses are not established.

In general, during the site visit the project team has not noticed any visual signs of significant oil pollution of the Hrazdan River. According to the company information, consumption of oils comprises about 20 tonnes per year (turbine and transformer); however no record-keeping on oil streams is in place on sites. It should be noted that the state ecological inspectorate has not fined the company for water pollution with oil for last years.
The IEC does not have centralized or special warehouses for storage of turbine oils and barrels with turbine oil are stored inside operation buildings, without proper demarcation, labelling, caution signage and registration of consumed oil. The staff on site was not able to provide documental evidences regarding the consumption of turbine oils.

Specific attention should be dedicated to the used turbine oils removed during the repair/rehabilitation works or for treatment. We were not able to see any used turbine oil accumulation area, except than one treatment unit located in the Kanaker HPP Turbine hall.

In some cases, floors seemed very slippery because of extensive use of oils (e.g. in the turbine halls of Argel, Kanaker and Yerevan 3) and probably insufficient clean-up of oil spills and adequate housekeeping.

**Transformer Oils**

According to the company information, about 150 ton of used dielectric oil will be removed during replacement of 110 kV switches. The major issue regarding used transformer oils is potential pollution with PCBs. The company has no information regarding PCB presence in old transformer oils. The company claims that there was investigation conducted as a part of international study for PCB presence in transformer oils in Armenia, but we were not able to review the relevant reports or study results. In fact there is a significant risk that PCB containing transformer oils is used in the infrastructure under the IEC operation, as transformers and high voltage switches are of the Soviet Union origin and provided in the mid-20th century, when PCB containing oils were widely used. Based on our experience, PCB containing oils were used mostly in high voltage switches.

As a part of the present program, the IEC has already started replacement of oil based switches with dielectric gas (SF6) based equipment. In most cases old switches are already demounted and disposed. However, the IEC still should carry out the program for PCB study for oil containing equipment and used oil storages in order to separate PCB containing oils and dispose them in accordance with international best practice. The important issue is not to mix PCB containing oils with others, as the later can be reused in the equipment.

According to the company information, new transformer oils supplied to plants is T-1500, which is produced in Russia. In compliance with material data safety sheet, T-1500 does not contain PCBs. New transformer oils are supplied and stored in in barrels, within power house buildings. The storage areas are not specifically constructed and does not have any pollution prevention arrangements. The storage areas are not demarcated from the main operation halls.

All the HPPs have an oil tank-yard, but they are out of operation at present. These are usually diked areas with vertical cylindrical reservoirs placed on concrete basement. The tank yards were built in accordance with the Soviet standard, which required the availability of oil reserves at each substation. At present the company is not required to maintain large size oil reserves. As we have been informed, the oil storage reservoirs are empty. We were not able to check transformer oils inside the reservoirs; however, it is likely that some oily deposits are inside the reservoirs. In most cases there were visual evidences of spills around the reservoirs. At present condition it is not possible to check whether the dikes are leaking, but most probably the integrity of dikes is lost. The photos of dielectric oil storage infrastructure showing evidences of oil contamination are given in Annex 2 (photos ## 14, 15, 39). Important is that in major cases oil tank yards are in the vicinity of river banks and river water pollution risk is quite high.
The exact quantities of waste oils is not available, accordingly it is not possible to evaluate, how much waste oil was generated during the past period. We have tried to collect information regarding the oil purchase in order to be able somehow to assess quantities of generated used oil. It should be stated, that company does not have requirements for monitoring of used turbine oils.

Company representatives has stated, that the consumption of oils annually reaches the figure of 20 ton, which includes both transformer and turbine oil, however the breakdown of oils by types and quantities is not available. It was also stated, that most part of purchased oil is turbine oil and share of transformer oils is very low.

**Recommendations**

1) In the frames of EMS the company should develop oil management plan, which describes:
   - issues related to proper handling and storage of raw and used oils to prevent spillage
   - requirements for testing of used transformer oils on PCBs to ensure separate storage of PCB containing oils
   - formalized procedures for accounting of oil usage and losses and respective record-keeping requirements
   - requirements to oil storage areas and facilities
   - oil spill clean-up procedures and tools required for clean-up
   - roles and responsibilities of personnel involved in raw/used oil management
   - disposal/recycling of used oils through licensed contractors, etc.

2) Central oil storage facility should be arranged by the company to store oil supplies and used oils

3) Oil storage areas should be properly arranged at each facility to ensure safe storage of oil supplies before consumption and safe storage of used oils before delivery to the central oil storage

4) It is recommended, that the IEC fulfils the project for removal of oil storage facilities and clean-up of the polluted territory. The dielectric oil storages are approximately of 200-300 square meter area at each substation and accordingly, clean-up should not require huge effort and resources. During demounting, residual oils and sludge should be removed from reservoirs and reservoirs should be cleaned before utilization. Removed slag and oil should be treated as hazardous waste and disposed in accordance with the international best practice. Contaminated soil removed during site clean-up should be treated as hazardous as well and respectively disposed/remediated. Authorized contractors should be used for disposal of oils and sludge and disposal/remediation of soil removed during clean-up. The documentation should be processed as required for registration of hazardous wastes.

**4.3.3 Management of Lead/acid batteries**

Lead/acid batteries are used in all power generated facilities operated by the IEC. Batteries are usually located in special rooms, which have a support room for preparation of electrolyte. The large amounts of sulphuric acid are not stored on sites, and battery maintenance is carried out by the company’s maintenance team responsible for battery infrastructure in all seven plants. The team have passed safety trainings and environmental trainings required for such maintenance activities.

Major concern regarding used batteries is that old battery cases should be disposed with care to avoid contamination with lead containing fluids and metallic lead with active surface. The IEC does not have formal document (method statement) for utilization or disposal of used batteries.

**Recommendations**

It is recommended to conduct search for Armenian companies having permit to utilize and recycle lead /acid batteries. If such company is not available, the IEC should organize special area for
temporary storage of batteries to ensure safe storage of used batteries and prevention of contamination. The proper documentation should be processed for accounting the batteries as hazardous waste. More details regarding the used battery processing are provided in the section on waste management.

4.3.4 Material/waste management

Material Management

The IEC does not have formal procedures and plans addressing housekeeping and equipment maintenance issues. In general the housekeeping in HPPs are at acceptable level, all facilities and yards look clean and tidy, however some issues can be highlighted. Material management is required only in relation of oils and spares; oil management is discussed in chapter 4.3.2.

As of spares and repair materials, their management is major problem in the company facilities. Some spaces in the power houses and in particular areas dedicated for repairing of large size equipment are blocked with pieces of old equipment or spear materials. It is necessary to remove all debris from sites (see photos #4, 12, 30, 34). The photos can be used as good representation of the existing situation. It should be mentioned, that this ‘blocked’ areas are not huge and situation can be improved easily, without significant efforts.

Recommendations

It is necessary to develop material management schemes on corporative level and ensure that it is implemented on each site in a way to prevent littering and pollution of surrounding environment. It is recommended to develop and implement Pollution Prevention Plan, which describes all types of materials used in facilities, by their types and hazard classes, procedures for safe handling and storage of these materials, requirements to storage areas, spill response and clean-up procedures for all materials, tool and equipment requirement for clean-up of small size pollution, roles and responsibilities of personnel involved in the process, etc.

Waste Management

A complex system for waste management does not exist in the company. However, certain information regarding waste collected from diversion channels is collected and respective report is delivered on quarterly basis to the local authorities. On the basis of this information the state authorities issued the waste passport to the company. According to the waste passport, amount of waste removed from irrigation channels comprises 800 t/y and it consists of sediment 50%, paper/cardboard 25%, textile 1.5%, rubber 3%, polymer compounds 4%, water 10%, other 6.5%. Recordkeeping on other wastes is not established in the company.

In terms of household waste, the IEC has contracts with local municipal household waste management companies.

Management of oil wastes and actions for oil clean-up, waste accumulators and dredged spoil is discussed above.

Another types of waste include are broken dielectrics made of ceramic or glass, scrap metal, residues of insulation materials etc. This kind of wastes should be disposed in accordance to the international practice and service availability in Armenia.
Important issue is management of debris left in yards after repair works, as they are pollution source and block access to some sections. It is very difficult to describe all sites separately, however it can be stated, that debris is presented as old, unused and demounted equipment, packaging materials, unused broken insulators, scrap metal etc. The good examples of dumped materials are provided on Photos ## 10, 11, 14, 27, 37 (see Photo review Annex 2). This situation definitely requires improvement: the company needs to ensure cleaning of all yards and management of collected waste according to their type and in line to the waste management plan.

One more significant issue is related with waste collected from the channels running through settlements. The problem is that local farmers, due to lack of waste management services, dispose domestic waste into the channels. Amount of disposed waste is significant: in some cases full dump trucks are discharged to the channels from nearby villages. Most part of this waste is collected at water intake’s screens, where operates special waste handling grapples to remove waste. The IEC does not have any specific procedure addressing this waste. The technical equipment used for waste removal from screens does not allow direct loading of waste on dump trucks; so waste is dumped and accumulated in depressions on the territory nearby to the grapples. This waste is not removed and disposed properly by the company or specialized contractor; instead, personnel working on site just burn it, what is a violation of laws and does not comply with any waste management requirements.

**Recommendations**

To improve waste management the company should develop a waste management plan, which provides comprehensive description of all waste types generated in the company facilities and their hazard class, procedures for collection, handling, labelling, storage and transportation of waste for each type, waste prevention, reduction and reuse strategies, waste accumulation areas for pollution prevention, record keeping system for waste streams, waste disposal requirements, roles and responsibilities of personnel involved in waste management, etc.

In order to improve management of waste removed from channels the best way is to organize waste collection points properly at all screens and dispose removed waste on local landfill. The design of waste collection areas and structures should be included in the project’s scope, as soon at the moment this issue is not addressed. For the improvement waste collection points can be provided with special bunkers located at height to discharge the wastes directly to trucks, or bunkers designed for special waste collection trucks could be supplied. As alternative, the IEC can involve in waste management contractors such are municipal waste management companies, which can provide bunkers and remove collected wastes from sites. The design of bunkers should be agreed prior to reconstruction of systems on site. The easiest way to handle the waste is using of skips and skip loader trucks. In such case the collection site should be designed for discharging the waste to the skips.

The burning of wastes on site should be restricted and all employees should receive training on waste related matters.

**4.3.5 SF6 management**

As mentioned above, the rehabilitation program considers replacement of oil switches with SF6 insulated ones. Part of new switches is already installed at substations (Picture 53). SF6 insulated switches are provided with manometers to control SF6 pressure inside them. Manometers are
connected to computers and recorded electronically. So any leakage of the gas can be detected immediately. Besides, the company has manual SF6 leakage detector device, which is required to determine exact place of leakage after pressure drop is recorded. All system is new and no upgrading of equipment or procedures is considered necessary.

4.4 Potential Adverse Impact on Environment

The potential environmental impacts from Project activities have been analysed in respect of the relevant EBRD’s Performance Requirement PR6 - Biodiversity Conservation & Sustainable Natural Resource Management and the ADB Safeguards Policy Statement (SPS) 2009 Safeguards Requirements (SR) 1 on Environment.

The very first water intake is located within the boundaries of the Sevan Lake National park. The gate is constructed in place of a historical discharge point of the Hrazdan River, which was converted into the water intake for the Sevan-Hrazdan irrigation–hydropower scheme. Later on some measures were implemented for protection of fish and the Sevan Lake. On governmental level decision regarding restoration of water level in the Sevan was adopted, and the water management for the lake became important issue. In accordance with local regulations, water abstraction volume from the Sevan Lake through the Sevan-Hrazdan diversion system should be approved by the Parliament of Armenia, in order to ensure adequate protection of the Sevan Lake. The IEC has no tool to influence this decision, and the company utilizes water energy upstream irrigation systems and water left after irrigation downstream them.

The most important and protected site connected with HPP cascade is Sevan lake. The IEC can not influence the lake itself, as soon all facilities are located downstream from lake as it was mentioned in previous chapters.

The Sevan lake is biggest and most important surface water bodies in Armenia and is protected by law. The environmental and ecological conditions of lake was significantly impacted by the anthropogenic factors. The improper management of resource caused significant drawdown of the water level. The over exploitation of resources of Sevan lake caused significant impacts on overall ecology of basin and surroundings.

The lake is one of the largest fresh-water high-altitude lakes in the world. Lake Sevan is situated in the central part of the Republic of Armenia, inside the Gegharkunik Province, at the altitude of 1,900m above sea level. The total surface area of its basin is about 5,000 km², the lake itself is 940 km², and the volume is 34.0 bln cubic meters. It is fed by 28 rivers and streams. Only 10% of the outgoing water is drained by the Hrazdan (Razdan) river, while the remaining 90% evaporates.

Before human intervention dramatically changed the Lake Sevan ecosystem, the lake was 95 metres deep, covered an area of 1,360 km² (5% of Armenia's entire area), had a volume of 58 km³ and a perimeter of 260 km. The lake surface was at an altitude of 1,916 m above sea level. The decline had two major causes: desiccation of spawning grounds and submersed macrophytes, and eutrophication of the lake.

There are six fish species in Lake Sevan basin, of which four are native and two introduced. Two native species Sevan trout (ishkhan) (Salmo ishchan sp) and Sevan beghlu (Barbus geokschaikus) are in the Red Data Book of Armenia; other two native species represented by Sevan koghak (Capoeta
capoeta sevangi) and khramulya (Varicorhinus capoeta) are also in decline\(^3\). These fish species were considerably impacted due to water level drawdown and fluctuation in the lake.

Countermeasures employed by fishery managers were: introduction of the pelagic whitefish (Coregonus lavaretus sp) in 1930s, which now represents 80% of the total fish catch and Giebel carp (Carassius auratus gibelio Bloch) in 1980s, which also established strong stock in areas rich in aquatic macrophyts; besides, water level fluctuation has been also minimized as much as possible. It is planned to gradually increase the water level in order to restore some of the lost trout spawning grounds, increase the dissolved oxygen levels and reduce eutrophication\(^4\).

Several environmental initiatives and programs have been implemented on the lake addressing different issues from restoration of Lakes level and finishing with clean up and removal of pollution sources. Especially the programs were focused on restoration of fish population and minimization of eutrophication process.

In terms of fish protection, water intake at the Sevan Lake is equipped with a screen which prevents large fish entry into the division system and a special protection system designed by the scientific community is provided for fry. The system is in operation at the moment and is based on flow rate difference between a stream directed to water intake and water flow rate in the lake. The system’s operation principle seems to be that the small size fish avoids fast streams and prefer to stay is slow water. From this area special pumps return water together with fry back to the Sevan Lake. The system facilities used for water pumping are well maintained and seem to be well operating. However, the effectiveness of the existing system has been never checked, and there is no monitoring in place downstream the fish protection facility to evaluate its effectiveness by amount of fish passing through the protection unit. Judgement on effectiveness of fish protection facilities based on fish surveys in the Sevan Lake is not reliable, as according to various publications regarding Sevan Lake, fish population is impacted due to several factors such as historical water drawdown in the lake, intensive fish harvesting and regulation of fish catching, and introduction of non-native species, which are food-competitors for some native species\(^5\).

The State Environmental Inspectorate performs scheduled checks of the protection system’s condition and operation stability. Besides, environmental NGOs are actively involved in the Sevan Lake protection. Based on the available information, it can be stated that the facility provides adequate protection and the company have never been fined by official structures in this regard.

In terms of the IEC and Cascade operations as well as planned activities, it can be concluded that the requirements regarding protection of the Sevan Lake are met. The fish protection system is working properly and rehabilitation is not planned; neither rehabilitation of other headwork facilities at the Sevan Lake is planned and respectively, the planned project cannot affect the Sevan Lake.

The important issue during the operation of the hydropower scheme is parameter regarding minimum allowable riverbed flow, sometimes called ‘Sanitary flow’. This parameter is very important to support biodiversity and protect fish against degradation. In case of the Sevan-Hrazdan Cascade,\(^3\)

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\(^3\) Integral Assessment of Ecologic Status of Sevan Lake (GEO-Lake Sevan), Association For SHD/UNEPCom, 2011

\(^4\) K.A. Savvaitova, T. Petr, Fish And Fisheries In Lake Sevan, Armenia, And In Some Other High Altitude Lakes Of Caucasus (http://www.fao.org/docrep/003/X2614E/x2614e13.htm)

\(^5\) Lake Sevan, Experience and Lessons learned Brief, A.Babayan et al

Restoring the Fallen Blue Sky: Management Issue and Environmental Legislation for Lake Sevan, Armenia, Douglas Lind, Lusine Taslakyan, Environs, Voll. 29.1, 2005
the situation is specific, as soon the natural riverbed was completely dried out several decades ago along the section between the Sevan Lake and the Hrazdan HPP; so impact on biodiversity due to water diversion is not an issue for this section. After the Marmarik River inflow, there is a stream in the natural river bed; however, the flow is very limited and significant eutrophication of river channel has a place along some sections due to high biological pollution levels and natural conditions (warm weather in most part of year).

We have evaluated the requirements applicable to the minimum river flow; however, specific documents in this regards does not exist. There is no information in Armenian legislation in this regard as well. The routine procedure followed by the Cascade team is to allow a minimum 0.5-1 m$^3$/sec flow in the river channel and flush river channel with at least 5 m$^3$/sec flow once a month. The only document which provides limits for water flows is “Water extraction/discharge limits” which only determines amount of water to be discharged per year; however, there is no limit for minimum flow rate.

The EU approach on this matter is different. The recommendations usually provide the minimum flow to be maintained in all times. The EU directive allows limits for the dry seasonal flow, when minimum discharge is calculated for 90 days period. Besides, there are several methodologies used in different countries for the minimum flow calculation. Methodologies are usually based on local situation and there is no methodology applicable for all rivers. Usually the minimum flow is calculated as a portion of average or minimum multiannual flow. Sometimes calculations are based on ecosystem vulnerability, reduction of wet perimeter of the channel, other water uses, etc.

We do not expect aggravation of this situation can state that routine operation of the cascade will not cause further degradation of the biological diversity including aquatic life; however, neither improvement is anticipated in short-term period, as a complex, state level river restoration program is required for that.

Some environmental impacts are expected from dredging operations of the Yerevan 1 reservoir. This is very important issue which can affect the biological environment downstream from Yerevan 1 dam. The issue should be discussed in detail in EIA study to be performed for reservoir dredging. It is expected that the corporation will employ effective methods for minimization of water quality degradation downstream during the dredging operations. The EIA study should clearly indicate what engineering methods should be employed for working in the river bed, works should be scheduled to avoid fish spawning seasons, measures should be developed in place to restrict release of suspended solids downstream dredging site, other prevention/mitigation measures should be defined to prevent/reduce anticipated environmental impacts.

**Recommendations**

EIA study for the dredging of Yerevan 1 reservoir should discuss in details anticipated environmental impacts and propose adequate mitigation measures for reduction of significant impact to acceptable level. This could include engineering methods to be employed for working in the river bed, scheduling of works to avoid fish spawning seasons, measures restricting release of suspended solids downstream dredging site and other best available practices.

It is recommended if the company develops and implements a river monitoring program with the aim to enable designing of river restoration program in long term.

5 **The Company’s Occupational Health and Safety Performance**
Occupational Health and Safety performance of the IEC has been reviewed in respect of the relevant EBRD’s Performance Requirement PR2 Labour and Health and Safety and the ADB’s 2001 Social Protection Strategy Requirements.

5.1 **Key Occupational Health and Safety Issues**

The IEC corporation approach to health and safety (HS) issues is based on local legal requirements, the former Soviet standards applicable for power house and substation operation as well as operation guidelines for hydro technical facilities having significant risk in terms of occupational safety.

On the corporate level, HS management is under the responsibility of the Safety Engineer, who has to maintain documentation system, provide support in preparation of safety training format, collect information regarding trainings carried out and control operation of training officers in each HPP.

The main part of HS programs employed at the corporative and facility level are related with safety trainings for operation and maintenance of electric systems inclusive high and low voltage transmission systems, substations, transformers, switchboards and other electrical equipment. The safety trainings also include training regarding first aid and the materials on first aid programs are also available in each facility. Each facility also has first aid kits, which are regularly controlled and replaced when necessary.

Special programs are dedicated to the specific operations like diving. This programs include full scope of safety trainings by authorised organizations responsible for granting operation permits to the personnel involved in the operations having high health and safety risks.

Each employee authorized to work with electric systems has to pass test (exam) on safety and safe operation systems inclusive golden rules for exploitation of power infrastructure. The trainings and exams are conducted by safety departments in each plant. It is a requirement of the local legislation to keep records regarding delivered safety programs. The log books are available in each facility.

5.1.1 **General safety on sites**

The safety system on sites is based on ‘Rules for exploitation of power generation facilities’ adopted by the Armenian state safety inspection. Description and discussion of all safety issues is definitely very difficult and is out of scope of present assignment; however, we would like to highlight some major issues which should be addressed and respectively, are included in the ESAP. These basic recommendations should crate the basis for general safety at all sites, and site/operation specific rules should be built on this basis.

The first impression is that general safety is not properly addressed at a corporate level. None of the employees is specifically responsible for implementation of safety requirements and preparation of documentation regarding general safety requirements on corporate level. The materials available at Safety engineer’s office have fragmented character and is based on general guidelines for operation of hydropower plants.

The company staff does not receive golden rule training on general safety risks. The impression was, that electric equipment operation is pretty much in line with local and international principles, however the general safety requirements are not in place and are not followed by the personnel.
In terms of PPE usage, the rules are not followed on site; The clear document regarding the requirements to use PPE’s on site is not available, accordingly it was not possible to verify the real operational process with document. The simple observation was, that employees do not wear helmets, safety boots, glasses or gloves.

In reality, from all sites visited it can be stated, that usage of PPE’s in electric systems is pretty high, but usage of PPEs in general operation is low. The operation crew practically was not using any helmets, in some cases the safety boots were used, but this was very rare (approximately 1 case per 10 employees). From documentation on site it is very difficult to understand, where the PPE’s should be used and where they are not required. The cases for usage of high visibility wests was also rare, however it cannot be clarified is it required or it is not. The statement of company management regarding the PPE sage was that helmets are available; however the employees refuse to use them. Regarding special footwear, there are no definitions, however it is presumed, that footwear should be obligatory in case of heavy equipment operation.

Here we don’t talk about specific requirements like special PPE’s for high voltage systems or PPE’s required for say electrolyte management in battery section of plant. All those are in place and used by the personnel. There are plenty of cases when the employees does not use PPE’s even in cases when usage is absolutely obvious. As an example, we have seen workers at substations or maintenance crew working on power generation units without PPE and any safety precautions.

The records on safety trainings are maintained in each facility, and all employees, passing the training has to sign the logbook for training records. Important issue is, that there is no system in place for introductory training dedicated to the visitor’s and contractors. The general safety rules are not delivered to all visitors or other individuals entering to site.

**Recommendations**

We recommend to improve the training system dedicated to general safety on sites via organisation of courses for general safety trainings for all employees, including technical staff and supporting personnel such are guards, unskilled labour etc. This course will be probably too simple for technical personnel; however, important is to cover all staff to ensure that general safety issues are correctly addressed.

In order to ensure work safety, the general rules should be prepared and included in safety management plan. The plan should include description of general approaches in terms of safety at corporative level, additionally for each facility the schemes with indication of zones where PPEs like helmets, safety glasses, footwear should be used (Scathes and maps should be provided for all facilities) should be prepared. During zoning can be defined spaces where PPE are not required, ordinary PPEs like helmet are sufficient, or PPEs for power infrastructure, earplugs, high visibility dressing or other specific PPEs are required. Besides, signage and demarcation of different zones should be provided in all facilities.

Important issue is also safety trainings for maintenance and specific action crews. It is also recommended to implement safety internal and external monitoring systems inclusive CCTV, internal audits, unexpected checks, etc. All this should be employed to force technical workers and support labour to follow the rules and work safely.
The establishment of system for internal auditing of safety infrastructure in place is recommended in order to identify places with high risks and necessity of safety structures to be replaced, rehabilitated or installed. This is mostly related with safety rails, staircases, handles, top covers, grills etc. The special team should be inspecting all sites and recommending technical needs for improvements.

The induction trainings and safety orientations should be delivered to any visitor, as soon the visitors should understand risks and safety requirements, and should be aware how to behave in emergency situations. The logging of all visitors is absolutely necessary to know how many persons are inside the facility - this information is absolutely necessary for emergency response teams. This is particularly important for underground facilities, where the risk of blocking inside structures is significant.

The top management’s understanding and willingness to improve the general safety on sites is crucial. Preparation and adoption of safety policy, safety rules and respective training materials, should be facilitated by the top management.

In general it is estimated, that instant improvement is not possible and the HS situation should be improved step by step. It is recommended to prepare long term plan focusing on HS improvement on site.

5.1.2 Safety in operation and maintenance of power equipment

The IEC operates and maintains power equipment based on ‘Rules for technical exploitation of energy units’ and ‘rules for exploitation of power networks and substations’, the reference documents adopted by the local regulation and controlled by the State inspection.

There are no major concerns in the field of safety during operation or maintenance of power systems, as soon respective training and instruction programs are in place, technical tools and equipment for disconnecting of particular sections are also available, personnel has adequate skills and experience regarding safe operations, and special PPEs inclusive insulating gloves, power tester, insulated boots and pads etc) are provided for this purpose. The procedure for testing and validation of PPEs and equipment required in power safety systems are also in place and enforcement on sites is strictly monitored. Special training is provided regarding usage of special PPEs and tools including power indicators, helmets, dielectric gloves and boots as well as special pads, where personnel should be standing during the maintenance activities.

The system used for safety during the maintenance works on power systems is based on tags, indicating, that works are under implementation and circuit is disconnected from power, however the lock out-tag out methodology is not in place. The international requirements on such operations is recommending usage of lock out tag out systems and considers physical locking of switches; At the moment only in high voltage systems has special technical tools giving possibility to lock the switches in order to restrict unauthorized switching of disconnected part.

Before starting maintenance works, the responsible engineer disconnects all equipment where the maintenance works should be implemented, demarcates the zone, personally checks grounding of each equipment (does not have right to dedicate the job to other employees) and allows maintenance crew to enter the site.

One more issues noticed on site is related with physical restriction of unauthorized access to the high voltage facilities; in some cases substations are not physically (with proper fence) demarcated from operation yards.
Recommendations

It is recommended, that the safety systems for operation of high and low voltage power equipment should be developed taking into account the requirements of international best practice and OHSAS.

The ‘Tag out-lock out’ systems are not used in the company. The implementation of ‘western’ methodology will be difficult and probably will not be adopted by the state organizations, however we would still recommend moving to Lock out-tag out methodology in long term perspective, with adoption of procedures by the state inspection and getting no objection on new procedures.

As it was mentioned above, some high voltage substations are not physically demarcated from the other areas of HPP or substations. The territory of each HPP is well controlled by the staff, however, this cannot ensure that some personnel will enter on the territory of substations. This should be improved in the future, even if entry to operation yard is restricted and unauthorized personnel is not allowed to the substation because still there is a risk of unauthorized entry. All substations should be demarcated by the fences and unauthorized assess should be prevented.

5.1.3 Lifting equipment

The operation and maintenance of lifting equipment is usual and very important part in hydropower plants, as soon they are required for installation and maintenance of large size equipment such are turbines, power generation units and support infrastructure. Respectively, each facility has and operates heavy duty installed cranes in the power generation main halls. The lifting equipment is inspected and tested by the state authorities responsible for safe operation of lifting equipment. The IEC has agreement with state authorities and on pay bases employs the professionals from state structures to carry out inspection and validation of lifting equipment. All cranes have documentation and passports. The general operation rules for lifting equipment are also available on corporative basis and are approved by the company management.

From site inspections, the project team had impression that the lifting infrastructure is well maintained; however, there are some minor issues to be accounted and addressed to improve safety of operations and prevent possible accidents:

1. The corridors under lifting equipment are not marked and written procedures for staff members during the operation of cranes are not available;
2. The extensions of lifting wires and felts are not maintained and stored properly: in some cases we found the lifting felts on the floor. The validation tags were not available on the equipment indicating maximum load.
3. The responsible personnel should have and maintain the validation records both at corporative and facility levels. The records can be even maintained internally on electronic bases.

Recommendations

- the documents should be prepared and issues like demarcation, warning signs etc should be installed at all sites;
- The areas under the lifting equipment should be marked in order to inform employees and visiting personnel regarding operation of lifting equipment.
- The lifting felts and extensions should be checked regularly and stored properly when not in use, the validation tags should be applied;
- The validation tags should be available at all sites.
5.1.4 Pressure Systems

The operation of pressure systems is very important for the facility, as soon most of the infrastructure and technical equipment operates at increased pressure conditions. The technical personnel is well aware regarding technical equipment and understand risks related with increased pressure equipment; but the technical documentation and written instructions in this regards is not available neither on corporative nor on facility level.

Within the scope of present assignment we were not able to assess high pressure systems in detail; however, general understanding was gained based on discussion with technical personnel and staff involved in such operations. The operations are conducted in accordance with general rules for exploitation of power generation facilities, which practically covers part of the safety issues related with high pressure infrastructure. Specific documents dedicated to this issue are not available in the company.

Recommendations

The instructions regarding works with high pressure infrastructure should be prepared and adopted on corporative and facility level, and all employees should be aware regarding the related HS precautions and actions to avoid pressure related incidents. The detailed descriptions of safe operation of hydraulic, pressurized gas and vacuum systems should be given to operating and maintenance staff. The records should be kept regarding safety trainings and validation of pressure equipment. Incident and near miss records should be included in incident recording system described in specific chapter.

5.1.5 Confined Spaces

The same approach as in case of pressure systems should be applied to the works in confined spaces. The definition of confined spaces, their locations in the facilities and general rules for operation inside them are not documented in the specific instruction, however instructions for operation of divers inside the confined space is available.

At time of site visit, there were no activities performed in confined spaces, accordingly we were not able to check and observe the system in operation, however it was clear, that the operation documentation is not in place.

The safety of working crews should be ensured and all required actions are in place taken to avoid blocking of personnel, preventing of life risks and minimizing of accidents risks in confined spaces.

HS trainings delivered to the personnel working in confined spaces should include detailed description of risks and rules how the mentioned risks can be minimized or avoided. Logging of activities performed in confined spaces can be introduced as a part of HS recording system.

5.1.6 Working at heights

Due to the specifics of the company operations and complexity of the system, work at heights is very common for the company staff. At corporative level we have been informed that the general rules for working at heights are respected, and safety equipment for working at heights are regularly purchased and used; however, on sites we have not seen crews at action.
The specific documentation for working at heights or records on respective trainings were not available in the company. So it is difficult to judge regarding the safety level during operations at heights. We have been informed, that safety belts are available for the crews working on heights, however we were not able to see such equipment and to verify acceptance of technology used, because there were no works under implementation.

**Recommendations**

- The general document on working on heights should be developed; All types of activities should be described in the plan;
- The documentation for working on heights should include requirements for implementation of such operations, specification of equipment to be used during such operations and safety measures to be taken by other staff members should be described in developed document;
- Safety belts should be a part of the repair crew’s equipment and the belts should have valid authorization.
- Stair cases and other climbing equipment should be registered in specific log books and should be inspected regularly, to ensure that risks for personnel are adequately managed.

5.1.7 **Management of works under water**

The specifics and profile of the IEC operations requires certain works to be conducted by divers under the water. The Company is employing the divers for technical maintenance works and has the technical documentation for implementation of diving works. The documentation includes all required preparatory works inclusive preparation of method statements with detailed drawings with indication of operations to be performed.

The review of the existing documents did not indicated any major gaps, and it can be considered that significant improvements are not needed; however, the procedures for accidents and near miss registration should be integrated in the general procedures.

No recommendations are required in this regards, as soon all works are accomplished in accordance to the existing legislation and rules.

5.1.8 **Safety Signs**

The situation with safety signs on site can be split in two parts: the safety signs for electric installations and general safety signs.

In terms of safety signs related with power infrastructure situation and set up is made relevant to the requirements for the rules of power equipment operations: high voltage and power hazards indications are provided practically on all equipment installed in the facilities. Safety signs to be used during the maintenance and repair of power infrastructure are also provided; however, they are very old and partly damaged. The replacement of the safety signs probably is not required as soon the technical inspections conducted by the state officials does not indicated such need. However, in our opinion, the issue related with safety signs should be inspected regularly by the company, and recommendation in case of sign shortage should be given to procurement department.

The situation regarding the general safety signs is worse: very few general safety signs are in places and they are very old and not visible. The signs addressing the PPE usage practically do not exist. They are required in order to remind regarding the necessity of special precaution actions to mitigate impacts or risks. Emergency signs regarding pressure systems, warnings for wet or slippery surfaces,
steep slopes, dangerous areas, hazardous materials etc. are not provided at all. The exception is battery sections and acid and electrolyte preparation rooms where the appropriate signage was provided, however the signs were very old and in some cases not visible.

**Recommendations**

It is recommended that each facility prepares the signage plan and the company ensures their approval and implementation. Special attention should be dedicated to the signage for exits, emergency routes and warning signs at entrances of specific infrastructure sections. The signage should be provided inside the buildings of each facility as well as operation offices, maintenance facilities etc. The signage should be compatible with Armenian legislation. However, we believe that requirements of Armenian legislation are not up to international best practice. Taking into account mentioned and with the aim to be compliant with Bank’s policy and requirements, the IEC should also consider the international best practice and requirements for signs.

The signs dedicated to the external (community, contractors) HS issues are discussed in the respective section of the present document.

5.1.9 **EHS issues related with contracts**

The Corporation will employ contractors for most part of the works planned within the proposed rehabilitation program. The Corporation has limited experience working with contractors. Usually contractual relationships are established on a project bases and is related with specific scope of work; however, it is not clear what procedures are followed for establishment of approved list of subcontractors.

One of the requirements to the company’s future ESMS system should be dedicated to the issues related with contractors’ management and their responsibilities in the environmental and EHS fields. All responsibilities in EHS field for all operations to be conducted by contractors should be delegated properly. This requires thorough understanding of corporate policy requirement and respective EHS responsibilities. The contractual documents should be prepared at high standards and include EHS requirements, and procurement department of the IEC should ensure that potential contractors fully understand the company requirements, and compliance to local regulations are not enough to satisfy mentioned requirements. The input for legal department will be also necessary for such actions, in order to harmonise local and international requirements.

It is very important, that contractor is informed prior to engagement regarding the issues to be respected during the dredging or channel rehabilitation works. Main requirements during the dredging will be related with transport management, with operation in the river channel in a way to minimize the impact on fauna and especially on river aquatic life. In terms of the channel and tunnel rehabilitation works the main issues will be related again with traffic management, cleaning and washing of the concrete trucks, disposal of the waste material, effect on local population etc.

In respect with electric equipment installation and maintenance crews, the general HS requirements should be in place. During the site visit the working crews were not equipped and dressed properly, were not wearing special footwear, helmets, high visibility wests etc. The issues related with operation safety were not respected.

**Recommendations**

In accordance with international best practice we recommend the IEC to establish a list of approved potential contractors, who has experience and is capable to provide required services at good international EHS standard.
Prior to engagement of contractor’s they should be informed regarding the specific and more strict than country legislation requirements and contractor should be informed accordingly;

The IEC should take responsibility for supervision of contractor’s performance and in case of non-compliances or proper operation should have internal reporting to the corporate management and the specific contractual tools should be available to force contractor to respect the obligations.

5.1.10 Workplace Environment

Within the scope of assignment we have tried to collect information regarding working conditions in the company facilities. Practically 70% of positions at HPPs are accounted as dangerous. Major work related hazards and risk are related to workplaces in underground facilities, high level of noise and vibration, exposure to electro-magnetic fields, temperature exposure at some sites, etc. The assessment of work spaces has not been done and there is no information available regarding the workspace safety. This issue is addressed by local regulations which establish time limits for working in specific conditions.

The assessment of work places is not easy job to perform as soon it needs complex assessment of workspace. Another difficulty is that in some cases it is not feasible to manage unfavorable work conditions in large buildings (e.g. temperature management through improved ventilation is rather challenging). In such case common practice is to address issues by reducing work time and increasing number of shifts though establishment of dynamic work schedule. It is recommended to start workplace assessments during the implementation of the proposed project; however, the full assessments does not seem be possible within the time scale of the project and instead, this should be a long term target in the corporation development plan. At the same time, some improvements should be put in places where unfavorable work conditions are easily identifiable and manageable.

5.1.11 HR Policy

The company’s HR policy is in line with the national requirements. For management of the HR issues the company has a personnel manual, which discusses major issues such are work time for non-hazardous and hazardous works, payments for overtimes, night shifts and hazardous works, medical checks, dismissal terms, etc.

According to the company policy, time limitations are applied to hazardous works. Personnel working in high risk areas and/or night shifts are paid higher salaries. Overtime works are remunerated. The total number of corporation employees is about 450 persons. The salary levels ensure, that the human resource flow is very low. The low flow of employees is not only because of the salaries, but also because of the specifics of work, high unemployment in country and in the areas where the HPP’s are located.

The percentage of women employed is low. IEC at the moment of site visit was employing 81 women which is approximately 5% of overall workers employed. From mentioned female staff 11 are on technical positions, 9 are managers at medium level positions, 26 are working in Hydro water plants. In line with local requirements and in accordance to best international practice company is providing special benefits to women. The tendency of increasing the women share in total employment is clearly visible in accordance to the corporation employees, however the quantitative evidences have not been reviewed.
The HR policy of IEC states special provisions to support women workers especially this covers maternity leave period, additional holidays etc. Each employment contract for women, in employ requirements are stating the conditions for employment.

The low share of women in the company, in our opinion is due to traditional approach in energy sector that the work is very hard, and only few women were keen to work in Energy sector in country. The other factor is that only part of personnel is working during normal working time, and majority of employees are working in shifts; accordingly the work in shifts is less attractive to women than to men. Important is also, that majority of jobs are qualified as hazardous jobs and also are less attractive to women.

The company operation policy does not include special statements or requirements addressed for non discrimination of women workers, however in accordance to the employees they can not remember any cases because of sexual harassment or sex based discrimination.

During recruitment of personnel for positions requiring working in hazardous conditions the company requires that candidates pass through medical examination to ensure that the selected person does not face significant health risks. Besides, the company staff passes annual medical examination as well. In case of dismissal employees are given respective reasoning. The company should inform a person 2 months in advance before dismissal and pay compensation.

The company does not have an internal grievance management system. Personnel’s claims are managed through informal procedures, on bottom-up approach, that is issues are first delivered to immediate supervisors, which involve higher level management if cannot solve problems themselves. It is recommended that the IEC establishes formalized internal grievance mechanism to ensure that all concerns and claims of personnel are adequately addressed.

During the implementation of proposed rehabilitation project and preparation of ESMS system for company operation, the special attention should be dedicated to the gender issues and possibly more benefits should be offered to women workers in order make work at IEC for women more attractive.

5.1.12 Safety Records

The safety records available on corporative level include only information regarding attendees of safety trainings for the personnel involved in operation power systems. All staff of the company also signs the induction training log list. The induction training covers the general HS items for workers employed in Power generation and power transmission systems.

The records regarding accidents and near misses are not available. The IEC staff has stated that there were no incidents during the past operation; however, it can be assumed that no registration system exists. From the interviews it was clear that some incidents had had place, some of which having significant outcomes. A good example supporting this statement is the failure of the emergency spillway at Argel HPP in 2006, when the river channel was blocked and part of the HPP building was flooded. The documentation regarding this incident is not kept and presumably other cases have not been recorded as well.

We recommend the company to establish the hierarchal system for incident and near miss recording. This can be separate log-books for incidents related with HS of employees or infrastructure; though, records can be incorporated with other recordkeeping as well. The log book should be readily
available at the IEC headquarter, information collected should be analysed and reported to the top management. The analysis should include recommendations for respective measures to be taken in order to minimize and prevent accidents.

5.2 Fire Protection and Major Accidents Control

Fire safety of the facilities is managed on corporate and facility levels. On the corporate level fire protection issues are managed by the technical department. The technical department determines fire protection measures which should be in place at each facility to ensure fire safety and meet national standards. The technical department together with facility staff designs fire emergency plans, checks implementation of company standards at each level and determines need for improvement. According to the company’s fire protection policy each facility under high fire risk (power houses, sub-stations, oil storage areas and control buildings) should have an approved fire response plan and fire fighting procedures for each high risk facility, fire extinguishers and other fire fighting equipment, and personnel should periodically receive fire safety instructions. Fire response plans should be reviewed and updated once in three years.

As the visits showed fire safety measures are factually standard for all plants. These mainly include:

- Approved fire response plans and procedures, which are available at all plants and for all high risk areas, including power houses, sub-stations, oil storage areas and control buildings. Fire response plans show access routes to be used for fire fighting. Fire fighting procedures describe safety measures which should be implemented before or during fire extinguishing to avoid escalation. Scheme showing layout of fire fighting equipment is provided at each facility.
- Fire extinguishers which are provided for power houses, sub-stations and control buildings. Majority of them are outdated and they are being replaced at the moment. New extinguishers are already delivered at plants, though not put in place yet in some cases (photo 46). According to the company information, extinguishers are checked periodically by the technical department as well as respective state service. However, no check records are available in the company.
- Other fire fighting equipment, which are also provide for power houses, sub-stations and control building. They include send, baskets, shovels, etc (photo 5).
- Instructing of personnel, which according to the company information is periodically delivered to staff by the technical department of the company and facility manager; however, the company does not maintain respective records.
- Buildings have an emergency exit.
- Emergency lightings are installed in all buildings.
- Vegetation control as the sub-stations, which is done mechanically.

In addition to the above mentioned measures, the sub-station of the Arzni HPP’s is provided with water sprinkler system (photo 29), as the sub-station is arranged in enclosed area. It should be mentioned that due to upgrading of transformers and switches oil storage areas factually does not contain oil and respectively, fire risk is at minimum for these sites.

No automatic fire detection and extinguishing systems are found in other company facilities. According to the company information, fire fighting systems present at facilities are up to the national requirements.
Though the company has certain fire safety standard on corporate and facility level, but some problems were clearly visible. The list of the major problems is as follows:

- Facilities have not evacuation plans, evacuation routes are not determined and marked in buildings
- Personnel’s registration system does not exists for underground facilities
- Check records on fire fighting equipment are not maintained
- Access to fire fighting equipment is often restricted by various objects due to poor housekeeping practices (photo 30)
- Empty and full oil barrels, wooden and plastic debris, mown dry grass, etc which contain fire escalation risk, are found factually in all spaces. Besides scattered objects may become a barrier during fire evacuation
- Air flow rate is rather high at some facilities (e.g. underground facilities), what is likely to acerbate fire and complicate fire fighting
- Grass is not always mown at sub-stations.

Respectively, the company should implement measures to improve the situation. First of all the company needs to introduce and implement good housekeeping standard in all facilities to ensure free access to fire fighting equipment, free passages for emergency evacuation and removal of easily flammable materials. Besides, evacuation plans should be developed for all facilities and respective evacuation routes should be marked in all buildings. It is recommended to organize fire safety training for personnel once evacuation plans are prepared to ensure that all staff members are fully informed and instructed regarding measures introduced.

Personnel’s registration system should be provided at least for underground facilities to ensure that all personnel are evacuated during emergencies. It is recommended if the company reviews sufficiency of fire fighting measures in place for all facilities with high ventilation rate and makes respective upgrading if required. It is also recommended to improve vegetation control measures at sub-stations, that is ensure regular mowing of grass there.

In addition, the company needs to introduce recording system for documentation of fire fighting equipment’s checks and personnel’s instructions/trainings.

Among major incident risks related to the company operations the flooding downstream dams during river’s high water period, or high discharge from spillway to remove water from power house should be also included; flooding may also be result of diversion system’s failure. Flooding risk mainly endangers population in the neighbourhood of the hydro power scheme, as well as engineered structures located in close proximity to or in the river course. As mainly community safety is a concern during flooding, this issue is discussed in respective section.
6 External Social Performance and Management

6.1 Potentially Affected Communities

External social performance of the community including community health and safety, impact on vulnerable groups, etc will be discussed in respect with the following population: Kanaker-Zeytun district of Yerevan city, the village of Geghamavan in the Gegharkunik Region and the villages of Getamej, Solak and Nor Geghi and the towns of Nor Hachn, Charentsavan and Hrazdan in the Kotayk Region. These are the communities which lie along the open channels of the SH diversion system or are quite close to reservoirs, power houses and sub-station, so that may undergo impact during the routine operation of the SH Cascade or the planned rehabilitation. As mentioned in section 2.2.8, the diversion channels are owned by IEC, which is responsible to maintain them and transport irrigation water through them.

These eight settlements are situated in the central part of Armenia. Their total population is little over 178,000 people (ca 44,900 households). About 98% of these people are ethnic Armenian. Minorities are presented by Russian, Ukrainian, Kurds, Yesidi, Assirian, etc, which are well integrated with majority group and cannot be classified as indigenous people. Further details on socio-economic profile of potentially affected communities are provided in Annex 3.

6.2 Community Health, Safety and Security

Community Health, Safety and Security management by the IEC has been reviewed in respect of the EBRD’s Performance Requirement PR4 Community Health, Safety & Security and the ADB Safeguards Policy Statement (SPS) 2009 Safeguards Requirements (SR) 1 on Environment.

Certain community health and safety risks are associated both with routine operations of the company infrastructure and planned rehabilitation works. It is important to identify health and safety risks related to the existing situation to enable planning and execution of remedial actions in the frames of the planned rehabilitation.

Risks Related to the Existing Facilities and Routine Operations

As the walk-over of the company facilities showed not all infrastructural units are safe for surrounding population. Most dangerous seem the open channels of the diversion system, which are about 4 m deep and according to the company information water flow there is up to 2 m3/sec. The channels have steep walls and no measure is provided for survival of people which may accidentally occur there. Thus, there is no chance of survival if somebody enters the channel incidentally or on purpose. In major cases the channels are not provided with fencing or railing to prevent accidental falling into channels, which pass through several settlements. Neither warning signs are provided to inform people about danger. Only small portion of the channel passing through the Geghamavan Village is equipped with rails, which are damaged at places.

The situation with the channels is aggravated with the presence of several aqueducts installed over the channels to bypass storm water. Population has free access to them and uses them as bridges to cross the channel. The aqueducts are rather old and not equipped with rails either. According to the personnel, there was an incident when a woman crossing one damaged aqueduct narrowly escaped falling into the channel and her caw drowned there. Besides, the channels have several ‘pockets’ used for machinery entry to perform maintenance operations. Flow is relatively low there and it
seems that population uses them for bathing. We personally have witnessed such case during the site visit. This is quite dangerous as the ‘pockets’ are not provided with measures preventing peoples washing down into the channel. Neither the aqueducts, nor service ‘pockets’ are provided with measures preventing people’s entry there, and no warning signs are provided.

Thus the channels and associated structures contain high health and safety risk to surrounding communities and the situation requires urgent improvement. Rails should be installed on the channel’s sides at least along the sections passing through settlements to prevent accidental entry. Aqueducts should be improved to the level to make them safe for community usage, or measures should be provided to restrict access to them. Fencing or other measures restricting access to the service ‘pockets’ should be also ensure. Installation of signs warning people regarding hazards and prohibiting using the channels, aqueducts and ‘pockets’ should be ensured.

Similar safety and precaution measures are required for emergency spillways, which are not also railed and no warning signs are installed there.

Factually all reservoirs of the SH Cascade are daily regulation. Due to this variation of water level should be frequent and notable there. Respectively, they are not safe for bathing and their banks are not safe as well as water inflow in lower reservoirs can be rather fast when water is released in upper ones for power generation or in emergencies. One more issue with reservoirs is questionable quality of water, as large amount of domestic waste thrown in channels by population and significant eutrophication indicating pollution at least with nitrates and/or phosphates. Here should be noted about community claiming the IEC to clean the Kanake Reservoir as malodour and mosquitoes propagation due to water pollution disturbs them. Meantime, no warning or prohibiting signs are provided at the reservoirs to inform population about health and safety risks and prohibit bathing.

These issues were discussed with the company management and technical department, and are addressed in the ESAP to ensure that they are incorporated and properly addressed in the planned rehabilitation.

Power houses and sub-stations are mostly rather distanced from population to have notable impact on people. Flooding risks and early warning system are discussed in the section below.

*Risks Related to the Planned Rehabilitations*

On the rehabilitation phase main community health and safety risks will be related to:

- construction works on the open channels, which will be source of nuisances such are noise and air emissions. It should be noted that very limited number of residential houses are so close to the channels to be significantly impacted.

  Community safety should be ensured through limitation of unauthorized access to construction sites.

- transportation operations, as some access roads pass through densely populated areas and close to residential houses. Major impacts related to transportation operations will be increased noise, vibration and dust, as well as community safety.
Particularly should be noted risks related to access road of Kanakher power house, as this one lane, narrow road passes in densely populated area of Yerevan City and movement of heavy trucks is anticipated there to deliver large size turbines and generators. Besides, important issue is transportation of spoil dredged from the Yerevan 1 reservoir. Volume of dredged material will be high requiring intensive movement of trucks through densely populated area of Yerevan City.

Respectively, special precautions are required in terms of traffic management during reconstruction operations. This should include traffic safety, speed limitation, traffic organization, minimisation of dust and noise, etc. Limitation of transportation time will be also necessary during the night time. Special measures should be taken to prevent spill of potentially polluted dredged material and its drainage water.

All mentioned issues should be studied and addressed in the frames of the EIA implemented for dredging operations. In addition the company needs to develop and implement transportation management plan, which will properly address all above mentioned issues. Respective recommendations are provided in the ESAP. The project will have a grievance mechanism (see SEP), which will enable community members to deliver their concerns and claims to the company so that to seek for mitigation of any significant impacts.

6.3 Emergency Preparedness and Response

Community related emergencies in the company operations include flooding and water flash risks due to natural floods passing through the company’s system, flooding due to failure of company facilities and specifics of the cascade operations. It should be noted that flooding risk is quite high due to several factors including:

- Illegal constructions within the natural river course and river floodplain
- Hydrology of the Hrazdan River and its tributaries, which are characterized with significant floods and flash floods.

To control flood risks the company receives daily hydro-meteorological forecasts from the state hydro-meteorological service and is always pre-warn regarding potential floods and their severity. The company notifies about upcoming floods local governments of settlements falling under the flood risk. Further on the governmental authorities are responsible to inform public about potential hazards and ensure evacuation of people from endangered zones if required. Though this system works properly some illegal properties within the river course and floodplain undergo high risk, especially during high floods. Such incident had place several years ago, when Q100 flood of 120 m3/sec flow endangered a restaurant built in the river course in Yerevan City.

One more issue is related with water flashes due to daily regulation character of the SH Cascade, that is the plants are operated so that to meet peak demand on electricity. Respectively, the system is characterized with sudden changes in water flow. To control related community safety risks the company employees the following approach: only 5 m3/sec flow is released during first 1.5 hours when starting the plants, after which flow is increased to 10 m3/sec for 1 hour and only after this flow is increased to designed or planned amount. The above described comprises the early warning system employed by the company.

The corporation does not have emergency response plan, which would clearly indicate actions and roles of the personnel to be taken in case of emergency situation.
In addition, IEC does not have oil spill response plan and equipment in place to deal with potential oil spills. The quantity of oil used on sites can be considered as quantities which can cause local impacts on soils, accordingly we have suggested to include oil spill response action in oil management plan. This requirement is included in the ESAP (see Annex 6). It is also suggested that the special equipment for oil spill response (at least tier 1) and clean up should be purchased and should be available in place. The oil spill response issues should be included in the training materials delivered to the staff.

Based on EU best practice and the EBRD PR1, as well as ADB SPS SR1, the Emergency Response Plan shall be part of the properly structured EMS, especially at industrial and infrastructure facilities related to energy production and transportation. The preparation of the Emergency Response Plan (to avoid/mitigate impact from possible accidents on local communities) is included into the ESAP for the IEC corporate Environmental Management System (EMS), in particular for rehabilitation and operation of SH Cascade.

6.4 Involuntary Resettlement & Displacement

Involuntary resettlement & displacement issues have been reviewed in respect of the relevant EBRD’s Performance Requirement PR5 Land Acquisition, Involuntary Resettlement & Economic Displacement and the ADB 2009 SPS SR2 on Involuntary Resettlement.

The SH Cascade was originally built during 1930-1965. There are no documentation readily available regarding ownership of lands used for the hydro power scheme or regarding resettlement (physical or economic) performed during Soviet time. At the time of cascade development all land was under the ownership of the Soviet Union. The Sevan-Hrazdan cascade was developed in order to support irrigation of the downstream land parcels, which before was absolutely not suitable for agricultural purposes. The most part of cascade, derivation channels and HPP infrastructure was situated in the hilly areas and the channels are passing on the tops of hills in order to keep the head at maximum level.

We have tried to collect some information regarding historical data on possible resettlement happened 50-70 years ago, however no evidence of such facts have been found. From the interviewers on different sites, we have been asking aged people if they can remember construction of the channels and infrastructure. Practically everybody stated, that can not remember that resettlement was conducted. At last stage we have reviewed the historical topography maps produced by Soviet military forces. The original topography survey was conducted back in 1940-1950, with scale of 50000 and 100000. The topography maps indicated that 90% of the area was not populated and population was concentrated near to the small streams, where they had possibility to irrigate small parcels of land.

Even nowadays, the most part of the channel length is not populated due to complicated landscape, so it can be stated that most probably no resettlement was happened and if any resettlement had very small scale character. Actually the opposite process was in place, after the construction of channel, people stated to settle near to the water sources, this fact is clearly visible at access road at Kanaker and Arzni HPP. After development of HPP’s, and establishment of access roads the land in vicinity became more popular and the settlements were established close to mentioned access roads and developed infrastructure.

It should be noted that no claims or grievances regarding compensation for lands or properties lost in past times are submitted to the IEC or court.
Considering that all works are planned within the existing footprint and the planned rehabilitation does not consider expansion of the existing facilities or installation of new facilities, the IEC does not require additional land acquisition. Respectively, no resettlement or displacement is envisaged within this project.

Due to the mentioned involuntary resettlement should not be considered as issue in respect with the planned rehabilitations and no respective actions are proposed in the ESAP.

6.5 Impact on Vulnerable Groups

Impact on Vulnerable Groups by Project implementation has been reviewed in respect of the EBRD’s Performance Requirements and the ADB SPS 2009 related to community health and safety, resettlement, indigenous people and other community impacts.

In this respect we have prepared social and cultural profile of potentially affected communities, which is delivered in Annex 3. As the community profile shows, about 98% of potentially impacted population are ethnic Armenian. Ethnic minorities including Russian, Yezidi, Assyrian, etc are factually assimilated with local population and they have not collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories, and they have not separate customary cultural, economic, social, or political institutions. Respectively, indigenous people is not an issue for the planned project. As described above, nor involuntary physical or resettlement are relevant for the project.

Considering the scope planned works and their location, mostly village population along the open channels could be classified as a vulnerable group, as the project has potential to notably impact their incomes. As mentioned above, communities along the channels are abstract water from the open channels and they break through pipes in the channel walls for this purpose. Some water abstraction is also in place from herders, which make holes in the channels to release water for cattle. To eliminate losses from the channel the IEC needs to solve this issue during rehabilitation of the channels. On the other hand, agriculture is the main income source of this population and cutting of irrigation water will notably reduce their income (29,979 Dram), which according to the official statistics is already below the minimum wage (32,000 Dram).

Due to this issue requires careful actions from the company’s side to prevent any significant impact on farmers and herders, and on the other hand prevent water losses from the channel. It should be mentioned that the IEC cannot allow water abstraction without involving the third party which is the Sevan-Hrazdan Water Intake Closed Joint Stock Company (Jerar), as this is state owned structure responsible for allocation of irrigation water from the channel. These issues have been discussed with the IEC management and it has been agreed the company will advocate with the Jerar arrangement of legal connections for local population. The company will ensure adequate design and implementation of water abstraction points for population and herders to prevent losses due to improper installations by community members and future damage of channels by locals. However, farmers should become legal water users through making respective contracts with Jerar. The affected communities will be consulted regarding this issue during public meetings, as it is described in the SEP and ESAP to timely inform them about planned operations and suggested solution to the problem.

Other rehabilitation works are not likely to have impact on agricultural activities and income of affected communities as the works will be mainly implemented during non-agriculture season, when the company has notably lower flow in the diversion system and respectively, power generation is small.
6.6 Impact on Cultural Heritage

Impact on cultural heritage has been reviewed in respect of the relevant EBRD’s Performance Requirement PR8-Cultural Heritage.

The planned rehabilitation works will be organized and implemented within the existing footprint of the SH Cascade. No new facilities or access roads are planned for the project. As the site visits showed, there are no cultural heritage sites within the potential impact zone of the SH Cascade facilities or access roads. Respectively, the planned rehabilitation has not potential to impact on cultural heritage.

The only exception from the statement could be a dredged spoil dumping site, which is not known at the moment. Impact on cultural heritage should be assessed during the site selection and prevented through proper siting. In addition, the IEC should ensure a chance finding procedure during preparatory earth works at the selected dump sites.

6.7 External Stakeholder Engagement

Stakeholders engagement and public communication procedures of the IEC related to this project have been reviewed in respect of EBRD’s Performance Requirement PR10 and ADB’s 2011 Public Communications Policy. Based on the above mentioned, the Stakeholder’s engagement plan including respective consultations methods and community grievance mechanism has been developed for the IEC SH Cascade rehabilitation project as standalone document. The SEP is provided in Annex 5.
7 Conclusions and Recommendations

7.1 Summary of Regulatory Compliance and Key Impacts, Risks and Liabilities

Based on legal and regulatory analysis conducted within the scope of present environmental and social review, it has been concluded that the SH Cascade rehabilitation program does not require the EIA process according to Armenian legislation, considering that all works are planned within the existing HPP facilities, channels/hydraulic structures and property boundaries. Rehabilitation doesn’t consider the increase of original capacity of the SH Cascade HPPs. It should be noted also that all facilities have been operational prior to 1995 and are exempt from EIA process, except of Yerevan-1 reconstruction where reservoir dredging is considered.

Main pollution risks associated with the company operations, such as reservoir management, management of oils and lubricants for turbines, transformers and support infrastructure, management of lead/acid batteries, material and waste management discussed in this report are addressed in the Environmental and Social Action Plan (ESAP) with recommendations for relevant mitigation measures and monitoring.

In terms of protection of the Sevan Lake the IEC and Cascade operations as well as planned activities, it can be concluded that the requirements are met: the fish protection system is working properly and rehabilitation is not planned; neither rehabilitation of other headwork facilities at the Sevan Lake is planned and respectively, the planned project cannot affect the Sevan Lake.

Some environmental impacts are expected from dredging operations of the Yerevan 1 reservoir. This is very important issue which can affect the biological environment downstream from Yerevan 1 dam. The issue should be discussed in detail in EIA study to be performed for reservoir dredging. It is expected that the corporation will employ effective methods for minimization of water quality degradation downstream during the dredging operations. The EIA study should clearly indicate what engineering methods should be employed for working in the river bed.

Among incident risks related to the company operations the flooding downstream dams during river’s high water period, or high discharge from spillway to remove water from power house, should be also included. Flooding may also be result of diversion system’s failure. Flooding risk mainly endangers population in the neighbourhood of the hydro power scheme, as well as engineered structures located in close proximity to or in the river course. As community safety is a concern during flooding, this issue is addressed in the Environmental and Social Action Plan/ Corrective action Plan in terms of requirement for preparation of Emergency Response Plan.

The negative socio-economic impacts, mostly related to transportation of equipment and materials, are expected to be localized and short-term. All potential negative impacts can be prevented and minimized by implementing appropriate community health, safety and security measures planned to reduce potential impacts and risks for community residents (for instance by providing fences, bridges, ensuring dust control, properly managing community liaison, etc.). These potential risks and impacts are addressed in Environmental and Social Action Plan (ESAP) through recommendations on corresponding actions and mitigation measures.

The summary of IEC/Project compliance with the National regulations, banks requirements and EU standards is presented in the Table below:
Table 7.1.1  Summary of IEC/Project compliance with the National regulations, banks requirements and EU standards

<table>
<thead>
<tr>
<th>International requirements</th>
<th>Issues</th>
<th>Compliance with Armenian Laws</th>
<th>Compliance with EBRD and ADB policies, EU requirements and “best practice”</th>
<th>Remedial action (all reflected in ESAP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Audit</td>
<td>- Company’s ability to manage and address E&amp;S issues;</td>
<td>n/a</td>
<td>EBRD PR1-11</td>
<td>Present Review, Due Diligence</td>
</tr>
<tr>
<td></td>
<td>- Compliance with applicable laws and regulations;</td>
<td></td>
<td>ADB SPS SR1-D1-10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Identification of stakeholders groups and activities (SEP)</td>
<td></td>
<td>ISO14001 EU EMAS, ISO19011:2011</td>
<td></td>
</tr>
<tr>
<td>Environmental Assessment</td>
<td>- Identification of E&amp;S risks and impacts of dredging operations at Yerevan-1 reservoir;</td>
<td>Law on EIA (1995)-Dredging EIA and permit required for Yerevan-1 reservoir</td>
<td>EBRD PR1</td>
<td>Obtain necessary permits</td>
</tr>
<tr>
<td></td>
<td>- E&amp;S impact analysis;</td>
<td></td>
<td>ADB SPS SR1-D1-9</td>
<td>See ESAP item 3.1</td>
</tr>
<tr>
<td></td>
<td>- Adaptation of avoidance and mitigation measures;</td>
<td></td>
<td>EU EIA Directive 85/337/EEC</td>
<td></td>
</tr>
<tr>
<td>Environmental Management System</td>
<td>- Company’s organizational capacity, commitment and structure for E&amp;S Management;</td>
<td>No legal requirements for old/existing enterprises</td>
<td>EBRD PR1</td>
<td>Establishment of corporate ESMS system, appoint ESHS managers</td>
</tr>
<tr>
<td></td>
<td>- E&amp;S Action Plan (ESAP);</td>
<td></td>
<td>ADB SPS SR1-D2</td>
<td>See ESAP item 1.3</td>
</tr>
<tr>
<td></td>
<td>- Performance Monitoring and Review;</td>
<td></td>
<td>EU EMAS</td>
<td></td>
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<tr>
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<td></td>
<td></td>
<td>ISO14001-2004, ISO14002, 14004 noncompliant</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Safe use and management of hazardous materials and oils;</td>
<td>Law on Environmental Fees and Nature Use Charges;</td>
<td>ADB SPS SR1-D9</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Emergency preparedness;</td>
<td>Water Code</td>
<td>EU Directive on IPPC</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>compliant</td>
<td>noncompliant</td>
<td></td>
</tr>
<tr>
<td>International requirements</td>
<td>Issues</td>
<td>Compliance with Armenian Laws</td>
<td>Compliance with EBRD and ADB policies, EU requirements and “best practice”</td>
<td>Remedial action (all reflected in ESAP)</td>
</tr>
<tr>
<td>----------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
<td>-------------------------------</td>
<td>----------------------------------------------------------------</td>
<td>---------------------------------------</td>
</tr>
<tr>
<td>Sustainable Natural Ecological Resource Management</td>
<td>- Natural Habitats; -Protected Areas; -Fisheries;</td>
<td>Ecological passport</td>
<td>EBRD PR6, ADB SPS SR1-D8, EU Biodiversity Strategy, EU Habitats Directive, EU Freshwater Fish Directive, Compliant</td>
<td>ESAP - project specific mitigation measures</td>
</tr>
<tr>
<td>Community Health, Safety and Security</td>
<td>-Community exposure to risks, impacts, diseases; -Transportation of materials; -Dredging activities; -Releases of water from system; -Emergency preparedness</td>
<td>Responsibilities not clearly defined</td>
<td>EBRD PR4, ADB SPS SR1-D10(b) noncompliant</td>
<td>SEP, community liaison, Emergency Response Plan See ESAP item 1.7, 3.2.</td>
</tr>
</tbody>
</table>
7.2 Non-Technical Summary of the Findings

To comply with EBRD and ADB requirements, based on findings/outcomes of the present Environmental and Social Review, the Non-Technical Summary of the proposed rehabilitation project with corresponding environmental and social aspects has been prepared as a standalone document (see Annex 4). The Non-Technical Summary can be also used by IEC during the information dissemination/disclosure program within a framework of stakeholder engagement and public consultation process.

7.3 Stakeholder Engagement Plan

In line with EBRD and ADB social safeguard requirements; based on findings/outcomes of the present Environmental and Social Review, the Stakeholder Engagement Plan (SEP) has been developed as a standalone document (Annex. 5). The SEP is focusing on practical steps to be implemented by IEC to inform key stakeholders through proper information disclosure, to allow them to provide input to the Project and company operations. SEP also establishes the formalised grievance mechanism for use by external stakeholder groups.

7.4 Environmental and Social Action Plan/Corrective Action Plan

To comply with EBRD and ADB requirements, based on findings/outcomes/conclusions of the present Environmental and Social Review, the Environmental and Social Action Plan/Corrective Action Plan has been developed for the IEC SH Cascade Rehabilitation Project as a standalone document (Annex 6). The Environmental and Social Action Plan (ESAP) summarizes in tabular form all recommended actions to be taken by IEC as identified by present Environmental and Social Review, with deadlines and responsibilities for implementation, timeframe, and the monitoring and reporting arrangements.
Annex 1  Drawings and sketches
Figure 1-1 General Layout of the Sevan-Hrazdan HPP Cascade
Figure 1-2 Layout of Sevan HPP

Figure 1-3 Layout of Hrazdan’s head pond, penstocks, power house and emergency spillway
Dredger’s operations in the Akhpamn Reservoir and spoil’s dumping site are also shown
Figure 1-4 Layout of Argel HPP

Figure 1-5 Layout of Yerevan 3 HPP
Annex 2  The project Photographs
Annex 2 The project photographs

Picture 1: The main entrance of the power house

Picture 2: The maintenance shaft used for air ventilation as well

Picture 3: The heavy lifting structure on the top of maintenance shaft

Picture 4: The stored empty oil barrels at underground turbine hall

Picture 5: The fire protection means in underground turbine hall

Picture 6: The first aid kit at workers rest room
The project photographs

**Picture 7:** Fire fighting equipment at the entrance of operation room

**Picture 8:** The substation area

**Picture 9:** The rehabilitation activities and firefighting system at substation area

**Picture 10:** The unused oil(-break) switches at substation area

**Picture 11:** The workshop building

**Picture 12:** The stored empty oil barrels in the workshop area
Annex 2 The project photographs

Picture 13: The shower room

Picture 14: The oil storage inside of substation area

Picture 15: The contaminated soil at oil storage

Picture 16: Fishes’ accumulated area at water intake

Picture 17: The fish protection facility

Picture 18: The pump system used for fish protection facility
Annex 2 The project photographs

Picture 19: The diversion channel throughout of village Geghamavan

Picture 20: The open diversion channel across to village Geghamavan

Picture 21: The waste-handling grapple

Picture 22: The view to the substation and the suction dredge

Picture 23: The company central garage area and workshops
Annex 2 The project photographs

Page 5 of 8

Picture 24: The lifting jack and firefighting equipment

Picture 25: The view to the HPP and the penstock

Picture 26: The substation area

Picture 27: The oil contaminated surface

Picture 28: The SF6 switchgear with manometer and sprinkler system

Picture 29: Various objects restrict access to firefighting equipment
1. Kanaker HPP

Picture 30: The water intake used as a daily regulation reservoir

Picture 31: The view to the HPP building and penstock

Picture 32: The supplied fire protection equipment

Picture 33: The bulked workshop area

Picture 34: The turnery

Picture 35: The HPP building facade and outlet area
2. Yerevan HPP-1

Picture 36: The scrap material stored at substation territory

Picture 37: The rehabilitation activities at substation

Picture 38: The oil storage inside of substation area

Picture 39: The new transformer with oil catcher structure

Picture 40: The waste-handling grapple

Picture 41: The waste accumulated are near to the water intake
Annex 2 The project photographs

Picture 42: The water reservoir

Picture 43: The eutrophication process at water reservoir

Picture 44: The pollute water reservoir

Picture 45: The supplied new fire extinguishers

Picture 46: The PPE and signs on the wall

Picture 47: The water drain structure and outlet area
Annex 3  Socio-Economic Profile of Potentially Affected Communities
Socio-Economic Profile of Potentially Affected Communities

The socio-economic profile of the communities potentially affected by the Sevan-Hrazdan Cascade Rehabilitation Project have been prepared with the aim to meet requirements of the TOR, and enable comprehensive assessment of potential impacts.

Among the potentially affected communities are included those living along the open canals of the SH diversion system or in the proximity to reservoirs, power houses and sub-station, so that may undergo impact during the routine operation of the SH Cascade and/or the planned rehabilitations. These settlements include the Kanaker-Zeytun district of Yerevan city, the village of Geghamavan in the Gegharkunik Region and the villages of Getamej, Solak and Nor Geghi and the towns of Nor Hachn, Charentsavan and Hrazdan in the Kotayk Region.

The socio-economic data for the affected communities are overviewed based on the secondary data of National Statistical Service of the Republic of Armenia (NNS RA) and information available on the official web-sites of Gegharkunik and Kotayk Regions.

The above mentioned 7 rural and urban communities are located in the central part of Armenia, at 920-1850 m datum above the sea level. Total population of these communities is little over 178 thousand people or about 44,800 households. Table 1 presents general demographic data of the affected communities.

<table>
<thead>
<tr>
<th>Community</th>
<th>Total population 1</th>
<th>Gender composition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Male</td>
</tr>
<tr>
<td>Yerevan city</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Kanaker-Zeytun district</td>
<td>79 911</td>
<td>46.9%</td>
</tr>
<tr>
<td>Kotayk Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Hrazdan town</td>
<td>53 683</td>
<td>49.2%</td>
</tr>
<tr>
<td>3. Charentsavan town</td>
<td>25 181</td>
<td>49.3%</td>
</tr>
<tr>
<td>4. Nor Hachn town</td>
<td>10 421</td>
<td>49.1%</td>
</tr>
<tr>
<td>5. Nor Geghi village</td>
<td>6 345</td>
<td>44.9%</td>
</tr>
<tr>
<td>6. Getamej village</td>
<td>624</td>
<td>48.5%</td>
</tr>
<tr>
<td>Gegharkunik Region</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Geghamavan village</td>
<td>1 947</td>
<td>52%</td>
</tr>
<tr>
<td>Total</td>
<td>178 112</td>
<td>48.6%</td>
</tr>
</tbody>
</table>

Great majority of the potentially affected communities are ethnic Armenian, which comprise about 98% of total affected people. Ethnic minorities in the affected communities are mostly presented with Yezidis and Russians (1.2% and 0.41% accordingly). Similarly, 98% of the affected communities are Christian and 2% follow other religions. Table 2 below gives ethnic composition of the potentially affected communities by individual settlements. As the table shows, ethnic minorities are mostly presented with very small groups, which usually are assimilated or fully integrated into the socio-economic life of

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Armenia. They have not collective attachment to geographically distinct habitats or ancestral territories in the project area and to the natural resources in these habitats and territories, and they have not separate customary cultural, economic, social, or political institutions.

Table 2: Project Ethnic groups General Description

<table>
<thead>
<tr>
<th>Community</th>
<th>Total Population</th>
<th>Armenians</th>
<th>Assyrians</th>
<th>Yezidis</th>
<th>Greeks</th>
<th>Russians</th>
<th>Ukrainians</th>
<th>Kurds</th>
<th>Others</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yerevan City (Kanaker-Zeytu district)²</td>
<td>79911</td>
<td>78854</td>
<td>16</td>
<td>336</td>
<td>22</td>
<td>463</td>
<td>61</td>
<td>0</td>
<td>160</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>98.68%</td>
<td>0.02%</td>
<td>0.42%</td>
<td>0.03%</td>
<td>0.58%</td>
<td>0.08%</td>
<td>0.00%</td>
<td>0.20%</td>
</tr>
<tr>
<td>Kotayk Region</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hrazdan, Charentsavan and Nor-Hachn towns</td>
<td>89285</td>
<td>88455</td>
<td>54</td>
<td>268</td>
<td>0</td>
<td>268</td>
<td>62</td>
<td>179</td>
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<tr>
<td></td>
<td>100%</td>
<td>99.07%</td>
<td>0.06%</td>
<td>0.30%</td>
<td>0.00%</td>
<td>0.30%</td>
<td>0.00%</td>
<td>0.07%</td>
<td>0.20%</td>
</tr>
<tr>
<td>Nor Geghi Village</td>
<td>6345</td>
<td>4822</td>
<td>0</td>
<td>1523</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td></td>
<td>100%</td>
<td>76%</td>
<td>0%</td>
<td>24%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
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<td>0%</td>
</tr>
<tr>
<td>Getamej Village</td>
<td>624</td>
<td>583</td>
<td>0</td>
<td>17</td>
<td>0</td>
<td>0</td>
<td>24</td>
<td>0</td>
<td>0</td>
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<td></td>
<td>100%</td>
<td>93.43%</td>
<td>0.00%</td>
<td>2.72%</td>
<td>0.00%</td>
<td>0.00%</td>
<td>3.85%</td>
<td>0%</td>
<td>0.00%</td>
</tr>
<tr>
<td>Gegharkunik Region</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Geghamavan village</td>
<td>1947</td>
<td>1947</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
<tr>
<td>Total</td>
<td>178112</td>
<td>174661</td>
<td>70</td>
<td>2144</td>
<td>22</td>
<td>731</td>
<td>61</td>
<td>86</td>
<td>338</td>
</tr>
<tr>
<td></td>
<td>100%</td>
<td>98.06%</td>
<td>0.04%</td>
<td>1.20%</td>
<td>0.01%</td>
<td>0.41%</td>
<td>0.03%</td>
<td>0.05%</td>
<td>0.19%</td>
</tr>
</tbody>
</table>

Household income data as per NNS RA (2010) are provided in Table 3 to describe the living standards of the affected population. As the data show, household income and income sources notably differ between urban and rural communities. Main income source in urban areas is waged employment, which comprises 57% there; same index for rural community is 29%. The share of non-monetary income, particularly in the form of food produced for self-consumption, is about 20% of total income in rural areas. Besides, these figures clearly demonstrate dependence of rural population on agricultural production.

Table 3. Income of Household by Urban/Rural Communities and Income Sources, 2010
(Mean Monthly (Average Monthly Income per Household Member)

<table>
<thead>
<tr>
<th>Description</th>
<th>Urban communities</th>
<th>Rural communities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AMD</td>
<td>%</td>
</tr>
<tr>
<td>1. Monetary income, including:</td>
<td>35682</td>
<td>96.7</td>
</tr>
</tbody>
</table>

² Data on the minority groups for Kanaker-Zeytu district is calculated based on statistics for Yerevan City with an assumption that ethnic composition is the same throughout the city.
Based on NSS RA data, poverty level is 27.1% in Yerevan city, 43.6% in Gegharkunik Region and 46.8 in Kotayk region. RA NSS calculates the poverty based on the mean monthly consumption indices per household (HH) member per consumer’s basket. HH is considered extremely poor when mean monthly consumption per adult member does not exceed extreme poverty line (food basket cost) and poor when mean expenditure is over extreme poverty line, but below common poverty line (cost of consumer basket). Extreme poverty level in the country is established at 19,126 AMD, and poverty level at 27,410 AMD. Table 4 provides official statistics on poverty level in the potentially affected communities. As these data show, poverty is more severe in rural areas.

<table>
<thead>
<tr>
<th>Region</th>
<th>Very poor</th>
<th>Poor</th>
<th>Very poor</th>
<th>Poor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yerevan</td>
<td>1.1</td>
<td>20.1</td>
<td>2.2</td>
<td>27.1</td>
</tr>
<tr>
<td></td>
<td>(0.4)</td>
<td>(1.4)</td>
<td>(0.6)</td>
<td>(2.2)</td>
</tr>
<tr>
<td>Gegharkunik</td>
<td>0.4</td>
<td>32.0</td>
<td>1.4</td>
<td>43.6</td>
</tr>
<tr>
<td></td>
<td>(0.1)</td>
<td>(3.1)</td>
<td>(0.6)</td>
<td>(4.3)</td>
</tr>
<tr>
<td>Kotayk</td>
<td>2.1</td>
<td>39.5</td>
<td>5.8</td>
<td>46.8</td>
</tr>
<tr>
<td></td>
<td>(0.7)</td>
<td>(2.4)</td>
<td>(1.3)</td>
<td>(3.5)</td>
</tr>
</tbody>
</table>

The households in rural area are mainly engaged in farming, mostly cultivating fruits, potatoes, vegetables, cereals and fodder. They are also involved in livestock breeding, mainly for provision of daily products for self-consumption. About 68% of the households of the area have experience and skills in farming, mostly in traditional farming.

Due to low incomes from farming and lack of job opportunities, men of working age (about 24% of households) in the area intensively migrate abroad (especially to Russia) in search of jobs and farms are mainly run by women, supported by children and elder family members.

There are cultural centers, schools and kindergartens in each affected rural and urban communities, but high schools are mainly concentrated in Yerevan city. General data on educational level in rural and urban communities are presented in Table 5.
## Table 5: Education Level Among Armenian Population (above 6 years old), %

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>Total</th>
<th>Urban</th>
<th>Rural</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Illiterate</td>
<td>0.8</td>
<td>0.7</td>
<td>0.9</td>
</tr>
<tr>
<td>2. Non-complete elementary</td>
<td>2.1</td>
<td>1.8</td>
<td>2.6</td>
</tr>
<tr>
<td>3. Elementary (until fourth grade)</td>
<td>4.5</td>
<td>3.2</td>
<td>6.8</td>
</tr>
<tr>
<td>4. Non-complete basic general (non-complete eight years)</td>
<td>5.3</td>
<td>4.9</td>
<td>6.1</td>
</tr>
<tr>
<td>5. Basic general (eight years)</td>
<td>6.8</td>
<td>5.3</td>
<td>9.4</td>
</tr>
<tr>
<td>6. Non complete secondary (non-complete ten years)</td>
<td>7.0</td>
<td>6.2</td>
<td>8.3</td>
</tr>
<tr>
<td>7. General secondary (ten years)</td>
<td>33.0</td>
<td>29.1</td>
<td>40.3</td>
</tr>
<tr>
<td>8. Specialized secondary</td>
<td>19.0</td>
<td>20.4</td>
<td>16.5</td>
</tr>
<tr>
<td>9. Non-complete higher</td>
<td>3.8</td>
<td>4.4</td>
<td>2.6</td>
</tr>
<tr>
<td>10. Higher</td>
<td>17.6</td>
<td>23.9</td>
<td>6.5</td>
</tr>
<tr>
<td>11. Post graduate</td>
<td>0.1</td>
<td>0.1</td>
<td>0.0</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>

As the table shows, the major portion of the Armenian population has received high, secondary or specialized secondary education. Education level is higher in urban settlements, than in rural due to better education opportunities. Besides, many young people with higher education tries to establish in urban settlements which provide wider employment opportunities.
Annex 4 Non-technical Summary
NON TECHNICAL SUMMARY

SEVAN-HRAZDAN CASCADE
REHABILITATION PROJECT
REPUBLIC OF ARMENIA

Final Version

41134_R2_Eng

October 2012
Introduction

The Sevan-Hrazdan HPP Cascade, comprising seven hydropower plants of 565 MW total nominal capacity, was built in 1930-1965. It is a key part of the Armenian electricity system and urgently needs substantial rehabilitation to ensure safe and stable operation and restore output capacity. The cascade is owned and operated by the International Energy Corporation (IEC).

The IEC and its major shareholder JSC RusHydro intend to invest in rehabilitation of the existing infrastructure in order to improve technical condition of the hydropower facilities included in the cascade and improve the operation characteristics of power generation plants. In order to improve the system, the corporation has prepared the five years development/investment plan and has started implementation of some works based on own resources. Additionally company applied for the loan from banks and has asked EBRD and ADB to support the project.

The banks require that the company’s current operations and investment project be in line with the Armenian and EU legal requirements, as well as EBRD’s Performance Requirements1 and ADB’s relevant environmental and social policies and requirements2. Under the EBRD’s Performance Requirement 1 (2008) and the ADB SPS (2009) Safeguards Requirements 4, for the projects involving existing activities and facilities, an Environmental and Social Review is necessary to determine environmental and social risks or impacts and develop mitigation measures to address such risks or adverse impacts. To comply with EBRD and ADB requirements and the outcomes of the Environmental and Social Review, the Environmental and Social Action Plan/Corrective Action Plan and the Stakeholder Engagement Plan have been developed, as well as the present Non-Technical Summary of the findings.

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1 The EBRD Environmental and Social Policy and Performance Requirements (PRs) are available on the EBRD website at: [http://www.ebrd.com/downloads/about/sustainability/2008policy.pdf](http://www.ebrd.com/downloads/about/sustainability/2008policy.pdf)

2 ADB’s relevant policies include the following: ADB’s 2009 Safeguard Policy Statement (SPS), Social Protection Strategy (2001) and Public Communications Policy (2011) which are available from [http://www.adb.org/about/other-operational-policies-and-strategies](http://www.adb.org/about/other-operational-policies-and-strategies)
Description of the Facilities and the Proposed Rehabilitation Project

The Sevan-Hrazdan (SH) HPP Cascade comprises seven small to medium scale hydropower plants, which were built during 1930-1960s. The Cascade spreads over the area from the Sevan Lake to Yerevan City, comprising about 70 km long corridor. In total there are seven power generation plants included in the cascade (Sevan, Hrazdan, Argel, Arzni, Kanaker, Yerevan-1 and Yerevan-3) comprising diversion channels, tunnels, aqueducts, reservoirs, power houses, sub-stations etc. The hydropower system is built on the Hrazadan River and its tributaries. During the irrigation season it receives water from the Sevan Lake as well. In order to maintain and control water level in the Sevan, amount of water supply from the lake is determined by the government each year, based on water availability in the lake and irrigation requirement. Usually 150 mln cubic meters of water is used from Lake Sevan.

As the agriculture is a priority sector in the country and water availability from the Sevan Lake is limited, the operation of the cascade is completely dependent on the country strategy for irrigation. Two first plants of the cascade are operated completely on water released from the Sevan; respectively they work only during irrigation season. The last stage of the Cascade (Yerevan 3), which is built over irrigation system, is also operated during non-irrigation season. The rest four plants are capable to generate power round the year. Total installed capacity of the SH Cascade is 560 MW and mean annual output is around 500 mln kWt/h.

The SH HPP Cascade comprises also a set of open diversion canals and tunnels which transports water from the Sevan Lake to the HPPs. Most of the canals are built in the middle of the last century and nowadays they are deteriorated notably. Due to moral depreciation and technical damages (including illegal connections) the canals are in very poor condition and require major rehabilitation. No major rehabilitation programs have been implemented at the plants during the lifetime. Respectively, despite routine maintenance works and some relatively small scale rehabilitation projects during the last decade, major part of the hydro power scheme is in poor condition including diversion canals, hydraulic units and sub-stations. Due to this the cascade faces big water losses, instable operations and frequent failure of hydraulic and power generation units, and respectively, its output is reduced to the minimum. To improve the situation and ensure continued safe and stable operation of the SH Cascade and to restore capacity, the IEC has planned the following rehabilitation works:

- reconstruction of Yerevan 1 plant - reconstruction of the weir, replacement of turbines, dredging of the reservoir;
- replacements of much of the electrical equipment in Sevan, Hrazdan, Argel, Arzni and Kanaker HPPs (accumulator battery, generator, excitation equipment, stators);
- reconstruction of diversion canals for Hrazdan, Argel and Arzni HPPs;
- replacements of hydro units in Argel, Hrazdan and Kanaker HPPs.

The planned rehabilitation works will be carried out within the existing HPP facilities, canals/hydraulic structures and property boundaries. Expansion of the existing facilities is not planned.
Regulatory Requirements

In terms of National legislation, the SH Cascade rehabilitation program does not require the EIA process according to Armenian legislation, considering that all works are planned within the existing HPP facilities, canals/hydraulic structures and property boundaries. Rehabilitation doesn’t consider the increase of original capacity of the SH Cascade HPPs. It should be noted also that all facilities have been operational prior to 1995, except of Yerevan-1 reconstruction where reservoir dredging is considered.

Armenian Legislation does not require presence of formalized Environmental and Social management system (ESMS), but has certain requirements for technical safety, environmental permitting, monitoring and reporting. The company periodically undergoes the state ecological inspection, which includes checking of sanitary flow left in the river, visual verification of water pollution with oil, waste management, etc.

In May 2001, Armenia ratified the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (UNECE). The convention is designed to improve the way ordinary people engage with government and decision-makers on environmental matters. Consequently, citizens of Armenia are entitled to be informed about all environment related issues pertaining to the project and it is the responsibility of public authorities, local authorities, or government departments to reveal such environmental information.

In terms of International legislation and banks requirements, as it is stated in the EBRD 2008 Environmental and Social Policy, the EBRD financed projects are expected to meet good international practice related to sustainable development. To help clients and/or their projects achieve this, the Bank has defined specific performance requirements (PR) for key areas of environmental and social issues and impacts, such as Environmental and Social Management; Labour and Working Conditions; Pollution Prevention and Abatement; Community Health, Safety and Security; Land Acquisition and Involuntary Resettlement; Biodiversity Conservation and Sustainable Natural Resource Management; Indigenous Peoples; Cultural Heritage; Information Disclosure and Stakeholder Engagement and other. Each PR defines, in its objectives, the desired outcomes, followed by specific requirements for clients to help them achieve these outcomes. Compliance with relevant national laws is an integral part of all PRs. The EBRD will require clients to structure projects so that they meet all applicable PRs. Central to this is a consistent approach to seek to avoid adverse impacts on workers, communities, and the environment, or if avoidance is not possible, to reduce, mitigate, or compensate for the impacts, as appropriate.

As it is stated in ADB 2009 Safeguard Policy Statement, the objectives of environmental and social safeguard requirements are to:

(i) avoid adverse impacts of projects on the environment and affected people, where possible;
(ii) minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
(iii) help clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

To comply with Armenian, EBRD and ADB requirements, as well as international and EU best practice, the Environmental and Social Action Plan/Corrective Action Plan has been developed to minimize, or mitigate adverse environmental and social impacts and to establish proper environmental and social management system within the company (IEC).
Company Environmental, Social, Health and Safety (ESHS) Performance

Currently the company does not have an environmental policy statement and formal environmental and social management system (ESMS) system in place, all issues are managed in accordance with the requirements of old GOST (former Soviet Union standards) and guidelines prepared for operation of HPPs and power substations, as well as requirements of Armenian legislation. The development and implementation of a formalized ESM system including all pertinent documentation and specific plans is recommended in order to ensure compliance with EBRD and ADB requirements. The system should cover whole operation process from the corporate level down to facilities. The system should address all specific issues related to rehabilitation and construction activities. The occupational H&S system should consider improvement in operation processes and appropriate training should be provided. The corporations operation should be in compliance with existing regulations in the employment field, the employment process should be in line with Armenian, International labour organization, EBRD and ADB requirements. The recommendations on the development of proper corporate environmental and social management system are presented in the Environmental and Social Action Plan (ESAP).

Main pollution risks associated with the company performance during operations, such as reservoir management, management of oils and lubricants for turbines, transformers and support infrastructure, management of lead/acid batteries, material and waste management discussed in this report are addressed in the Environmental and Social Action Plan (ESAP) with recommendations for relevant mitigation measures and monitoring.

In terms of protection of the Sevan Lake the IEC and Cascade operations as well as planned activities, it can be concluded that the requirements are met: the fish protection system is working properly and rehabilitation is not planned; neither rehabilitation of other headwork facilities at the Sevan Lake is planned and respectively, the planned project cannot affect the Sevan Lake.

Some environmental impacts are expected from dredging operations of the Yerevan 1 reservoir. This is very important issue which can affect the biological environment downstream from Yerevan 1 dam. The issue should be discussed in detail in EIA study to be performed for reservoir dredging. It is expected that the corporation will employ effective methods for minimization of water quality degradation downstream during the dredging operations. The EIA study should clearly indicate what engineering methods should be employed for working in the river bed.

Among incident risks related to the company operations the flooding downstream dams during river’s high water period, or high discharge from spillway to remove water from power house, should be also included. Flooding may also be result of diversion system’s failure. Flooding risk mainly endangers population in the neighbourhood of the hydro power scheme, as well as engineered structures located in close proximity to or in the river course. As community safety is a concern during flooding, this issue is addressed in the Environmental and Social Action Plan/Corrective action Plan in terms of requirement for preparation of Emergency Response Plan.

The negative socio-economic impacts, mostly related to transportation of equipment and materials, are expected to be localized and short-term. All potential negative impacts can be prevented and minimized by implementing appropriate community health, safety and security measures planned to reduce potential impacts and risks for community residents (for instance by providing fences, bridges, ensuring dust control, properly managing community liaison, etc.). These potential risks and
Impacts are addressed in Environmental and Social Action Plan (ESAP) through recommendations on corresponding actions and mitigation measures.

**External Social Performance and Management**

External social performance of the company (IEC) during the implementation of the project and further operations will include community health, safety and security; emergency preparedness and response; management of impacts on vulnerable groups; management of impact on cultural heritage; stakeholders engagement including consultations, disclosure of information and grievance mechanism.

Based on EU best practice and the EBRD PR1, as well as ADB SPS SR1, the Emergency Response Plan shall be part of the properly structured EMS, especially at industrial and infrastructure facilities related to energy production and transportation. The preparation of the Emergency Response Plan (to avoid/mitigate impact from possible accidents on local communities) is included into the ESAP for IEC corporate Environmental Management System (EMS), in particular for rehabilitation and operation of SH Cascade.

Considering that all works are planned within the existing footprint, do not lead to increase of original capacity the SH Cascade rehabilitation doesn’t require any additional land acquisition and thus no resettlement or displacement are envisaged within the project. Also no specific impact on vulnerable groups, including indigenous peoples, is expected during construction and operations.

According to the initial planned Scope of Work the rehabilitation works will be organized and implemented within HPPs area and within the ROW of their rehabilitated Canals and Reservoirs, mostly above-ground or inside the existing HPPs’ buildings. The infrastructure rehabilitation works will be organized and implemented within canals and reservoirs and within their ROWs that also belong to HPPs. It can be concluded that proposed works will not have any impact on Cultural Heritage. However the development of the chance finding procedure for the contractors and supervisors is included in the ESAP.

Stakeholder engagement and public communication procedures of the IEC related to this project have been reviewed in respect of EBRD’s Performance Requirement PR10 and ADB’s 2011 Public Communications Policy. The Stakeholder Engagement Plan has been developed for the IEC SH Cascade rehabilitation project, which includes grievance mechanism.
Summary of ESAP Requirements

Based on findings of the Environmental and Social Review, the Environmental and Social Action Plan (ESAP) has been prepared for the Sevan-Hrazdan Cascade Rehabilitation Project. ESAP includes a series of actions that will be undertaken by International Energy Corporation (IEC) to plan and implement specific measures to avoid, reduce, control and mitigate, or compensate for, the potential environmental, occupational health and safety, and social impacts during rehabilitation and operation of the SH Cascade HPPs and associated structures, assets and infrastructure.

IEC will be reporting periodically on the status of the implementation of each of the required actions to the EBRD and ADB providing status reports on environmental, social and occupational health and safety (ESHS) matters.

The proposed ESAP covers the environmental management planning, mitigation and monitoring of the following issues:

Section 1: Project-specific actions related to proposed rehabilitation
- Reservoir dredging at Yerevan-1 HPP
- Rehabilitation of diversion channels and tunnels
- Upgrading the power systems and substations

Section 2: Strengthening of corporate environmental and social management
- Preparation of environmental and social system outline
- Preparation of corporate environmental and social policy document
- Preparation of environmental and social management plan
- Appointment of responsible managers for ESHS issues. Training.
- Preparation of emergency response plan
- Completion of permitting process
- Preparation and implementation of pollution prevention plan, oil management plan, waste management plan
- Establishment of occupational H&S system
- Implementation of stakeholder engagement plan, including grievance mechanism

Section 3: Project monitoring and reporting
- Establishment of environmental monitoring system
- Establishment of H&S monitoring system
- Preparation of the monitoring reports
Annex 5  Stakeholders engagement Plan
STAKEHOLDER ENGAGEMENT PLAN

SEVAN-HRAZDAN CASCADE
REHABILITATION PROJECT
REPUBLIC OF ARMENIA

Final Version

41134_SEP_Eng_02
October 2012
1. Introduction

1.1. Summary of Proposed Project

The International Energy Corporation (IEC) of Armenia, which owns a cascade of seven hydropower plants of 565 MW total nominal capacity and its main shareholder JSC RusHydro plan to rehabilitate these plants. This hydro power cascade, known as the Sevan-Hrazdan Cascade (SH Cascade) is a key part of the Armenian electricity system. It urgently needs substantial investments to ensure safe and stable operation and to restore output capacity.

The SH Cascade is built on the Hrazdan River and spreads from the Sevan Lake to Yerevan City, over 70 km distance. General layout of the hydro power scheme is shown on Figure 1.

The planned rehabilitation of the SH Cascade involves:

- reconstruction of Yerevan 1 plant - reconstruction of the weir, replacement of turbines, dredging of the reservoir;
- replacement of much of the electrical equipment in Sevan, Hrazdan, Argel, Arzni and Kanaker HPPs (accumulator battery, generator, excitation equipment, stators);
- reconstruction of diversion channels (all within existing footprint) for Hrazdan, Argel and Arzni HPPs;
- replacement of hydro units in Argel, Hrazdan and Kanaker HPPs.

The planned rehabilitation works will be carried out within the existing footprint. Expansion of the existing facilities is not planned. The project’s potential adverse impacts will be readily understood and mitigated. Planned works and mitigation measures will have net positive environmental and social effects as soon as they decrease community and labour health and safety risks, and reduce environmental pollution.

Main adverse impact of the planned rehabilitation include: air emissions, noise disturbance, increased turbidity downstream dredging site, increased traffic, waste generation including hazardous waste, incidental damage to private properties, etc. All these impact will be short term. Activities will be planned and implemented so that to manage and minimize them.

Among the project’s positive environmental and social impacts are: reduction of water pollution with oils, removal of PCBs, clean-up of oil polluted sites, significant reduction of health and safety risks among the plant’s personnel and affected communities, increased employment opportunities during construction works, etc. In addition the project will increase efficiency of HPPs and decrease water losses, which will allow generation of more electricity with the same renewable resource. These beneficiary effects will be mostly long-term.

The owners addressed the European Bank for Reconstruction and Development (EBRD) and Asian Development Bank (ADB) to partially finance its investment plan for 2012 to 2017. The Project has been categorised as B under the EBRD’s Environmental and Social Policy 2008 and is expected to be classified as category B for environment and both category C for involuntary resettlement and Indigenous Peoples under ADB Safeguard Policy Statement (SPS) 2009.
Figure 1: General Layout of the SH Cascade
1.2. Objectives of the Stakeholder Engagement Plan (SEP)

To meet EBRD and ADB requirements for stakeholder engagement and public consultation and disclosure (EBRD Performance Requirement PR10 and ADB’s 2011 Public Communication Policy), a stakeholder and public engagement process with development of a Stakeholder Engagement Plan (SEP) should be applied to this project. The goal of a stakeholder engagement is to inform public and interested parties about planned project, its potential environmental and socio-economic impacts and proposed mitigation measures.

This Stakeholder Engagement Plan has been developed with the aim of explaining how IEC will communicate with people and institutions which may be affected by or interested in the SH Cascade Rehabilitation Project, at various stages of project preparation and implementation. The plan includes a grievance mechanism for stakeholders to raise any concerns related to the project for IEC’s attention.

2. Regulatory Context

2.1. National Requirements for Stakeholder Engagement/Public Consultation

In May 2001, Armenia ratified the Aarhus Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (UNECE). The convention is designed to improve the way ordinary people engage with government and decision-makers on environmental matters. Consequently, citizens of Armenia are entitled to be informed about all environment related issues pertaining to the project and it is the responsibility of public authorities, local authorities, or government departments to reveal such environmental information.

The Armenian legal and regulatory framework relevant to the public consultation is based on the following major laws:

- Law on Environmental Impact Assessment, which requires public engagement in decision making during process
- Law on Freedom of Information, which secures a right of Armenian citizens to be informed regarding matters affecting them and deliver their concerns to decision makers

The Law on Environmental Impact Assessment (EIA Law) (adopted in 1995) contains the list of economic activities (projects) which are subject to the environmental expertise and public hearings. The Law regulates the legal, economic, institutional and procedural aspects of the environmental impact assessment and respective public hearings.

In compliance with the EIA Law, rehabilitation projects in general are not subject to EIA process and respectively public hearings. However, one of the project components, in particular dredging of the reservoir falls within the list of such activities as according to Article 4, the following related activities are subject to EIA and public engagement:

- disposal or recycling of hazardous waste
- establishment of waste disposal facilities

Further on, the Law on EIA defines the public notification and hearing procedures. According to the law, the project owner informs authorized bodies about planned activities which screen the project against local legislation to determine need for EIA. Authorized bodies are liable to engage impacted
communities and local authorities in the screening process and inform them about the planned activities. Public hearing shall be organized for screening process within 15 days after notification about planned activities to get the concerns of local communities. Following 15 days are also allocated for public to deliver further concerns. In 30 days after notifying affected communities the authorized bodies make decision regarding necessity of the EIA.

Further, after fulfilling EIA study respective documentation and information is circulated among officials of affected communities, which are obliged to respectively inform affected communities about planned activities and make documentation available for them. Public hearings on planned activities and EIA study should be arranged within 30 days after community notification and officials of the affected municipality can submit the opinion of the public to the authorized body. Other stage bodies which are involved in the process shall also provide their opinion to the authorized body within this 30-days period.

Armenian law does not require that public consultation and community engagement continue after approval of the EIA and permitting, i.e. on the project’s construction and operation phases; and there is no requirement related to dealing with grievances after the EIA consultation period. Neither SEP is required.

According to Armenian Law, the public engagement is not required for the planned project until starting official procedures for EIA study for the reservoir’s dredging and sediments disposal operations.

2.2. EBRD and ADB Requirements for Stakeholder Engagement and Public Consultation

The principles and requirements of stakeholder engagement for EBRD and ADB Category B projects are described in detail respectively in EBRD’s PR10 “Information Disclosure and Stakeholder Engagement” and ADB’s 2011 Public Communications Policy. General principles and approaches of these two financial institutions towards public engagement are aligned and outline a systematic approach to stakeholder engagement that will help clients build and maintain a constructive relationship with their stakeholders and with affected communities in particular.

According to the banks’ policies, stakeholder engagement is an ongoing process comprising the public disclosure of appropriate information (whether positive or negative) about planned activities, as well as related social and environmental issues and mitigation measures so as to enable meaningful consultation with stakeholders and potentially affected parties. Information should be delivered in a timely, understandable manner and should be readily available for stakeholders. This process should begin at the earliest stage of project planning and continue throughout the life of the project. Consultations should be undertaken in a free atmosphere to enable the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues.

To ensure successful stakeholder engagement, the project implementation body should identify the project stakeholders, especially those directly impacted. The engagement program must actively address vulnerable and disadvantaged population who may be affected by the project. Besides, stakeholders should be offered a procedure by which they can make comment or complaints.
Both Banks require development of a stakeholder engagement plan (SEP), with the aim to ensure that all project stakeholders are identified and appropriately addressed throughout consultations process, and grievance mechanism is in place for the project.

2.3. Project’s Public Consultations Principles

As mentioned above, Armenian law does not require public consultations for the planned SH Cascade Rehabilitation until starting official public hearings which should be organized after development of EIA study for reservoir’s dredging and sediments disposal operations; and continuation of consultations is not necessary as soon as public hearings are finished and environmental permit issued. Respectively, on the current stage the process of public consultations will be entirely planned and implemented to the requirements of the EBRD and ADB and Armenian requirements will be followed only after starting public hearings for the EIA study. In particular the following steps will be undertaken for public engagement in the SH Cascade Rehabilitation Project:

- Stakeholders groups including potentially affected communities and people and parties which may have interest in the project will be identified for further consultations and level of their engagement will be determined

- Consultation mechanism will be developed for each category of stakeholders to ensure their informed consultations and effective engagement in respective decision making process.

- All stakeholder groups will be consulted and engaged to the required level

- Grievance mechanism will be developed and put in place to ensure that all concerns and claims are received and handled in a prompt and consistent manner.
3. Stakeholder Identification and Communication Methods

In order to define a communication process in line with EBRD PR10, and ADB’s 2011 Public Communications Policy, it is recommended that IEC identifies all stakeholder groups that may be interested and/or affected by the SH Cascade Rehabilitation Project.

The stakeholders identified include:

- internal stakeholders, such as:
  - IEC employees
  - Workers of IEC construction contractors

- external stakeholders
  - Project affected communities
  - Local authorities of project affected communities
  - State governmental authorities, including those in charge of energy, environment protection, water, irrigation, agriculture and social sectors
  - Entities responsible for water allocation from the Sevan Lake and water released through Sevan-Hrazdan system
  - Community based and non-governmental organisations.

The SH Cascade stretches through Kotayk and Gegharkunik Regions and the Municipality of Yerevan. Considering the planned activities, the following communities can be potentially affected:

- In the Municipality of Yerevan
  - Kanaker-Zeytun District of Yerevan City

- In the Gegharkunik Region
  - Village Geghamavan

- In the Kotayk Region
  - Villages of Getamej, Solak and Nor Geghi, as well as the cities of Nor Hachn, Charentsavan and Hrazdan

Respectively public administration bodies of these settlements are deemed among local authorities to be engaged in the project consultations process. For communication of project related information including planned activities and mitigation measures and get community concerns, public meetings will be arranged in each of the affected communities with participation of community member and local administration. Meetings will be held prior to launching of preparatory or construction operations. A grievance mechanism will be made available for affected communities to submit their further concerns and claims.

The state governmental authorities which are in charge of energy, environmental, water, agriculture and social affairs and are deemed to be the project’s stakeholders are represented by the following entities:

- The Ministry of Nature Protection
- The Ministry of Energy and Natural Resources
• The Ministry of Labour and Social Affairs
• The Ministry of Economy
• The Ministry of Agriculture
• The Ministry of Territorial Administration

Ongoing communication will be ensured with governmental structures to ensure that they are informed regarding planned operations, obtain their support and documentation required for project implementation.

Entities responsible for water allocation and intake from the Sevan Lake include:

• State Committee of Water Systems (SCWS), which functions under the Ministry of Territorial Administration and is responsible for allocation and monitoring of irrigation and drinking water among users
• Sevan-Hrazdan Water Intake, Closed Joint Stock Company (Sevan-Hrazdan Jerar), established under SCWS. Function the Jerar is establishment of quotas on irrigation water and issuing irrigation water abstraction permits

These two structures will be consulted so that to solve problem of illegal water intake from diversion canals by communities. They will be contacted early on the planning stage to ensure that the issue of illegal connections is resolved to the satisfaction both the illegal water users and these entities.

Community organizations are not well developed in Armenia and no active CBOs were identified within the project’s area during Due Diligence study. NGO sector, which is likely to have particular interest in issues related to the Sevan Lake protection, are mostly present in the capital city of Yerevan. The planned rehabilitation project does not imply any impact on Sevan Lake, as soon IEC of Armenia is just using the water from Lake Sevan which is dedicated for irrigation in the quantities approved by the Parliament of country. Based on above mentioned, no special engagement activities are considered for NGO sector. The interested NGO,s will have access to the project related information through corporative web site, via communicating to the corporation or from the information disclosed to the local population and administrative offices.

Table 1 below summarizes the stakeholder engagement program and communication methods that will be used to notify stakeholders of information regarding the planned rehabilitation. Any suggestions for improvement of proposed communication methods are welcomed and can be submitted via the contact information at the end of this document.
Table 1. Stakeholder engagement program for IEC SH Cascade Rehabilitation Project

<table>
<thead>
<tr>
<th>Stakeholder group</th>
<th>Communication method /channel</th>
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</thead>
<tbody>
<tr>
<td><strong>Internal Stakeholders</strong></td>
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</tbody>
</table>
| Company’s employees                                                                | - Internal newsletters  
- Grievance procedure  
- Information boards  
- Staff meetings  
- Company’s web-site |
| Temporary Construction Workers, subcontractors                                     | - Information in contract  
- Induction sessions  
- Information board, training  
- Grievance procedure |
| **External Stakeholders**                                                           |                                                                                                                  |
| Potentially affected communities                                                   | - Formal and informal meetings  
- NTS  
- Ongoing contacts with company staff and contractors  
- Grievance procedure  
- Company’s web-site  
- Information letters  
- TV announcements (if required) |
| • Kanaker-Zeytun District of Yerevan City                                           |                                                                                                                  |
| • Geghamavan, Gegharkunik Region                                                   |                                                                                                                  |
| • Getamej, Solak, Nor Geghi, Nor Hachn, Charentsavan and Hrazdan, Kotayk Region    |                                                                                                                  |
| Local authorities                                                                  | - Formal meetings with officials and communities  
- NTS  
- Information letters  
- Company’s web-site |
| State Authorities                                                                  | - Official environmental monitoring and performance reports (water flow rate/levels, etc)  
- NTS, ESAP  
- Official correspondence  
- Meetings |
| Entities responsible for water allocation and intake from the Sevan Lake            | - Meetings and negotiations  
- NTS  
- Official letters  
- Company’s web-site |
| NGOs                                                                              | - Company’s web-site                                                                                             |
4. Project Consultation and Disclosure Program

To meet the environmental and social requirements and performance standards of EBRD and ADB, IEC will develop, disclose to the public and then implement an Environmental and Social Action Plan (ESAP), which will identify mitigation measures to minimize, reduce, eliminate or control potential adverse impacts on environment and people. The final version of ESAP will be published on IECs official website, printed copies will be distributed among affected parties on public meetings and available on request from the IEC’s Yerevan Office (contact information available below). In addition, IEC will have a Non-Technical Summary of the Project which can be disclosed to major stakeholders, including state authorities, interested organizations and local communities.

Potentially affected communities including the population of Yerevan City and the settlements along the channel (see Table 1) will receive timely information through public meetings and circulated documents regarding planned activities, as well as measures planned to avoid and mitigate potential impacts of construction works including safety measures in the vicinity of the construction site, traffic management, employment opportunities, grievance mechanisms and others identified through the development of the ESAP. Public meeting will be arranged in each potentially affected community prior starting rehabilitation works. On the rehabilitation phase ongoing contacts will be maintained with locals through the company’s staff working at construction sites or constructor contractors. Besides, communities will be offered a grievance mechanism (see below) to submit their concerns to the company.

CJSC Sevan-Hrazdan Water Intake (Sevan-Hrazdan Jerar) will be consulted so that to solve problem of illegal connections to the diversion canals. Consultations will be carried out on early stage to ensure that the issue of illegal connections is resolved to the satisfaction of illegal water users to prevent significant adverse socio-economic impact on local population.

Ongoing contacts will be maintained with state governmental bodies to ensure that they are adequately informed regarding the planned works and all permits required for rehabilitation are obtained.

Main disclosure documents will be the Project’s Non-Technical Summary and ESAP, which will be made available to all stakeholders. In addition, letters and advertisements can be used to communicate information updates. The project’s grievance mechanism will be made available also for all stakeholders to receive their concerns and undertake responsive actions. To ensure smooth flow and effectiveness of the stakeholder engagement process the IEC will designate a person responsible for community liaison within the company. Among responsibilities of the designated person will be communication of project related information and information updates, organization of public meetings, facilitation to collection and addressing of community concerns and claims, etc.

Further, public hearings for the reservoir’s dredging EIA will be organized and held to the requirements of Armenian Law and the banks standards. The SEP will be respectively updated so that to comprise newly emerged stakeholders and plan engagement process.

Annual progress reports describing environmental and social impacts, health and safety performance and implementation of the external grievance mechanism will also be disclosed on IEC’s official website and will be available on request at the IEC office in Yerevan and from the local governance offices.
5. Grievance Mechanism

The objective of a grievance procedure is to ensure that all comments and complaints from any project stakeholder, including local/regional authorities, residents of neighbouring residential areas, IEC employees, IEC contractors’ staff and other interested parties, are received and addressed in an appropriate and timely manner.

IEC will accept all comments and complaints associated with the project. A sample of a Comments and Complaints Form which can help community members to draw up their concerns is shown in Appendix A. Petitions in any other format are also acceptable; though, petitions should include contact information to enable the IEC to contact claimant for response or further details. Individuals who submit their comments or grievances have the right to request that their name be kept confidential.

The Comments and Complaints form will be made available to the local communities through the offices in each plant. Local people may also approach the managers of each HPP for any grievance. The plant security guards will be informed, that in case of request from public, they will arrange meeting with appropriate person, who will be trained to record verbal claims and register it in special form.

Depending on the nature of the complaint, corrective actions will be implemented by the respective HPP or contractor within 3 to 5 days upon receipt of complaint. More complex complaints or grievance may take longer to be resolved. Information regarding the solutions will be recorded.

The IEC will develop a separate, formalized internal grievance mechanism for the company personnel, which will enable company staff to effectively deliver their concerns to the attention of the management and seek for solution of their problems. All company staff will be consequently informed about the availability internal grievance mechanism and prescribed procedures.

Any person or organization can send comments and/or complaints in person or via post, email, or fax using the contact information specified below:

- IEC Office address: 10B, Adonts St, Yerevan, 0012, Armenia
- official web-site of IEC: www.mek.am
- email: office@mek.am
- phone: (+374 10) 24 50 99, 23 08 12
- fax: (+374 10) 24 51 99

All grievances will be registered and acknowledged within 5 days and responded to within 20 working days. All comments and complaints will be responded to either verbally or in writing, in accordance with preferred method of communication specified by the complainant in the Comments and Complaints Form. Comments will be reviewed and taken into account in the project; however, claimers may not receive an individual response unless requested.

Grievances in relation to construction activities will be managed by the IEC and construction contractor. The Corporative Management & Legal Matter Department (CMLMD) of the IEC will have overall responsibilities for collection of community grievances and their solution. On sites responsibility for claim collection will be assigned to the managers of each HPP and construction work supervisors. In case if problems cannot be solved in situ, they will involve the CMLMD in the process.
Affected communities will be informed about the contractors contact information before construction begins through announcements in public places. A separate grievance mechanism will be available for workers, both employees of IEC, contractors and sub-contractors.

The comments and complaints will be summarized and listed in a Complaints/Comments Log Book, containing the name/group of commenter/complainant, date the comment was received, brief description of issues, information on proposed corrective actions to be implemented (if appropriate) and the date of response sent to the commenter/complainant. The IEC will report on grievance management, as part of annual project progress reports, available at the IEC website and on request at the IEC office in Yerevan.
## Appendix A Comments and complaints sample form

### Comments and complaints sample form

<table>
<thead>
<tr>
<th>Reference No:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full Name</td>
</tr>
</tbody>
</table>

**Contact Information and preferred method of communication**

- **By Post:** Please provide mailing address:
  - 
  - 
  - 

- **By Telephone:**

- **By E-mail**

**Description of Incident or Grievance:**

- What happened? Where did it happen? Who did it happen to? What is the result of the problem?

**Date of Incident/Grievance**

- One time incident/grievance (date ____________)
- Happened more than once (how many times? ____)
- On-going (currently experiencing problem)

**What would you like to see happen to resolve the problem?**

**Signature:** _______________________________

**Date:** _______________________________
Annex 6 Environmental and Social action Plan
ENVIRONMENTAL AND SOCIAL ACTION PLAN

SEVAN-HRAZDAN CASCADE REHABILITATION PROJECT
REPUBLIC OF ARMENIA

Final Version

41134_ESAP_Eng_02
October 2012
Introduction

The present Environmental and Social Action Plan (ESAP) is prepared for the Sevan-Hrazdan Cascade Rehabilitation Project and includes a series of actions that will be undertaken by International Energy Corporation (IEC) to plan and implement specific measures to avoid, reduce, control and mitigate, or compensate for environmental, occupational health and safety, and social impacts during rehabilitation and operation of the SH Cascade HPPs and associated structures, assets and infrastructure.

IEC will be reporting periodically on the status of the implementation of each of the required actions to the EBRD and ADB providing status reports on environmental, social and occupational health and safety (ESHS) matters.

The table below presents the actions required by this ESAP, showing the source and timing of the requirement and the criteria by which performance of the action will be evaluated. Implementation of all the actions is the responsibility of IEC. When third parties, including other companies, contractors or subcontractors, perform work under contract, IEC will be responsible for those third parties’ and contractors’ compliance with the requirements of the ESAP. This is expected to be accomplished by inclusion of appropriate requirements and conditions in tender documents, contracts and subcontracts, and by direct oversight and supervision by IEC as needed.

As specified in various required actions, or as otherwise agreed by the parties, this ESAP may be amended from time to time with the prior written consent of EBRD during project implementation as long as the legal agreements between IEC and EBRD remain valid. No amendments or changes will allow violation of Armenian Law or of EBRD and ADB requirements for environmental and social performance.
## Actions to be implemented at corporate level to strengthen environmental and social management

<table>
<thead>
<tr>
<th>No</th>
<th>Issues / Action</th>
<th>Requirement description</th>
<th>Resources to be used</th>
<th>Action to be Completed</th>
<th>Target and Evaluation Criteria for Successful Implementation</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Actions to be implemented at corporate level to strengthen environmental and social management</td>
<td>Compliance with Armenian law</td>
<td>Internal and external resources as needed</td>
<td>Throughout project performance</td>
<td>No cases of noncompliance. Report to lenders immediately regarding all cases of noncompliance with any permit or authorization</td>
<td>Compliance to the national law is required to meet basic requirements in country. Compliance to national law is requirement of EBRD and ADB environmental policies.</td>
</tr>
<tr>
<td>1.1</td>
<td>Receive permits and authorizations as needed, comply with all permits and authorizations</td>
<td>EBRD PR1 ADB-SPS SR-1</td>
<td>Internal and external resources as needed</td>
<td>Throughout project performance</td>
<td>No cases of noncompliance. Report to lenders immediately regarding all cases of noncompliance with any permit or authorization</td>
<td>Compliance to the national law is required to meet basic requirements in country. Compliance to national law is requirement of EBRD and ADB environmental policies.</td>
</tr>
<tr>
<td>1.2</td>
<td>Prepare and submit reports to lenders on status of all ESAP items</td>
<td>Improved knowledge of ESAP requirements and implementation</td>
<td>EBRD PR1 ADB-SPS SR -1</td>
<td>Anually, by 31 March of each year</td>
<td>Submission of reports in format agreed with lenders</td>
<td>Report to include status of each ESAP requirement</td>
</tr>
<tr>
<td>1.3</td>
<td>Development and implementation of Environmental Management System (EMS) based on ISO14001 at corporate level and at all HPPs. The EMS should include: - Corporate policy statement (item 1.3.1) - General Environmental management plan and it sub-plans (item 1.3.2.) - Structure and set-up of the unit responsible for environmental and social issues - Environmental monitoring, recordkeeping and reporting schemes</td>
<td>Proper approach and planning to all company environmental aspects related to on-going operations and rehabilitation/development projects.</td>
<td>EBRD-PR 1-10, ADB-SPS International Best Practice</td>
<td>Internal resources or consultants</td>
<td>During 2 years from project start</td>
<td>Corporate Policy Document prepared and adopted ESMS system document available, which describes the system and gives references to specific documents</td>
</tr>
<tr>
<td>No</td>
<td>Issues / Action</td>
<td>Environmental Risks Liability / Benefits</td>
<td>Requirement description</td>
<td>Resources to be used</td>
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<tr>
<td>1.3.1</td>
<td>Set up a Unit at Corporate level responsible for Environmental and Social Issues. Appoint a responsible party for all matters related to EHSS management across the business and execution of the project in compliance with the EBRD’s Environmental and Social Policy and European Legislation requirements</td>
<td>Proper approach and planning to all company environmental aspects related to on-going operations and rehabilitation/development projects. Capacity building within the Company</td>
<td>EBRD PR1 ADB-SPS SR -1</td>
<td>Internal resources</td>
<td>During 6 months from project start</td>
<td>Set up EHSS Unit Appointed EHSS manager</td>
</tr>
<tr>
<td>1.3.2</td>
<td>Preparation of Corporate Policy Document and its adoption</td>
<td>Proper approach and planning in order to improve Corporative performance</td>
<td>EBRD-PR 1-10, ADB-SPS International Best Practice</td>
<td>Internal resources, or consultant</td>
<td>During 12 months from project start</td>
<td>Policy statement available and approved by the top management</td>
</tr>
<tr>
<td>1.3.3</td>
<td>Preparation of Environmental and social management plan for Corporate operation and rehabilitation / development projects, which describes: - Actions/operations having significant environmental/social impacts - Methods to be used to manage identified impacts - Roles and liabilities of responsible personnel.</td>
<td>Improvement of environmental and social performance</td>
<td>EBRD-PR 1-10, ADB-SPS SR 1 International Best Practice</td>
<td>Internal and External resources</td>
<td>During 12 3 month from project start</td>
<td>Prepared general environmental and social management plan at corporate level</td>
</tr>
<tr>
<td>No</td>
<td>Issues / Action</td>
<td>Environmental Risks Liability / Benefits</td>
<td>Requirement description</td>
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| 1.3.4 | Preparation and implementation of pollution prevention plans, which should describe:  
- Materials used in facilities by types, hazard classes and amounts  
- Procedures for management of materials (including hazardous)  
- Tools and equipment to be provided on sites to deal with small size pollutions  
- Procedures for spill response and clean-up  
- Roles and responsibilities of personnel involved in the process | Improvement of environmental performance | EBRD-PR 3, ADB-SPS SR -1 International Best Practice | Internal and External resources | During 8 month from project start | The pollution prevention plan available and enforced | The pollution prevention plan should consider issues related with potential pollution during the normal operation, maintenance and rehabilitation periods.  
A separate plan is recommended for oil management due to amount of oil used in the company. This is covered in paragraph 1.3.4. |
| 1.3.5 | Preparation and implementation of oil management plan, which covers management of oil stocks and waste oil.  
The plan at least should include:  
- Procedures for handling, storage and transportation of raw/used oils  
- Requirement for testing of existing transformer oils for PCBs  
- Requirement for separate storage and labelling of PCB containing oil.  
- Requirements for oil storage facilities  
- Disposal/recycling of used oils through licensed contractors  
- Roles and responsibilities for personnel involved in oil management  
- Recordkeeping system for registration of raw/used oil movement  
- Oils spill response procedure and relevant spill response equipment. | Improvement of environmental performance and pollution prevention | EBRD- PR 1, PR 3, ADB-SPS SR -1 International Best Practice | Internal and External resources | During 8 month from project start | The pollution prevention plan available and enforced during the operation | The oil management plan should consider processes to be followed in turbine and transformer oil management. It is important to split procedures for PCB containing oils and other dielectric, hydraulic and turbine oils. |
<table>
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</table>
| 1.3.6 | Preparation of waste management plan and implementation in place. The plan should include:  
- Description of wastes generated in the company by types, hazard class and amounts  
- Waste minimization and reuse/ recycling strategies  
- Procedures for handling, labelling, storage and transportation of each waste type  
- Recordkeeping scheme for waste flow  
- Requirement for facilities intended for temporary storage of various wastes  
- Procedures for identification of contractors for waste disposal | Improved environmental performance and reporting | Best practice, international experience | Internal or external resources | During 12 month from project start | The waste management plan available and enforced during the operation | The waste management plan should be prepared based on the existing experience on types and quantities of the wastes. The plan should consider all significant waste streams.  
Due to specifics, it is recommended to cover management of waste oil by Oil Management Plan (see paragraph 1.3.5) |
<p>| 1.3.7 | Deliver trainings regarding established ESM system to all staff with content appropriately tailored to management and operational level. | Ensure effective implementation of EMS management system | EBRD-PR 1-10, ADB-SPS International Best Practice | Internal and External resources | During 12 month from project start | The company developed E&amp;S management trainings. All company staff is respectively trained in E&amp;S management system, training attendance records are maintained | EMS training should cover all environmental issues related to company operations and planned rehabilitation. Training program should contain general approaches of EMS and should be known by all staff. Besides, specific training courses should be developed and delivered for personnel involved in specific activities related to Company’s EHS aspects. |
| 1.3.8 | Complete study of river flow and biodiversity to support development of a plan to implement feasible measures to restore river ecosystem. | Improved environmental performance | Best practice, international experience | External resources | 2014 | Study of river flow and biodiversity is developed | This study is required to understand current flow and biodiversity conditions in the river following long term river exploitation. |</p>
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<tr>
<td>1.3.9</td>
<td>Based on river flow and biodiversity study, develop a long term plan for river eco-system.</td>
<td>Improved environmental performance</td>
<td>Best practice, international experience</td>
<td>External resources</td>
<td>2015</td>
<td>Long-term program for river flow and biodiversity monitoring is developed</td>
<td>This program is required to plan river and biodiversity restoration program in long term perspective</td>
</tr>
<tr>
<td>1.3.10</td>
<td>Establishment of environmental monitoring and reporting system in accordance to ESMS objectives</td>
<td>Improved operational performance, minimisation of environmental risks</td>
<td>Best practice, international experience</td>
<td>Internal or external resources</td>
<td>During 12 month from project start</td>
<td>The monitoring in place and monitoring reports available</td>
<td>The Monitoring system is required to highlight main problems raised during the implementation of project. The monitoring should have constant inspection character on monthly basis</td>
</tr>
<tr>
<td>1.4</td>
<td>Upgrade of existing occupational Health and safety system in accordance with OHSAS 18001 requirements</td>
<td>Improved Health and safety in company operations</td>
<td>Best practice, international experience</td>
<td>Internal or external resources</td>
<td>During 1.5 years from project start</td>
<td>The documentation system including instructions on safe operations is in place, safety trainings are delivered and respective records available.</td>
<td>The occupational safety system should consider improvement in some general operation processes like working on heights, general maintenance works, confined spaces, application PPEs, trainings etc, as provided in paragraphs 1.4.1-1.4.6.</td>
</tr>
<tr>
<td>No</td>
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| 1.4.1 | Develop and implement occupational health and safety plan, to include at a minimum:  
- Job-specific hazard analysis  
- Job-specific safety instructions (including works at heights, lifting equipment, working in confined spaces, diving works, etc)  
- Training (initial and refresher) on job-specific hazards and safety procedures for all staff  
- Requirements for PPE use, with Company to provide and enforce use of PPE  
- Maintaining detailed records on OHS performance, including training, incidents, near-misses, lost-time incidents, fatalities, etc. | Improve OHS management and performance | EBRD PR2 ADB-SPS SR1 | External or internal resources | Prior to first disbursement  
Implementation: throughout construction and operation phases | - OHS plan developed and approved by independent expert  
- Training for all staff  
- PPE provided for all staff  
- Enforcement program in place  
- Reports to Bank on training, incidents, lost-time, fatalities, etc. | The company’s classification of jobs by hazard classes and respective OHS instructions should be reviewed and upgraded to meet requirements of OHSAS 18001 and best international practices. The personnel should be delivered respective trainings to ensure that all of them are aware about health and safety risks and changes made in H&S instructions. |
| 1.4.2 | Assessment of work space safety, ensuring of workspace zoning by hazards, arrangement of safety signs, marking of emergency routes and exits | Improved environmental and social performance | Best practice, international experience | Internal or external resources | In accordance to approved plan | Workspace safety assessment is performed and documented, workspace zoning is in place, safety signs are provided | The company should ensure zoning of work spaces in all facilities according to hazard risks and provide respective demarcation to restrict access to high risk areas. This should be based on workspace safety assessment of all facilities. Safety procedures, warning signs and PPE requirement should be defined for each zone separately. |
| 1.4.3 | Maintain records on employment diversity: number of employees by job responsibility (management, skilled labour, unskilled), gender (by category), etc. | Improve knowledge of opportunities | EBRD PR2 ADB-SPS SR1 | Internal resources | From project start | - Records  
- Report to Bank on numbers and gender (by job responsibility) | These records should include data on number of employees by job responsibility (management, skilled labour, unskilled), gender (by category), etc. |
<table>
<thead>
<tr>
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</thead>
</table>
| 1.4.4 | Develop employee grievance procedure                                             | Improve management attention to employee issues | EBRD PR2 ADB-SPS SR1                 | Internal resources        | From project start            | - Grievance procedure developed  
- Grievances resolved with allotted time period | The grievance mechanism should facilitate to improved communication between the management and staff, as well as ensure effective solution of job related problems |
| 1.4.5 | Establishment of HS monitoring and reporting system. It should provide data for assessment of improvements reached during the target period against goals and objective of paragraph 1.4 of the given plan. | Improved operational performance, minimisation of occupational safety risks | Best practice, international experience | Internal resources | During 6 month from project start | The occupational safety monitoring is in place and monitoring reports available | The Monitoring system is required to highlight main problems in the field of occupational safety and demonstrate progress achieved. Separate monitoring scheme should be established for community HS monitoring. |
| 1.5 | Implementation of Stakeholder Engagement Plan (SEP) including establishment of grievance mechanism covering overall operation and proposed project | Improved operational performance, minimisation of impact on social sphere | Best practice, international experience | Internal or external resources | Immediately after project start | The grievance mechanism is in place, enforced and effectively operated. | Implement the agreed SEP to receive comments and input, inform stakeholders of activities and progress, and receive and respond to grievances. The grievance mechanism should be established with formal procedures for claim collection inclusive claims from public affected by the project. The formal procedure for reacting and responding should be established and enforced. |
| 1.5.1 | Carrying out of consultations with population living along the channel to be rehabilitated and other project stakeholders in accordance with the SEP prepared for the project. Consultations should include:  
- informing population regarding planned | Minimization of impacts on local population, conflict prevention, ensure smooth flow of works | EBRD-PR - 10 ADB-SPS - 1 International Best Practice | Internal resources or env/social consultants | 6 months prior to start of works | The stakeholder consultation protocols, public comments report available. Collected information | Consultations should be carried out in each potentially affected community, as defined in the SEP. |
<table>
<thead>
<tr>
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|    | works and mitigation measures  
- informing communities about health and safety risks on rehabilitation and operation phases  
- obtaining community feedback on and concerns regarding the planned project and mitigation measures  
Community concerns should be accurately recorded to enable addressing. | Obtaining stakeholders’ support, verification of legal basis for project implementation, identification of conflicting interests, ensuring of smooth flow of planned works | EBRD-PR - 10 ADB-SPS - 1 International Best Practice | Internal resources or env/social consultants | 6 months prior to channel upgrade works | The minutes of consultation meetings available | Analysed Records of public consultations and received feedback. Preparation and disclosure of comment-response document that describes response to each public comment. |
| 1.5.2 | Consultations with government offices, water resources management authority, heads of local municipalities in accordance with SEP prepared for the project | | | | | Consultations with state governmental officials is necessary to inform them regarding planned operations verify project related legal aspects including necessity for EIA study for rehabilitation project, dredging and disposal, obtain support with dumpsite selection, etc. Consultation with Jerar is important for restoration of existing water intakes from diversion channels. |
| 1.6 | Ensuring of community health and safety throughout rehabilitation and operation activities via safety arrangements and contingency planning, described in paragraphs 1.7 and 3.2 | Improved operational performance, minimisation of impact on communities | Best practice, international experience | Internal resources | Throughout construction and operation | Safety arrangements and contingency plans as of paragraphs 1.7 and 3.2 are in place. |
| 1.7 | Upgrade of existing Emergency Response system to take into account at least  
- Fire emergency plan | Improved occupational and community health | Best practice, international experience | Internal or external resources | During 6 month from project start | The emergency response plans are prepared and | Community meetings arranged in compliance with SEP should be used to inform public about health and safety risks to ensure that community members are aware about them and act in the way to avoid incidents. |
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<tbody>
<tr>
<td></td>
<td>- Flood emergency plan</td>
<td>The plans should clearly define procedures to be implemented in each emergency situation, responsibilities and roles of personnel involved in emergency response, necessary equipment and their location, describe internal and/or external resources for required for tiered response, etc.</td>
<td>and safety, pollution prevention, minimization of environmental damage</td>
<td></td>
<td>approved</td>
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</table>

2. **Actions to be implemented at all HPPs**

2.1. Implementation of all EM plans prepared in accordance to item 1.3 and it’s subchapters in all plants

<table>
<thead>
<tr>
<th></th>
<th>Improved environmental performance</th>
<th>EBRD-PR 1-10, ADB-SPS International Best Practice</th>
<th>Internal resources or consultants</th>
<th>In accordance to EMS requirements</th>
<th>Established procedures in accordance to EMS system</th>
<th>The plans operating in accordance to items 1.3.1-1.3.8</th>
</tr>
</thead>
</table>

2.2. Construction of small size temporary oil storage areas at each plant dedicated for temporary storage of raw and used oil prior to shipment to central oil storage facility. All storage areas should be designed to international best practice and meet requirements set for oil storage facilities set on corporative level

<table>
<thead>
<tr>
<th></th>
<th>Environmental improvement, pollution prevention</th>
<th>EBRD-PR1, PR3 ADB-SPS SR -1 International Best Practice</th>
<th>Internal resources or consultants</th>
<th>Prior to replacement of oil containing equipment</th>
<th>small size temporary oil storage areas are available in each plant</th>
<th>The small size areas are required for temporary storage of raw and used oil. This will enable to store oil in barrels at facility level for short period of time.</th>
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2.3. Implementation of oil management procedures, as defined by the oil management plan

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<tr>
<th></th>
<th>Environmental improvement, pollution prevention</th>
<th>EBRD-PR1, PR3 ADB-SPS SR -1 International Best Practice</th>
<th>Internal resources</th>
<th>After development of oil management plan</th>
<th>Procedures in place on used oil management Log-booking of oil reserves and flow is ensured</th>
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</table>

2.4. Study of PCBs in used transformer oils at all facilities.

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<tr>
<th></th>
<th>Environmental improvement, pollution prevention</th>
<th>EBRD-PR 1, PR3, ADB-SPS SR -1 International Best Practice</th>
<th>Certified laboratory</th>
<th>After removal of oil from transformers and switches</th>
<th>PCB test results are available for all used transformer oils</th>
<th>PCB containing oils should be stored separately from other dielectric oils. Proper labelling should be provided. Final disposal of oil should be ensured through licensed contractor, in compliance with international good practice</th>
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<tbody>
<tr>
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<td>2.5</td>
<td>Construction/arrangement of storage area for hazardous wastes other than oil</td>
<td>Environmental improvement, pollution prevention</td>
<td>EBRD-PR 1, PR3, ADB-SPS SR -1 International Best Practice</td>
<td>Internal resources or consultants</td>
<td>During 6 month after the project start.</td>
<td>The facility constructed, Procedures in place on used oil management</td>
<td>A temporary waste storage area in accordance with the international standards should be established as soon the part of hazardous wastes (e.g. accumulator electrolytes) cannot be recycled or disposed in Armenia at present.</td>
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<td>2.6</td>
<td>Improvement of water born waste management, in particular:</td>
<td>Improved waste management, pollution prevention, compliance with law, avoidance of liabilities</td>
<td>EBRD-PR 1, PR3, ADB-SPS SR -1 International Best Practice</td>
<td>Internal resources, waste management companies, municipal waste management services.</td>
<td>During 6 month after the project start.</td>
<td>Waste management company is contracted, waste is removed to municipal landfill.</td>
<td>Waste management should comply with national requirements and company’s waste management plan to prevent environmental pollution and avoid additional liabilities.</td>
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<tr>
<td>2.7</td>
<td>Improvement of water born waste management infrastructure and arrangements, in particular</td>
<td>Improved waste management, pollution prevention, compliance with law, avoidance of liabilities</td>
<td>EBRD-PR 1, PR3, ADB-SPS SR -1 International Best Practice</td>
<td>Internal resources, waste management companies</td>
<td>During 12 month after the project start.</td>
<td>Waste management company is contracted, waste is removed to municipal landfill.</td>
<td>Waste management should comply with national requirements and company’s waste management plan to prevent environmental pollution and avoid additional liabilities. Required investments will be subject to agreement with tariff regulator and inclusion into tariff.</td>
</tr>
</tbody>
</table>

3 Actions to be implemented at specific HPPs

3.1 Reservoir dredging at Yerevan 1 HPP

Prepare and disclose for public comment appropriate impact assessment of dredging program, to include:
- Characterization of potential sediment contamination
- Maximum reuse of uncontaminated sediment, selection and permitting of

Minimisation of environmental impacts from dredging

EBRD-PR 3 ADB-SPS SR -1 International Best Practice

Professional consulting company, authorised laboratory

During 3 month prior to the start of dredging works.

Appropriate dredging program and its environmental assessment are developed and published on IEC website, the

The dredging program and environmental assessment has to comply with ADB and EBRD’s safeguard policy requirements as well as requirements set by the local regulation.
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<td></td>
<td>disposal area for dredged material that cannot be used beneficially</td>
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<td>documents are</td>
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<td>- Least environmentally damaging options for dewatering and water discharge,</td>
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<td>forwarded to the</td>
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<td>including treatment if needed</td>
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<td>lenders for review</td>
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<td>- Traffic management plan for off-site transport of dredged material</td>
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<td>and approval prior</td>
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<td>- Minimum disruption of fisheries and aquatic habitat in sensitive periods</td>
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<td>- Review and approval by lenders and, if necessary, authorities</td>
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<td>dredging works.</td>
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<td>- Disclosure for public review and comment</td>
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<td></td>
<td>3.2. Channel Rehabilitation works. Update of existing technical design for</td>
<td>Minimization of community safety risks</td>
<td>EBRD PR1, PR4 ADB SPS SR1</td>
<td>Internal Resources</td>
<td>The updated technical</td>
<td>Entry to channels constrains life risk due to high water flow and depth/shape. Therefore, special precautions should be in place to restrict entry in water and inform population regarding related risks to prevent fatalities.</td>
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<td>channel rehabilitation works in order to include fencing, solutions for</td>
<td>and mitigation of potential livelihood</td>
<td>technical design company</td>
<td>design to be available</td>
<td>technical design of</td>
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<td>pipe connections, warning signs and channel crossing structures. This</td>
<td>risks</td>
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<td>specific works</td>
<td>project available</td>
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<td>- installation of fences/railings along channel sections in populated areas</td>
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<td>Adequate design and</td>
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<td>- fencing of high risk sites along channels such as truck access ramps,</td>
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<td>- solutions for community pipe/water connections</td>
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<td>affordable community</td>
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<td>- installation of warning signs at channels and reservoir informing</td>
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<td>water abstraction</td>
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<td>- solution for Channel crossing structures</td>
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<td>points (e.g. installation of flanged connections and proper valves)</td>
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<td>3.3</td>
<td>Establishment of monitoring system in order to assess effectiveness of impact mitigation measures during the rehabilitation of channels (ref 1.5.1. and 1.5.2).</td>
<td>Assessment of community health and safety measures and residual community safety risks after mitigation measures in place</td>
<td>EBRD-PR 1, PR4 ADB-SPS SR -1 International Best Practice</td>
<td>Internal resources</td>
<td>During the channel rehabilitation works</td>
<td>The updated project documentation available</td>
<td>This monitoring should be incorporated into overall community health and safety monitoring scheme given in paragraph 1.5.</td>
</tr>
</tbody>
</table>
| 3.4 | Central oil storage facility  
Construction of the new, central oil storage facility to serve all HPP’s and substations in accordance with best practice for oil storage areas, including bundling and/or alternative impermeable technical solution to contain at least 110% of maximum volume of oil to be stored | Environmental improvement, pollution prevention                                                           | EBRD-PR1, PR3 ADB-SPS SR -1 International Best Practice                                 | Internal resources or consultants | Prior to replacement of oil containing equipment            | The facility constructed, Procedures in place on new and used oil management                                                  | A central oil storage facility should be established for used oils, or one of the existing facilities should be upgraded to the required standard. |
| 3.5 | Preparation of long term strategy (max. 3 years) for removal of existing oil storage facilities and clean-up of the oil storage areas. | Environmental improvement, pollution prevention                                                           | EBRD-PR1, PR3 ADB-SPS SR -1 International Best Practice                                 | Internal resources or consultants | During 12 month from project start and implementation in accordance to prepared plan | The strategy in place, existing facilities removed in accordance to the plan.                                                      | The existing facilities should be removed and territory cleaned up in accordance to the requirements of best international practice. The plan should indicate the schedule of works to be implemented. |